A GUIDE TO

ExamBuilder™

A MathWriter™ 2.0 Module for Building Examinations

Version 1.0

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E. Ted Sobel

(PDF Version Dec 9, 1996)

Keyboard Commands

Arrow Key Usage   (, , , or with key combination)

Command	Option	Shift	Result
			Moves insertion point a line or a character*
Cmd			Scrolls window large amount
	Option		Begin/end line; top/bottom page, then doc.
		Shift	Extends Selection small amount
Cmd	Option		Scrolls window small amount**
Cmd		Shift	Move between cells in a matrix/table
	Option	Shift	Extends Selection large amount
Cmd	Option	Shift	<NotUsed>

*Arrow keys (   ) alone.

** *Cmd Option* scrolls document window down approximately 1 line

Vertical Scroll Bar Usage

| Key	Mouse	Result
	Drag Scroll Box	Scroll arbitrary amounts
	Click Arrow	Scroll large amount (approx 8 lines)
Option	Click Arrow	Scroll small amount (approx 1 line)
	Click Scroll Bar	Scroll 1 screen
Cmd	Click Scroll Bar	Top of Next/Prev Page*
Option	Click Scroll Bar	Top of Next/Prev Header*
Cmd Option	Click Scroll Bar	Advance to top of Next/Prev Page Body*

*To scroll through lecture note screens

Special Key Combinations:[1]

Command + ⊥ _____Can't select sublines.

Option + scroll up/down_____10 pixel scroll, as opposed to 80 pixel scroll.

Command + [ ] ; '_____Corresponds to superscripting/subscripting tools as follows:

⌘ [= ↑   ⌘] = ↗

⌘ ; = ↓   ⌘ ' = ↘

*Option*_____Toggles between ⊥ and][.

Option + drag tab_____Smooth drag.

Command + drag left margin _____Doesn't move indent marker.

Option + symbol in palettes_____Vertical bar; always extends to the limits of the line.

---

[1] Command ⌘

ExamBuilder and *MathWriter* Keyboard Commands

	EB1	MW2	MW2	MW2
Key	**Command** (⌘)	*Command* (⌘)	*Command Shift*	*Command Option*
A	Select All	Select All	Copy Ruler & Format	
B	Bold (style)	Bold		Auto Bracket
C	Copy	Copy	Copy As Picture	
D	Transfer From Doc	Calc Prev or | Size	Paste Style	
E	Build Exam	Auto Math		Number equation
F		Find/Replace	Copy Format	Insert footnote
G		Find Next	Paste Format	Italicize Greek
H		Replace Selection		
I	Italic	Italic		
J	New (cell) Before	Paragraph Format	Delete Row	
K	New (cell) After	Line Spacing	Delete Column	
L	Long Summary	Lower Diacritical		
M	Switch To MathWriter	New Entry Entry From Clipboard	Copy Memo	
N	New Book	New Entry From Selection	Paste Memo	
O	Open Book	Open	Column Before	Auto Operator Spacing
P	Plain	Plain or Print*	Column After	
Q	Quit (EB)	Quit	Row Before	
R		Raise Diacritical	Copy Ruler	Revision Tracking
S	Short Summary	Save	Copy Style	Auto Use Symbol Font
T	Transfer To Doc	Print or Plain*	Paste Ruler	
U	Underline	Underline		
V	Paste	Paste	Paste In Context	
W		Close	Row After	
X	Cut	Cut		
Y		Other Styles		
Z	Undo	Undo	Paste Ruler & Format	
1-9,0	(New Questions)	•Template Categories		
` (~)		Hide/Show Ruler		
= (+)	Next (question)	Larger Size (on menu)		1 Pt. Larger Size
- (_)	Previous (question)	Smaller Size (on menu)	Soft Hyphen	1 Pt. Smaller Size
, (<)	First (question)	Style 1		
. (>)	Last (question)	Style 2		
/ (?)	Entire Question	Help		
\ (|)		Last Style		
; (:)		•Center Subscript	Math Editor	
' (")		•Right Subscript	TextEditor	
[({)		•Center Superscript	Character Editor	
] (})		•Right Superscript	Sidebar Editor	
Tab		Tools Window		
Return		•Same as Enter key		
Space		•Toggle Greek		

* Use the supplied Command Key Switcher to exchange the Print and Plain assignments.

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Trademark information

Apple Computer Inc.: Finder, ImageWriter, LaserWriter, MultiFinder; Cooke Publications, Ltd.: ExamBuilder, MathWriter

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The Guide was written and formatted entirely in *MathWriter*™ and output on a Linotronic™ 300 Imagesetter.

The special version of MathWriter included in the ExamBuilder system is licensed
for use **only** as the host for the ExamBuilder Module.

P R E F A C E

ExamBuilder™ is a tool for using a data base of questions to create and print examinations. The tedium of creating examinations can be dramatically reduced with *ExamBuilder*, even making the creation of practice tests simple. The easy creation of multiple versions of an examination is particularly useful for large classes and allows tests to be given in classrooms and lecture halls during regular class hours, without resorting to evening testing when multiple classrooms become available.

The functional specifications for *ExamBuilder* were prepared by Vicki Roberts and Greg Hill. David Cassel, Edith Cassel, and Steven Holzner shared their extensive experience with a program of similar purpose used in teaching large introductory physics courses. They suggested features such as the log file the question cross-reference file, and an inactive-question designator. We also benefited from advice by James Mass.

The *ExamBuilder* design emphasizes ease of learning and ease of use. It addresses a broad spectrum of users by supporting any combination of text, graphics, and mathematics in the questions. Perhaps the most significant innovation demonstrated in its design is the concept of modular extensions to a host program. A module represents a substantial generalization of a desk accessory: 1) it is self installing, 2) it can modify directly the active document of the host, and 3) it can access the internal code of the host.

This approach has several important consequences. The module can be smaller in size. The features supported by the host can be expanded *post facto*. Only those features required by a particular user need be installed. The host application provides a familiar environment and provides a path of upward compatibility with the more feature-rich versions of the host for power users. From the developer's perspective it dramatically increases code reusability and reduces maintenance tasks. We hope this is the first of a family of modular extensions to *MathWriter*.

Of the beta testers we especially wish to thank Greg Hill and Steven Holzner for their patience and thoroughness. Nancy Cooke provided criticisms of the early drafts of this Guide. Phyllis Larimore provided much valuable advice and editorial assistance.

We hope you enjoy using *ExamBuilder* and that it contributes to your teaching efforts!

J. Robert Cooke
E. Ted Sobel

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1 Introduction

For a brief overview of how *ExamBuilder* works, see the last section of this chapter, *ExamBuilder* structure. To get started building exams immediately, use the Quick Start Guide, chapter 2.

Testing to measure success in meeting educational objectives is a well-established part of the formal educational process. Many publishers provide resource materials, such as printed collections of test items, to supplement their textbooks. To use these materials you must select questions that reflect your emphases, edit them if necessary, and then produce a handwritten or typed copy for duplication.

ExamBuilder™ expedites this process in several ways. First, *ExamBuilder* utilizes collections of publisher-supplied test questions stored in a computer file called question files or "books". You can visually inspect the questions and transfer those of your choice into an examination file. Alternatively, you can instruct *ExamBuilder* to assemble or "to build" the exam after you made all your selections or to select questions randomly according to criteria you specify. You can edit individual questions and format of the exam. All these options allow you to completely circumvent the manual transcription process and its accompanying errors.

ExamBuilder automatically numbers the questions transferred into your examination file and totals their point values. Pages are numbered automatically. Questions can include text, graphics, and even mathematical expressions. And professional quality laser-printing is supported.

Illustrative Examination

To make the discussion more concrete we include an *ExamBuilder*-created sample examination (Figure 1.1) to illustrate each of the seven question types supported—free form/essay, fill-in-the-blank, true/false, multiple-choice, matching, scenario, and composite. In this example the answers are printed immediately after each question, rather than at the end of the document or separately. The header with date and page-numbering was created automatically using a word-processor template document. The questions were

numbered automatically, and the total point count was also inserted automatically. An actual exam, of course, would be unlikely to contain such a mixture of question types.

Name _____ Section _____ May 15, 1993   Page 1 of 1

Total Points: 30

1. Points: 5   *[Free Form/Essay]*

In twenty-five words or less, describe the impact of computers on the field of theoretical physics.

Answer: The impact has been very large…

2. Points: 2   *[Fill In The Blank]*

In the world of_____animals, the giraffe is the tallest.

Answer: large

3. Points: 1   *[True/False]*

The field of Mathematics is involved in the study of people named Matthew.

Answer: False

4. Points: 3   *[Multiple Choice]*

Of the following five possibilities, which is the fastest computer?

a. IBM PC Jr.   b. Tandy TRS-80 c. Macintosh IIfx d. Apple II+ e. Macintosh 512

Answer: c.

5. Points: 5   *[Matching]*

Match the following five actors with the movies they starred in.

1. Meryl Streep   a. Dead Poet's Society

2. Ronald Reagan   b. Barbarella

3. Robin Williams   c. Mask

4. Cher   d. Bed Time For Bonzo

5.Jane Fonda   e. Sophie's Choice

Answers: e. d. a. c. b.

6. Points: 4   *[Scenario]*

If $a = 1$, $b = 2$, $c = 3$, $d = 4$, and $e = 5$, then

6a. Points: 2 *[Scenario-Free Form/Essay]*

What is the sum of a, b, c, d, and e?

Answer: $a + b + c + d + e = 15$

6b. Points: 2 *[Scenario-Free Form/Essay]*

What is $d - e$ equal to?

Answer: $d - e = -1$

7. Points: 10   *[Composite]*

If $a = 0$, $b = 10$, $c = 100$, and $d = 50$, then

7a. Points: 7 *[Composite-Free Form/Essay]*

What is $e = a \cdot b \cdot c \cdot d$?

Answer: $e = 0$

7b. Points: 3 *[Composite-Free Form/Essay]*

What is $e / 0$?

Answer: e/0 = undefined

Figure 1.1 A sample examination illustrating question types

ExamBuilder Features

In general terms, there are three methods of creating an exam with *ExamBuilder*. First, as discussed, you can select displayed questions from a question bank and immediately transfer them into the test document. Second, you can select a

group of questions from a question bank and ask *ExamBuilder* to "automatically" generate an exam for you. The third option is a more completely automatic exam generating process: *ExamBuilder* randomly selects questions from question banks using criteria you specify. This approach is especially attractive when you create multiple versions of an examination.

ExamBuilder can scramble the order of the questions in a generated exam and can even scramble the order of response alternatives for multiple-choice and matching questions. (Individual response alternatives, such as "none of the above," can be exempted from scrambling.) The questions are numbered automatically and *ExamBuilder* can compute and print the total point value for all questions if requested.

ExamBuilder stores the answer for each question and, when prompted, generates answer keys, even when questions and response items are scrambled. Answers can be printed with each question, at the end of the examination, in individual files, or in a composite format when multiple versions are generated.

Because the options for generating examinations are so numerous, *ExamBuilder* provides macro files called "Build Choices" with which to reconstruct frequently used combinations of conditions. For example, if you normally use multiple-choice tests with a specific numbering format and a specific page arrangement, use Build Choices to quickly create that set of configuration conditions. Additional customization is provided by exam template files to be discussed later.

When requested, *ExamBuilder* provides a usage log to indicate which test questions are used on each version of an examination. This log file permits you to edit or improve individual questions in the question file and then to create new examinations using the same set of questions. In addition, you can generate a list of the examinations on which each question appears: a cross-reference ("xref") list. If you subsequently discover a deficiency or ambiguity in a particular question, you can consult the xref file to know immediately which versions of your exam are affected.

ExamBuilder allows you to use the considerable editing and formatting tools that are available in *MathWriter* for modifying and printing examinations. You can modify examinations—both content and format—that were generated from supplied question banks just as if you had typed them yourself. As just mentioned, you can also edit the entries in a question file. Using *ExamBuilder* you can create files of questions and answers or easily select questions from already created question files to form custom exams. Each question is entered and stored in one of the seven formats—free form/essay, fill-in-the-blank, true/false, multiple-choice, matching, scenario, or composite.

When you are choosing questions, *ExamBuilder* allows you to display the questions in either detailed or summary form. You can also rearrange the display

order of the questions on the screen according to a number of descriptive attributes such as point value, topic, or chapter. To make question selection easier, each question also has various descriptive attributes associated with it, such as topic, objective difficulty, point value, and so on.

ExamBuilder's Modular Design

Because *ExamBuilder* is the first of a new class of software, a few comments about its organization are in order. *ExamBuilder* is a specialized data base program designed specifically to store, retrieve, and print arbitrary collections of the seven most common types of examination questions. In addition, the formatting, editing, and printing features of a word processor are also needed. To produce this hybrid software we created and introduced the concept of "modules"—an innovation that provides many benefits for the user and developer.

Because *ExamBuilder* is a module, you have immediate access to the minimal word-processing features required to edit, format, and print the exams you build. If your needs expand, you can simply replace the word-processing host supplied with *ExamBuilder* with a more powerful version of the same word processor. For example, you can have access to spell checking, hyphenation, a thesaurus, automatic revision tracking, an interactive glossary, and so on. A family of modules is expected to extend the scope of the word processor in many directions and thereby enhance the support available for building exams.

The original Macintosh system design included "desk accessories". We extended this concept in four ways: First, a module is designed to interact directly with only one application, making a translation for compatibility with the clipboard unnecessary. Second, a module is self-linking to the host at startup. Third, since a module is application-specific, it can manipulate the host's active file directly. In this case, *ExamBuilder* is designed to insert questions directly into the host's active file. Fourth, a module can also access some code within the host thereby avoiding duplication of code. This allows *ExamBuilder*, for example, to automatically numbers the questions in the exam file using the equation numbering code of its host.

ExamBuilder™1.0 Module

ExamBuilder is a modular extension of the technical word-processing software *MathWriter*. Because of the special relationship between the two packages, you have access to the powerful formatting, graphics, and equation-building features of the *MathWriter* system, most of which are included in ExamBuilder/MW2.

> You cannot activate the *ExamBuilder   Module* by double-clicking its icon. You must activate it from the Modules command on the Windows menu of its host.

ExamBuilder™/MW 2.0

A reduced-feature of *MathWriter* is the host of *ExamBuilder,* **and is named** *ExamBuilder/MW2.0*. **This host system produces exam files which are Math-Writer documents and, therefore, are fully compatible with the Educational and Professional versions of MathWriter.** *Note: If you are allergic to mathematics and don't require MathWriter's special mathematical features, just leave them hidden.*
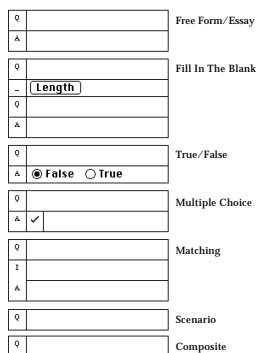
ExamBuilder Files

Figure 1.2
Building an Exam
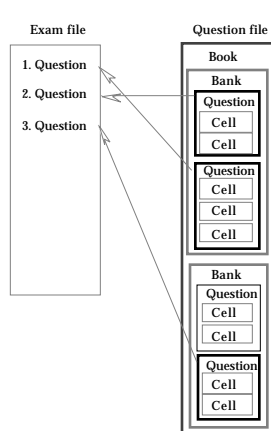
Exam questions are stored in a named *ExamBuilder* question file that is referred to as a **book** because the collection of test items is often drawn from a companion textbook. Related items within a book are grouped into an arbitrary number of **banks** that correspond to chapters, sections, or topics having some logical relationship. Banks contain an arbitrary number of **questions** or test items that you either select individually or allow *ExamBuilder* to select randomly. The subparts of a question are called **cells** and all cells of a question are transferred into the exam file if the question is selected.

Test items can contain text, mathematics, and graphics, making *ExamBuilder* useful in a broad range of disciplines. Each question, when shown in detail, includes information in the following descriptive fields (Figure 1.4): book and bank, number of questions in the active question bank, check box for manual selection, question type, check box for inactive status, difficulty rating, description of topic, chapter or section, objective, and point value. A book file is disk-based so its size is limited only by the available disk space, not available RAM.

Figure 1.3
Initial templates

There is a template structure for each question type. When you select a question template, *ExamBuilder* produces one of the forms shown in Figure 1.3. When a **free-form/essay question** template is selected, *ExamBuilder* creates rectangular regions the width of the window for the question and answer. The height adjusts automatically to accommodate the contents. **Fill-in-the-blank** question templates provide space before and after a blank of user-specified length. Multiple blanks can be created. **True/false** questions have "radio buttons" for entering the answer. **Multiple-choice** questions can have any number of response cells, although initially the template has only one. A **matching** question template provides space for a general question and an arbitrary number of item-answer pairs. Scenario and composite questions can have an arbitrary number of related questions of the previous five types. A **scenario** question consists of several linked questions that share an introductory statement, and they can include graphics and background materials. **Composite** questions have an introductory statement, but unlike scenario questions, the linked composite questions are considered interdependent and are, therefore, treated as a sequential, unbreakable set.

EB Demo.book

ExamBuilder stores each exam question and answer as a single record in a question file, usually referred to as a "book." Each record contains space for a few descriptive fields, that are common to every question, as illustrated by the multiple-choice example in Figure 1.? These include: topic, chapter/section reference, objective, point value, difficulty level, and whether the question is currently active, i.e., available for selection.

A question can be of arbitrary length and can contain text or a graphic (which in turn might include text or mathematics). A multiple-choice or matching question can include an arbitrary number of alternative responses. A check mark identifies the correct response.

≪ ExamBuilder™ ≫

Mathematics 10: Calculus I, II, III   25 Questions

Multiple Choice   ☐ Inactive Medium ▼

Topic:

Chapter/Section:

Objective:

Point Value: 0

Q | Find the slope of the tangent line to the curve
  | $2x^3 + 2y^3 - 9xy = 0$ at the point $(1, 2)$

A		3
A		9
A		9/2
A		1/3
A	✓	4/5

Figure 1.4 Multiple-choice question

ExamBuilder Structure

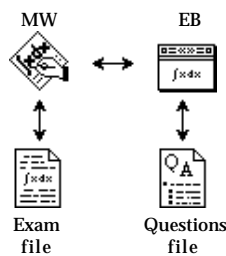MW   EB

Exam
file

Questions
file

**Figure 1.5 Data
flow relationships**

There are two parts to the *ExamBuilder* system: *ExamBuilder/MW2.0*, the host word processor, and *ExamBuilder   Module*, the data base manager; each part has its own file type: exam files and question files, respectively. The *Exam-Builder Module* is the part of the system that allows you to select questions from a question file and transfer them into an exam, or to generate an exam with randomly selected questions. *ExamBuilder /MW2.0* manipulates the generated exam; it edits, formats and prints your exams.

The question files are data base files and the exams are word-processor files. The Module creates the exams; it takes data base questions and forms the exams. The word processor is the engine of the entire system and allows you to enter and exit the *ExamBuilder Module*, add graphics and mathematical expressions to your questions, and format, save, and print exam files.

> For the sake of brevity and clarity, hereinafter *ExamBuilder/MW2.0* will be referred to as *MW   (alias   MathWriter™2.0)*. *ExamBuilder 1.0 Module* will be referred to as *EB (alias   ExamBuilder)*. Together these constitute the *ExamBuilder system.*

2 Quick Start Guide

This chapter provides an abbreviated tutorial introduction to creating exams with *ExamBuilder*. In this quick start guide we assume that you are familiar with the Macintosh interface. If you are not or need a refresher on icons, buttons, check boxes, pull-down and pop-up menus, mouse usage, and so on, refer to your Macintosh user's manual.

Installation

ExamBuilder requires System 6.0.2 or higher, is compatible with System 7.0, and is MultiFinder compatible.The Times font must be available to your system. Also required is the modified version of the Adobe Symbol font; it has been merged with *MW2.* If your system already contains the Apple-supplied Symbol font, remove it with the Font/DA Mover; although Apple's Symbol font works, it contains some peculiarities that have been altered in the supplied version. To conserve space, remove unnecessary files, fonts, desk accessories, and INITS.
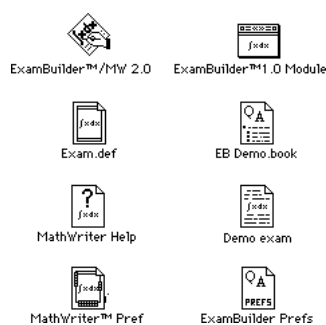
Create and name a folder on your hard disk, and then copy all the files you received into the folder. Remember to store the original disks in a safe place. Use the original diskettes only as backup. The *ExamBuilder Module,* MathWriter Help and Exam.def files must either be in the same folder with *ExamBuilder/MW2.0* or in the system folder. The EB Demo.book file can be placed anywhere. When activated the first time a "MathWriter Pref" and an "ExamBuilder Prefs" file will be created automatically and placed in the system folder.

Fig 2.1 File icons

Allocate RAM

Because MW2 retains its open documents in RAM, you must allocate space for both MW2 and its open documents during this first session. While at the Finder level, single-click the ExamBuilder/MW2 icon, select Get Info from the File menu, and assign as much as your system supports, preferably 2000K or more, for Application Memory Size, and click the close box. If you have only 1 megabyte of RAM, you must use the Finder, rather than the MultiFinder.

Activate ExamBuilder/MW2.0

The first step in using *ExamBuilder* is to activate the word processor.

1. Double-click on the *ExamBuilder/MW2.0* icon (not the *ExamBuilder Module* icon).

At startup the word processor automatically locates the Exam.def file, the help file, and *ExamBuilder Module.* Because this is your first use of the word processor the system creates a "MathWriter Pref" file in the System folder.

If you wish additional background on the use of the word processor, access the online help from the Windows menu, or experiment with the tutorial exercises 1 - 4 to learn to scroll, create paragraphs, move text, edit headers, print files, and format text, graphics, and mathematics.

2. Select Exam.def from the New submenu (Figure 2.2). This file has been configured for this purpose. *Note: Use "Save As..." with MW2 Default File type to create and save your own startup files in the system folder.*

File
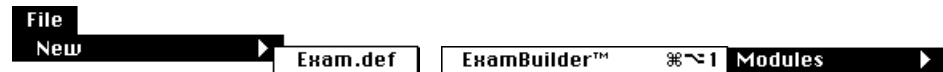**New** ▶   **Exam.def**   **ExamBuilder™** ⌘⌥1 **Modules** ▶

Fig 2.2 Select a formatted file and *ExamBuilder* Module

Activate the ExamBuilder Module

1. Select *ExamBuilder™* from the Modules submenu on the Windows pull-down menu (Figure 2.2), or use the equivalent key command: ⌘ *Option 1.*

> Note: Because *ExamBuilder* is a module, rather than an application, you cannot double-click on it to effect startup.

Because this is also your first use of *ExamBuilder*, the system creates an "ExamBuilder Prefs" file and places it in the system folder to save your customization preferences.

Notice (Figure 2.3) that the menu bar now contains menus pertinent to the management of question files.
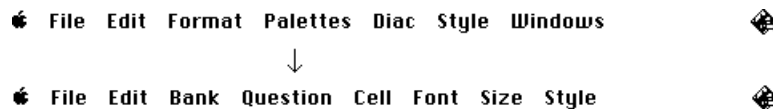
 File Edit Format Palettes Diac Style Windows
↓
 File Edit Bank Question Cell Font Size Style

Fig 2.3 Menu bar changes

2. Use the Open Book command on the File menu to gain access to the questions in the file EB Demo.book). The set of questions that you see in this file are those of one question bank in the larger "book" file. (See the section

"*ExamBuilder* files" in chapter 1, for more information.) To access other question banks in this "book," pull down the Banks menu and select one from among those listed at the bottom of the menu (after the Sort By command). Notice that the active question bank has a check by its name in the Banks menu.

3. Switch among the three views of the questions in this question bank using the View submenu of the Questions menu. There are three levels of detail to choose among, Short Summary, Long Summary, and Entire Question.

In the Short and Long Summary views (Figure 2.4) the question number is displayed at the left border of the item. When you use the Entire Question view (Figure 2.5), only one question is visible at a time, and the vertical scroll bar box on the right of the *ExamBuilder* window indicates the number of the displayed question. If the question is larger than the *ExamBuilder* window, a second vertical scroll bar for scrolling within the question appears to the left of the question number scroll bar.
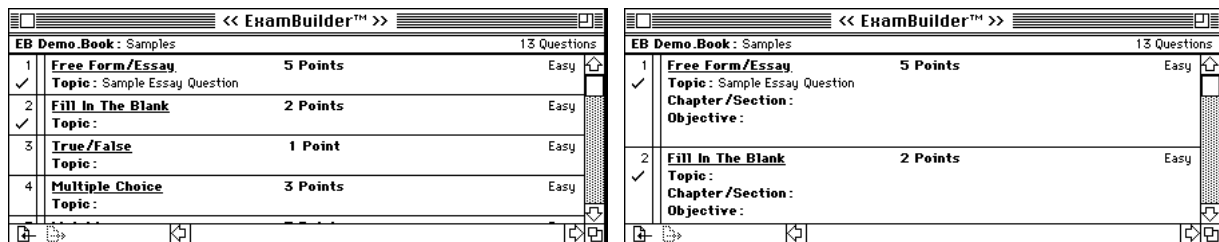
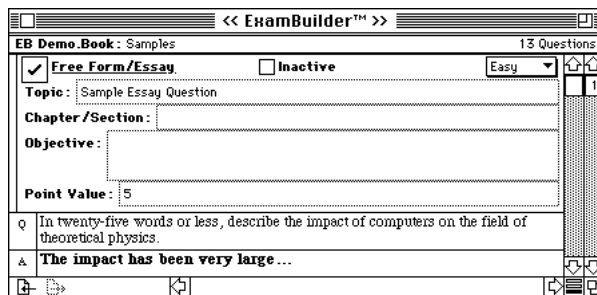**Fig 2.4 Short and Long Summary views**

Fig 2.5 Entire Question view

Creating an Exam

To create an exam, start by choosing UnMark All Questions on the Edit menu to assure that no previously selected questions remain selected. Then select one of four ways to create the exam:

1. *Manual Exam Building* Choose questions and transfer them into an exam file (a *MathWriter* file) one-at-a-time.

2. *Automatic Exam Building with User-Selected Questions*   Select all the questions you want transferred into one or more exams (*MathWriter* files), then let *ExamBuilder* transfer them into the word processor document, number them, etc.

3. *Automatic Exam Building with Randomly Selected Questions*   Select the question banks you want questions drawn from and the question selection criteria and let *ExamBuilder* create as many exams as you need—one per file.

4. *Automatic Exam Building with Questions Identified from a Log File*   Select the same questions utilized in a previous session, after question editing. This is really a re-building option.

When you choose to create an exam automatically ("build" an exam) you will be presented with a number of choices about exactly how you want the process to take place. These include such questions as which question banks to draw from, how the questions should be numbered, whether to create an answer key, and what the file name of an exam should be. You have the option of saving all the settings you select as a set of "Build Choices" so that creating the same type of exam another time can be as simple as (1) selecting the Build Choices and (2) clicking the Build button.

Manual exam building

1. If the EB window is active, return to the MW window. To do this either click on a portion of a MW window if one is visible or select Switch To MathWriter on the File menu (or press ⌘ *M*).

2. Select Exam.def from the New submenu of the File menu. This creates a copy of the template file previously configured to receive questions. (The question numbering variable was established in this exam file using Variables Format on the MW Format menu and uniformly spaced tabs were established after double-clicking on the ruler.) **Position the insertion point to indicate the destination location of the question to be transferred into this window by *EB*.**
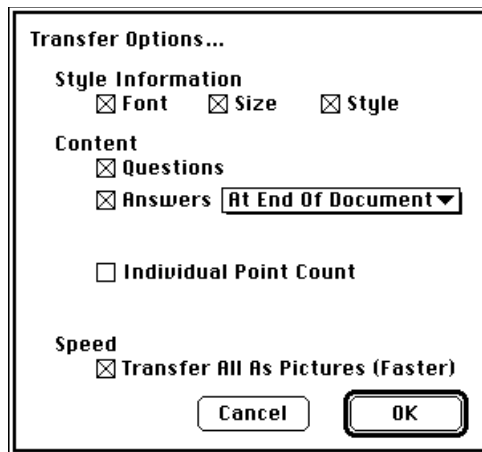
3. Switch to the *EB* module by clicking on any visible portion of its window or select "ExamBuilder™" from the Modules submenu of the Window menu (or press ⌘ *option 1* since this is the first and only module listed).

4. Adjust the settings as needed in the Transfer Options (Questions menu) dialog box (Figure 2.6).

a) Check Font, Size, and/or Style if you wish to maintain those features assigned to the question rather than having them change to match the typeface adjacent to the insertion point in the exam document.

b) Select the content to be transferred: Questions and/or Answers. If answers are to be included, also specify a placement—After Each Question or At End of Document.

```
┌─────────────────────────────────────────┐
│ Transfer Options...                      │
│   Style Information                      │
│       ⊠ Font    ⊠ Size    ⊠ Style        │
│   Content                                │
│       ⊠ Questions                        │
│       ⊠ Answers ┌──────────────────────┐ │
│                 │ At End Of Document  ▼│ │
│                 └──────────────────────┘ │
│                                          │
│       ☐ Individual Point Count           │
│                                          │
│                                          │
│   Speed                                  │
│       ⊠ Transfer All As Pictures (Faster)│
│            ┌────────┐  ┌──────────┐      │
│            │ Cancel │  │    OK    │      │
│            └────────┘  └──────────┘      │
└─────────────────────────────────────────┘
```

Fig 2.6 Manual transfer options

c) Decide whether you want the point count for each question displayed.

d) Select Transfer All As Pictures (Faster) to preserve the layout and style of the stored question by leaving the question in PICT (graphics) format. This also speeds the transfer considerably. If this option is not checked, the question is reconstituted in the exam document character-by-character. This provides greater editing and formatting flexibility after the exam is created.

5. Click the OK button to implement your choices.

6. *Only* if you will be selecting multiple choice questions:

a) Select Multiple Choice Format... on the Question menu.

b) Decide whether you want *EB* to scramble the multiple choice alternatives, and select a numbering format for the alternatives.

c) Click the OK button to implement your choices.

7. *Only* if you will be selecting matching questions, select Matching Format... from the Question menu:

a) Decide whether to scramble the questions and answers.

b) Select numbering formats for the questions and answers.

c) Click the OK button to implement your choices.

8. Scroll through the list to select questions. When using a summary view, click to highlight the desired question; when using the Entire Question view the currently visible question is selected de facto. Note: Use the View submenu of the Question menu to select the desired level of displayed detail. *EB's* interface allows you to select what you see, rather than by a list of numbers.

9. To transfer the selected question, click on the transfer icon at the bottom of the *EB* window or choose Transfer To Document from the Questions menu (or ⌘ *T*) to copy the question into the exam document (at the insertion point). The question will be numbered automatically. Note: You assign the numbering format using the Variables Format command on the Format menu of *MW*.

10. Repeat steps 8-9 as needed to select and transfer additional questions into the exam.

11. *EB* places the questions in the *MW* document that was active when you entered *EB*. To look at your exam, edit it and print it, select "Switch To MathWriter" on the *EB* File menu, type ⌘ *M*, or click on a visible portion of the exam document. See the instructions at the end of this section, under "Editing, Formatting, and Printing an Exam."

Automatic exam building with user-selected questions

When you build an exam automatically, you must specify one of the three categories of destination files for the exam—Current Document, MathWriter Default File Format, or Default File. The destination choice is made in *EB* in step 9d below, but you must prepare the receiving *MW* file earlier.

1. If the *EB* window is active, return to the *MW* window. To do this either click on a portion of the desired window if visible or select "Switch To MathWriter" on the File menu (or press ⌘ *M*).

2. In anticipation of using "Current Document" as the *EB* destination, select Exam.def from the New submenu of the File menu. This creates a copy of the template previously configured to receive questions and supplied with *ExamBuilder*. **Position the insertion point to indicate the precise destination of the question to be transferred into this window by *ExamBuilder*.**

3. Switch to *EB* by clicking on any visible portion of the *EB* window or select "ExamBuilder™" from the Modules submenu of the MW Window menu (or press ⌘ *option 1* since this is the first and only module listed).

4. Open the *EB* file of questions using the Open Book command on the File menu. In this exercise open the file EB Demo.book supplied with *ExamBuilder*. Note: The ".book" appendage on the file name is a convenient, but optional, way to identify the file.

5. As explained in chapter 1, the questions in the EB Book have organized into logical groupings called Banks. The *EB* window displays the name of the file (or book) and the name of the subgroup (or bank) just below its title bar. If "EB Demo.book: Samples" is not shown there, select Samples from the Bank menu.

6. Using the View submenu of the Question menu, select the view of the questions having the appropriate level of detail—Short Summary, Long Summary, or Entire Question. The keyboard equivalents are ⌘ *S*, ⌘ *L*, and ⌘ *?*, respectively.

7. To assure that your choices are not interspersed with previous selections, use UnMark All Questions on the Edit menu.

8. Scroll through the list of questions and mark those you wish to use. These marked questions are transferred by EB in a later step. The marking procedure differs slightly depending upon the question view.

8a) In the Short and Long Summary views the check mark is displayed in the box at the left edge of the window that displays the question number. Click in this box to select (or deselect) that question.

8b) In the Entire Question view click in the square box at the top-left corner of the question to select (or deselect) it.

An exam can be built using marked questions from one or more banks. If appropriate, repeat steps 7 and 8 for all other banks.

After selecting all the questions to be used, proceed to the next step.

9. Click on the Build Exam... command in the File menu (or use ⌘ *E*) and adjust as required any of the pop-up menus and check boxes. (See chapter 3 for more details on the choices you have when building an exam.)
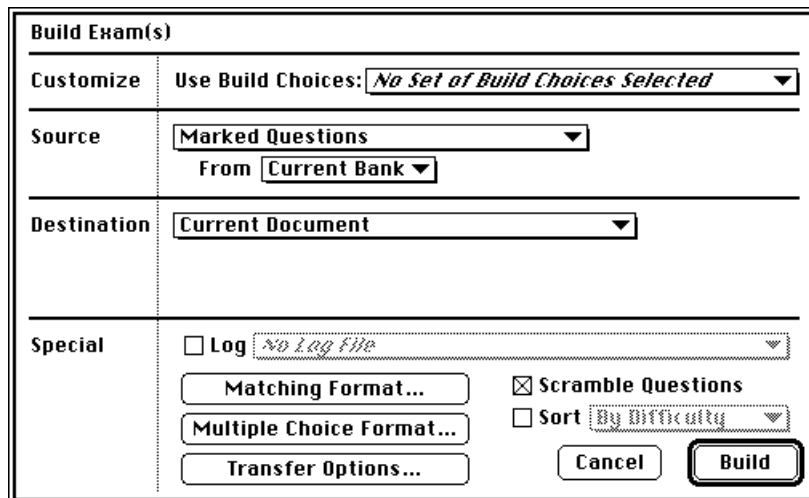
```
Build Exam(s)

Customize    Use Build Choices: No Set of Build Choices Selected    ▼

Source       Marked Questions                    ▼
             From  Current Bank ▼

Destination  Current Document                        ▼

Special      ☐ Log  No Log File                           ▼
             [   Matching Format...   ]     ☒ Scramble Questions
             [ Multiple Choice Format... ]  ☐ Sort  By Difficulty   ▼
             [   Transfer Options...   ]    [ Cancel ]   [ Build ]
```

Fig 2.7 Build Exam dialog box

9a) Customize: The Customize category should read "No Set of Build Choices Selected." This option permits you to save and to recall all choices made in this large dialog box.

9b) Source: If necessary use the pop-up menus to designate "Marked Questions" from the "Current Bank" as the source of questions for this exam.

9c) Destination: If necessary, choose "Current Document" as the file to receive the questions. In step 2 you chose a preconfigured file to receive the questions. That file already contains a course header, page numbering, typeface choices, and a question numbering variable.

9d) Special: Access to several miscellaneous features is provided here. You will use the defaults in this exercise. You can of course create a log file for this build session to track question usage. The Matching Format button controls the scrambling of questions and answers and the numbering scheme for matching questions. The Multiple Choice Format button provides controls for scrambling answers, the arrangement of the choices on the page, and the numbering format for the choices for multiple-choice questions. The Transfer Options dialog box provides control for typeface, inclusion of questions and/or answers, inclusion of point counts for individual questions and the total for all questions transferred, and whether the question remains in PICT format on the exam or is converted back into editable format. With the exception of total point count and file name extension, this dialog is the same as the Transfer Option command discussed earlier for the manual transfer of questions (Figure 2.6). When Scramble Questions is checked, the ordering of the marked questions will be shuffled automatically. Alternatively, the questions can be sorted by difficulty, point value, or type.

10. Click the Build button in the Build Exam... dialog box after all your choices have been made.

ExamBuilder will create an exam file that includes the questions you selected. It will number the questions and take into account the choices you made in the Build Exam... dialog box. To look at your exam, edit it, and print it, see the instructions at the end of this section, under "Editing, Formatting, and Printing an Exam."

Automatic exam building with randomly selected questions

Random selection of questions adds a few additional considerations, but the process is basically the same as for user-selected questions. The following discussion emphasizes the differences. We will also create multiple exams.

When you automatically build an exam, you must specify one of the three categories of destination files for the exam—Current Document, MathWriter Default File Format, or a Default File. The actual choice is made in step 9d below, but you must prepare the receiving *MW* file first. For convenience in this example we use the same Exam.def file used before, but we will select it differently. Alternatively, you could return to MathWriter (⌘ *M*), create a master file that contains the elements common to all exams in the set, and return to *ExamBuilder* (⌘ *option 1*).

1. Open the *EB* file of questions using the Open Book command on the File menu. In this exercise open the supplied EB Demo.book. Note: The ".book" appendage on the file name is a convenient, but optional, way to identify the file.

2. Click on the Build Exam... command in the File menu (or use ⌘ *E*) and adjust the pop-up menus and check boxes as instructed below to match Figure 2.8. (See chapter 3 for more details on the choices you have when building an exam.)

Fig 2.8 Build Exam dialog box

9a) Customize: The Customize category should read "No Set of Build Choices Selected." This option permits you to save and to recall all choices made in this large dialog box.

9b) Source: Use the pop-up menus to designate "Random Questions" and click "Select" (Figure 2.8) to create selection criteria for questions for this exam (Figure 2.9).

Click "New" (Figure 2.9) to create each selection criterion panel. Use the pop-up menus to select a Question Bank (a subset of the book), the question category (all questions, difficulty level, point value, or question type) and the number of questions you wish selected from this category. The total number of questions in this category is supplied automatically.

To create additional selection criteria repeat these steps.

9c) Destination: Choose Default File... as the prototype file to be copied and used to receive the questions. Choose a preconfigured file (in this example use Exam.def in the system folder or in the folder with *EB*) to receive the questions. That file already contains a course header, page numbering, typeface choices, and a formatted question numbering variable. Supply a family name, e.g., Demo Exam, (Figure 2.9), a sequence numbering format, and, optionally, a name to append to identify this as a test or answer file.
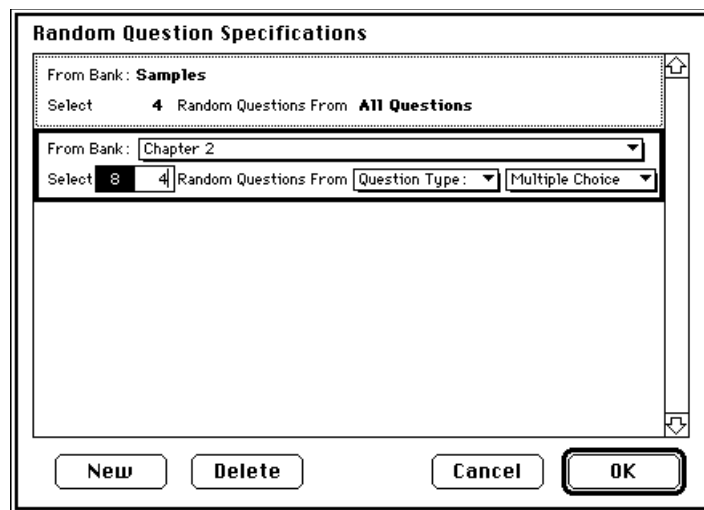
Fig 2.9 Question selection panels

9d) Special: Access to several miscellaneous features is provided here. You will use the defaults in this exercise. You can of course create a log file for this build session to track question usage. The Matching Format button controls the scrambling of questions and answers and the numbering scheme for matching questions. The Multiple Choice Format button provides controls for scrambling answers, the arrangement of the choices on the page, and the numbering format for the choices for multiple-choice questions. The Transfer Options dialog box provides control for typeface, inclusion of questions and/or answers, inclusion of point counts for individual questions and the total for all questions transferred, and whether the question should remain in PICT format on the exam or be converted back into a fully editable format. With the exception of the total point count and file name extension, this dialog is the same as discussed earlier (Figure 2.6) for the manual transfer of questions. When Scramble Questions is checked, the ordering of the marked questions will be shuffled automatically. Alternatively, the questions can be sorted by difficulty, point value, or type.

10. Click the Build button in the Build Exam... dialog box after all your choices have been made.

EB will create two exam files as requested. It will number the questions and take into account the choices you made in the Build Exam... dialog box. To look at your exam, edit it, and print it, see the instructions in the next section.

Editing, formatting, and printing exams

EB always generates exam files rather than sending material directly to the printer. This provides you an opportunity to refine the exam before printing it. Most of considerable editing, formatting and printing capabilities of MathWriter are available for this task.

1. Choose "Switch To MathWriter" from the *EB* File menu or click on the Close box to return to *MW* for final editing, formatting, and printing.

2. Refer to the second half of chapter 4 and to the MW Exercises file tutorial for a brief guide to using the text editing and formatting features of the *MW*.

You may need to provide tabbing for text alignment. At this point you have complete editing and formatting control unless you chose to transfer questions as PICTs, in which case you traded speed for some editing control.

3. If your printer is properly attached, selected in Chooser[1], select Print on the File menu, adjust the options as needed, and click OK (Figure 2.10).
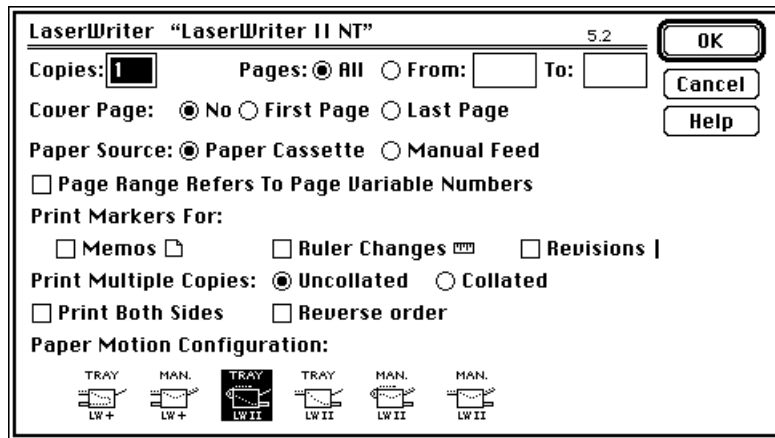
Fig 2.10 *MW* print dialog box

The printer dialog choices are probably clear except "Paper Motion Configuration." If you click on the configuration appropriate to your situation, the "Print Both Sides" option will provide instructions for changing the paper and the printing will produce output in the normal reading order.

Quitting

If *EB* is active click Quit on the *EB* File menu or click the close box to return control to *MW.* Then to end the session, click Quit in the *MW* File menu.

---

[1] If the original MW template was not formatted for this printer type, select Page Layout on the File menu, click the Page Setup button, select printer type, and click to close the two dialogs. If you changed the printer type, scroll through the document to inspect any changes produced.

ExamBuilder menus

❖

About ExamBuilder™...

File

New Book...	⌘N
Open Book...	⌘O

Create a question file
Open a question file

File Info...	
Preferences...	

Question file statistics and lock
Global font preferences

Build Exam...	⌘E

Dialog box for building
examinations automatically

Log Document...	
Examine Log Files...	

Audit trail of question
usage and cross-references

Page Setup...	
Print...	

Print question file
(not an exam file)

Switch To MathWriter	⌘M
Quit	⌘Q

Exit control

Edit

Undo	⌘Z

Undo last command

Cut Question	⌘X
Copy Question	⌘C
Paste Text	⌘V
Clear	
Paste Before	
Select All	⌘A
UnMark All Questions	

Standard tools for
 interaction with
 the clipboard.
 Applies to text,
 graphics, cells, and
 questions.

Global command to
 Mark/UnMark all questions

Clear Document	
Insert Point Count	

Erase receiving document
Count points currently in doc

Bank

New Question Bank...
Rename Question Bank...
Delete Question Bank

Create, rename, and
 delete sets or related
 questions within a book

Sort By ▶

Sort the questions in this bank
 by category for easier selection

✓**Samples**
Chapter 2

Select question
 banks in this book

Question

View	▶

Select scope of view

First	⌘<
Last	⌘>
Previous	⌘–
Next	⌘+

Locate questions

New Before	▶
New After	▶
Delete	

Create and delete
 templates for seven
 types of questions

Transfer To Document	⌘T
Transfer From Document	⌘D
Transfer Options...	

Transfer text and pictures
 to and from the question
 file according to defaults

Multiple Choice Format...	
Matching Format...	

Numbering formats

Cell

New Before	⌘J
New After	⌘K
Delete	

Create or delete
 cells within a
 question

Picture	
✓**Text**	

Identify structure
 of cell

Answer	
✓**Mixable**	

Identify the answer cell and if
 position change is allowed

Arrange Horizontally	
✓**Arrange Vertically**	

Arrangement of choices as a
 paragraph or in columns

Font

Chicago
Courier
Geneva
Helvetica
Monaco
New Century Schlbk
New York
Symbol
✓**Times**
Venice

A sample list
 of fonts
 currently
 selectable

Size

7 point
8
9
10
✓**12**
14
18
20
24
36
48
Other...

Font sizes
 available to
 EB. Sizes in
 outline
 style are in
 system.
 Sizes in
 pixel
 increments
 up to 127
 are
 selectable.

Style

✓**Plain**	⌘P
Bold	⌘B
Italic	⌘I
Underline	⌘U
Outline	
Shadow	
Condense	
Extend	

Selectable
 font styles

3 Using *ExamBuilder*

ExamBuilder Structure

The *ExamBuilder Module* is a specialized data base designed to store and to retrieve examination questions and to facilitate their selection and placement to form actual examinations. *MathWriter* hosts the data base by providing an editing, formatting and printing environment for examinations produced by *EB*. This chapter provides step-by-step instructions for performing the various exam-building tasks, including the creation and use of files of questions.

Books and banks

ExamBuilder stores data in files called "**books**" because a collection of questions and answers often, but not necessarily, coincides with the contents of a specific textbook. A book usually includes chapters or sections of more limited scope. In *EB* this subgrouping is treated as a question bank, or more simply as a **bank** and is a group of questions with a common focus. A book usually contains multiple banks. Note: With this same structure you can create an alternative organization—a file for each chapter and a bank for sections or topics.

Using this nomenclature you can instruct *EB* to randomly select questions from a specific bank or from all banks in the book when creating multiple forms of an examination. This makes it easy for you to create examinations that have variants of a question. For example, you can ask each student to compute the mean and standard deviation for different sets of numbers. Access to the answers of old exams will not allow the student to fake comprehension of an underlying concept. *EB* can be instructed to select randomly a specified number of equivalent questions from within a bank and to produce as many different examination versions as desired. Of course *EB* can also automatically produce the corresponding answer sheets, as well as study versions of the examinations (with answers) for distribution to the students, if desired.

Questions

A **question** is the smallest logical unit within a bank. In traditional nomenclature, a question constitutes a record. Figure 3.1 displays the format of a free-form question—one of seven classes of questions. Five of these classes (free-

form/essay, fill-in-the-blank, true/false, multiple-choice, and matching) are meaningful without regard to contiguous questions. The other two utilize inter-dependencies: scenario questions require that some sequence, such as an introduction to a group of questions, be preserved, but any combination of the related group of questions can be used in any order; but composite questions are multipart questions for which sequencing of the questions is essential and must be preserved. Note: With multiple-choice questions the ordering of the alternative choices can be scrambled, while preserving the prescribed positions of some, such as "none of the above."
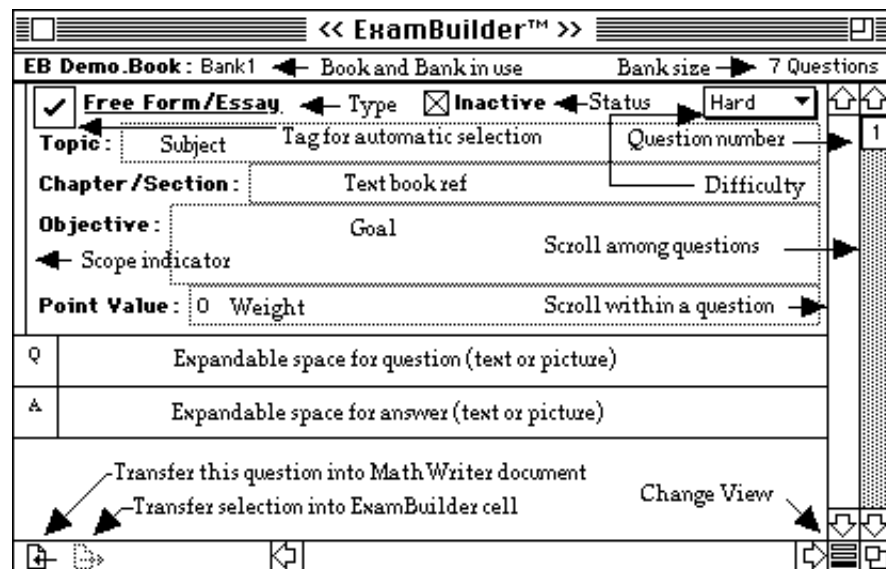
Fig 3.1 *ExamBuilder* window in entire question view

Viewing question fields

Several fields (Figure 3.1) common to all question types are specifically reserved for characterizations of examination questions that are useful when selecting questions for a specific examination. These fields are listed Table 3.1.

When selecting questions for use in an examination, you control the amount of information displayed in the *EB* window using the View command on the Question menu. The Short Summary (items 1-4 in Table 3.1), the Long Summary (items 1-7 in Table 3.1) display these descriptors. Use the Entire Question view to see and to edit the actual questions as well as the above fields. These three views are illustrated in Figures 2.4 and 2.5.

Double-clicking anywhere on the summary view of a question expands the view of the entire question, which reveals all the details of a single question and permits you to edit the fields. Let's review each of the fields listed in Table 3.? on page 9.

Table 3.1 Characterization of common fields

Category	Explanation
1. Question Type	See previous paragraph
2. Point Value	Importance or weight
3. Difficulty	Easy, medium, or hard
4. Topic	Subject matter category
5. Chapter/Section	Textbook reference
6. Objective	Performance criteria
7. Inactive	Temporary exclusion of question

Question fields

Six of the descriptive fields (2-7 in Table 3.1) can be modified when viewed in the entire question view, and then only if the file is unlocked (see the File Info command of the File menu in chapter 4).

Selection field
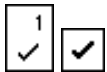
If checked, the box at the top left corner of the window in any view "marks" questions to be used in building an examination. Click in the question number rectangle on the left side of summary views or in the square box at the top left corner of entire question views (Figure 3.1) to mark (or unmark) a specific question. Note: Use EB's Build command on the File menu to effect the transfer of the marked questions into an examination file in RAM.

Inactive question field

If you wish to suspend usage of a particular item in the question file, check the Inactive box. When inactive, the question is shaded in the summary views. An inactive question is excluded from selection when you are building an examination automatically. For example, use this feature if you do not wish to cover a certain topic this term or if the test item contains an ambiguity or is otherwise unsuitable; simply check the inactive box to retire the item until you decide to re-enable it. If you attempt to use this question when creating an examination manually, you will be asked to approve the action.

Difficulty field

Use the pop-up menu at the top-right (Figure 3.1) to assign a difficulty level (Easy, Medium, Hard) to characterize a test item. This field can be used when selecting questions randomly, sorting items for ease of selection from the screen display, and when sorting the order of questions when building automatically.

Topic field

The topic field contains a description of the subject covered in this question. You can use keywords or phrases. Use the Bank/Sort command to establish viewing order by topic.

Chapter/Section field

This field identifies the relevant textbook topic and citation. This free-form entry can include section, page, or other references to sources. Use the Bank/Sort command to establish viewing order.

Objective field

This field identifies the goals or performance criteria relevant to this question. Use the Bank/Sort command to establish viewing order.

Point value field

Assigning a point value to a question provides a numerical basis for recognizing the importance or difficulty of the item when you take a test or compute a weighted score for the examination. Use the Bank/Sort command to establish viewing order. To transfer and display the point value of individual questions in the exam, select "Individual Point Count" in Question/Transfer Options or in File/Build Exam/Transfer Options.

Scope indicator field

A thin rectangular region at the left edge of a question in each view is shaded when a question belongs to a multipart sequence of questions. Note: Selection of a continuation question in a scenario sequence automatically selects the common header question, but in a composite question it automatically selects all parts of the sequence too.

Scrolling within a question

If the question window does not reveal the entire question, a vertical scroll bar automatically becomes available. Use the Grow box at the bottom-right corner of the window to make the window larger.

Scrolling among questions

A second vertical scroll bar becomes active, regardless of the view—Short Summary, Long Summary, or Entire Question— when more than one question is included in the active bank of questions. In the entire question view the scroll box displays the number of the question currently displayed (in summary views the question number is displayed to the left of the question). Drag the scroll box to locate a specific question by number. Click on the up or down scroll arrow to move to the next question, or click in the scroll bar above or below the scroll box to scroll up or down in steps of 10 questions. Menu and keyboard equivalents for scrolling through the question bank are provided (see inside covers). Note: Questions numbers are relative, not absolute, i.e., when you add or delete a question in a bank, the number of all higher-numbered questions change.

Change-view icon

To quickly switch from the entire question view to the last used summary view, click the icon adjacent to the Grow box. To switch to the entire question view from a summary view, double-click on the summary view of the question.

Question transfer icon

At the bottom-left corner of the *EB* window are two icons used to manually transfer questions between *MW* and *EB* and vice versa. The *EB* Question menu provides mouse and keyboard command equivalents to these transfer buttons. To transfer a selection into *EB*, make a selection in *MW*, make *EB* the active window, select a destination cell or field, and then click the Transfer From Document icon. To transfer a question into *MW,* position the insertion point in the exam document to identify the destination, switch to *EB*, select a question, and then click the Transfer To Document icon. *EB* performs certain formatting operations you specify using Transfer Options on the Questions menu as it transfers a question into the exam document.

Close, Zoom, and Grow boxes

The *EB* window contains the usual controls for closing the window, toggling its size between its current size and an enlarged size, and adjusting its size arbitrarily.

Question types

Only the bottom portion of the entire question view (Figure 3.1) changes with a change in question type. There are seven types of question available.

A question can include text, mathematics, and graphics (bit-mapped, object, and encapsulated PostScript); but since each cell (question or answer) is stored entirely as either text or as a graphic, *EB* transforms a composite selection into a PICT (graphic) when transferring it from the document into a question. You can type text directly in a cell, but you must create mathematical expressions in *MW* and then transferred them into a cell of the question template.

Free form/essay

You can change the width of a cell (question or answer) using the Grow box in the *ExamBuilder* window. The height of a free-form cell (Figure 3.2) adjusts automatically to accommodate the typeface, the number of lines of text, and the height of a picture.

| Q | In twenty-five words or less, describe the impact of computers on the field of theoretical physics. |
| A | **The impact has been very large…** |

Fig 3.2 Free form/essay question

Fill-in-the-blank

The fill-in-the blank template (Figure 3.3) initially contains four cells: The first question cell (labeled "Q") can contain text, a PICT, or can be left blank. The second cell provides a blank of user-specified length. Click the Length button to assign the length. The third cell, like the first, is an optional question cell and can contain text, a PICT, or can be left empty. Optionally, you can add any number of sets of these three cells. The fourth cell, labeled "A", contains the answer.

Q	In the world of
_	[**Length**]
Q	animals, the giraffe is the tallest.
A	**large**

Fig 3.3 Fill-in-the-blank question

True/false

The true/false example (Figure 3.4) shows a question cell that occupies two lines. To specify the answer in the second cell, click either the true or the false button.

| Q | The field of Mathematics is involved in the study of people named Matthew. |
| A | ◉ **False** ○ **True** |

Fig 3.4 True/false question

Multiple-choice

Multiple-choice questions (Figure 3.5) contain a question cell and an arbitrary number of answer cells. To add answer cells, click in an existing one and choose Cell/New Before or Cell/New After. Click in the second column to identify **the**

answer with a check mark; only one correct answer is allowed. A bold rectangle identifies answers that must occupy a special position, i.e., the sequence can not be varied. To make this designation, place the insertion point in the cell whose position must remain fixed (even if the remaining cells are shuffled when the question is added to the exam file) and select Cell/Mixable to remove the check mark adjacent to that menu command.

Q		Of the following five possibilities, which is the fastest computer?
A		Apple II+
A		Macintosh 512
A		IBM PC Jr.
A		Macintosh IIfx
A	✓	Tandy TRS-80
A	☐	None

Fig 3.5 Multiple choice question

Matching

Matching questions (Figure 3.6) can have a user-specified number of entries. Each item cell "I" is followed immediately by its correct answer cell "A." *EB* can scramble the order of the items and answers when placing them in the document in either paragraph or columnar format. To add additional "item-answer" pairs to the question template, place the insertion point within an existing pair and choose Cell/New Before or Cell/New After or their keyboard equivalents, ⌘ J or ⌘ K, respectively.

Q	Match the following five actors/actresses with the movies they starred in.
I	Meryl Streep
A	Sophie's Choice
I	Ronald Reagan
A	Bed Time For Bonzo
I	Robin Williams
A	Dead Poet's Society

Fig 3.6 Matching question

Scenario

Scenario questions (Figure 3.7) begin with an initial, common statement (possibly including text, graphics, and math) that is followed by one or more questions. The number and sequence of the questions is *immaterial*. All make use of the common problem statement, but are otherwise independent of each other. The parts of scenario questions can be any combination of types: free-form/essay, fill-in-the-blank, true/false, multiple-choice, and matching. *EB* assures that the common introductory material is included if any of its appended questions is selected.

Q	If $a = 1$, $b = 2$, $c = 3$, $d = 4$, and $e = 5$, then

Q	What is the sum of a, b, c, d, and e?
A	$a + b + c + d + e = 15$

Q	What is $d - e$ equal to?
A	$d - e = -1$

Q	What is the square of d?
A	$d^2 = 16$

Fig 3.7 Scenario question

To identify the parts of a scenario question, a shaded vertical bar appears to the left of the test item. A solid bar to the left of the test item identifies a multipart composite question for which *EB* preserves all parts as a unit, including the sequencing.

▧ Scenario   █ Composite

Composite

Composite questions (Figure 3.8) contain a common initial statement followed by one or more questions. The sequencing of the set of questions is crucial; so if you choose any one of these questions, the entire set, including the introductory cell, is selected, and the parts will not be shuffled even if you select "scramble" in the Transfer Options dialog box. Succeeding questions may depend on the content and/or answer of an preceding question in the composite.

When you select a cell, the leftmost column that contains Q, I, or A becomes highlighted. The Copy command on the Edit menu then applies to the entire selected cell.

To create a scenario question, first select a question (if one exists in this bank) and use Question/New Before or Question/New After to select a scenario template. This creates the cell for the common text and/or graphic. Next add a free-form/essay, fill-in-the-blank, true/false, multiple-choice, or matching question template using Question/New Before or Question/New After. When asked whether to "Attach this question to the previous Scenario/Composite question," click "Yes" to add this question to the sequence, or click "No" if this question template is not part of the sequence.

Q	If $a = 0$, $b = 10$, $c = 100$, and $d = 50$, then

Q	What is $e = a \cdot b \cdot c \cdot d$?
A	$e = 0$

Q	What is $e / 0$?
A	$e / 0 = $ **undefined**

Q	What is one possible way of finding an answer to part b?
A	**Ask the professor.**|

Fig 3.8 Composite question

Building Examinations

Having established a vocabulary in the previous section, we can now turn our attention to the productive use of *EB* with a question file. In a later section we discuss techniques for creating a file of new test questions and editing questions in an existing file. For the moment, we assume that you simply want to use the book of questions supplied with this *ExamBuilder* system to create an examination.

You can select questions individually while viewing them and transfer them immediately into an exam document for editing and printing. You can also mark individual questions and then build examinations automatically. *ExamBuilder* can produce multiple versions of examinations by shuffling questions and/or the answer alternatives in multiple-choice and matching questions. Another way to generate examination variants is to let *ExamBuilder* select questions randomly from the various banks of questions according to user-defined criteria. *ExamBuilder* can produce a transcript or log of the questions used and automatically print answers. Chapter 2 presented a cursory introduction to exam building, but now let us examine in depth the options and possibilities provided.

Manual exam building

To make these instructions more specific, we refer to the files supplied in the EB Demo folder.

Startup

1. Activate *MW*.

Choose a destination file

2. Select Exam.def from the New submenu.

Entries on the New submenu correspond to the stationery files placed in the system folder or n the folder with *MW*. Selecting a name from the New submenu creates a *copy* of the stationery file to establish a writing environment. You create the stationery files using the MW Default File type on the Save As command. This means that you can preconfigure your choice of paper size, margins, headers, footers, font, font size, font style, ruler settings, printer type, and many other conditions. The document can contain formatted text that identifies your course, the date, space for the student's name and section, and even page totals. Exam.def is such a file.

Alternatively, you could simply select New (without selecting from the submenu) for an unspecialized document and "prepare" it to receive the questions from the data base — set margins, font, font size, font style, identifying title and other prefatory materials, etc. Don't forget to specify tabs (e.g., fixed at 0.5 inch spacing) and a format for the question numbers. You must also format the User Category # variable to provide the automatic numbering

of the questions. Use Variables Format on the Format menu to assign the format, e.g., no character before the question number and a trailing period.

A brief summary of MathWriter usage is provided by the online Help file available using *MathWriter's* Windows menu. In addition, a set of word processor tutorial exercises in included as part of the *ExamBuilder* system.

Open *EB*

3. Select *ExamBuilder™* from Windows/Modules[1] or use its keyboard equivalent, e.g., ⌘⌥ 1 if EB is the first entry in the Modules submenu.

This opens the *ExamBuilder* window and changes the menu bar (Figure 3.9) to provide appropriate commands.

 File Edit Bank Question Cell Font Size Style

Fig 3.9 *ExamBuilder* menu bar

Choose a Source file

4. Open the question file "EB Demo.book" using File/Open Book.

The book opens to the view that existed when the file was used last. File saving is automatic, so the File menu contains no Save command.

Three views of questions

The Short Summary, the most abbreviated of the three views, permits an abbreviated summary of several questions at once. Only one book can be open at a time, so opening another book automatically closes the open one.

The Long Summary (Figure 3.10) supplies additional detail, but is otherwise similar to the Short Summary.

The third form for viewing (and editing) questions, the Entire Question view (Figure 3.10), displays all fields of a question, although some scrolling and/or use of the Grow box may be required to bring all portions of the question into view.

Select a view

5. Use the View submenu or the keyboard equivalents to cycle among the three views (Short Summary ⌘ S, Long Summary ⌘ L, Entire Question ⌘ ?). Alternatively, double-click a question in the Short or Long Summary views to switch to the entire view. To return to the immediately previous view, use the View submenu again or click the icon ▤ at the bottom right corner of the window.

---

[1] This notation means select Modules on the Windows menu.
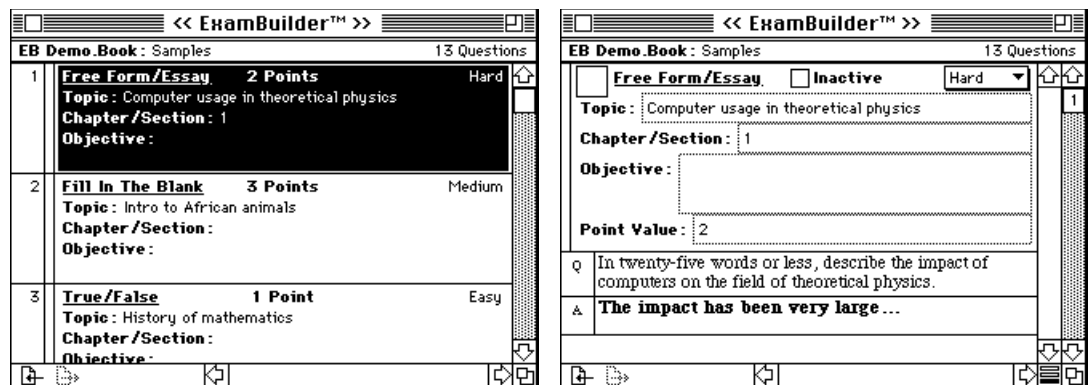
Fig 3.10 Question views (Long Summary and Entire Question)

Examine the questions

6. Use the scroll bar common to the three views to view all the questions in the current bank[2]. Alternatively, use the Question menu or keyboard commands [First (⌘ <), Last (⌘ >), Previous (⌘ -), and Next (⌘ +)] to move among the questions (Figure 3.11). In the entire question view the question number is displayed in the scroll bar; in the summary views the question number is displayed near the left margin.

Fig 3.11 Locating a question

You decide the basic structure of the questions and the formatting choices when you create the question file. The *ExamBuilder* system provides additional numbering and placement control as it transfers the questions into the exam document. Even after the questions are transferred into an exam document, considerable reformatting capability remains available.

Select format default settings

7. Before selecting any questions, establish the formatting you want *Exam-Builder* to apply as you transfer the questions manually from the question file into the examination document. Three Question menu commands are applicable: Transfer Options..., Multiple Choice Format..., and Matching Format... .

Transfer Options... command

The font, size, and style of the text of the stored questions can be preserved or matched automatically with the adjacent characters in the exam.

1. Select Question/Transfer Options to access a dialog box (Figure 3.12).

---

[2] A question file can contain multiple subgroupings, called banks. To view questions in another bank, you must first select it from the last group of commands on the Bank menu.

Style

2. If you wish to preserve the text attributes of the stored questions being transferred into the exam document, select those attributes here. The attributes of text for unchecked categories will be changed to match the adjacent text in the *exam* document.

> *WARNING:* Changing the font can produce unexpected results because characters other than alphabetic and numerals are not the same in all fonts, do not have standard keyboard assignments, and, therefore, substitutions can change the meaning of a question.

ExamBuilder preserves the font identification of PICTs transferred into an exam document. The names of fonts used in PICTs, not just the local font number, are passed to *MW* which then converts the name into the local font identification number.
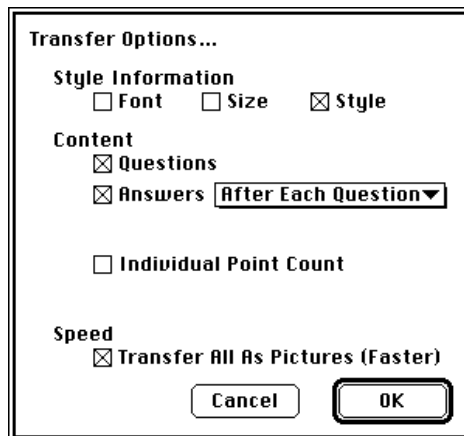
Fig 3.12 Transfer options dialog box

Content

3. Specify the portion of records you want *ExamBuilder* to transfer—questions only, answers only, or both questions and answers. If answers are included, use the pop-up menu (Figure 3.13) to specify whether the answers are to be listed separately, merged with the questions, or placed in a unified answer key if multiple exam versions are being produced.
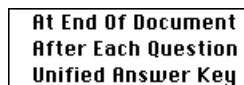
Fig 3.13 Transfer options

Point count

Select this option if you want the *ExamBuilder* system to place the point value of each question immediately following the question number. To have *EB* total the points of selected questions, use Edit/Insert Point Count *AFTER* you place all questions in the exam document because that operation triggers a one-time-only tally. *The tally is taken from the uneditable, hidden memo notes, not the*

displayed values, so if you remove any of the hidden notes or manually edit the point values, you must also manually modify the reported total point count.

Speed

ExamBuilder ordinarily transfers text and mathematics from the question file into the exam document character-by-character, including mathematical expressions, such that full formatting flexibility is preserved. With the low-end Macintoshes this flexibility exacts a considerable computational cost. To overcome this limitation you can elect to transfer each cell in a question as a single composite graphic. Text, mathematics, and pictures are stored as PICTs; this option just disables the translation back to editable text. There is an additional reason for exercising this option — preserving the exact layout and format of the question. The price you pay for this advantage is a commitment *a priori* to a page width.

> The *ExamBuilder* system provides an extension to the standard interface. These files store the font names for text (even that used in PICTs), not just the FONT IDs which vary from computer system to computer system, and the *ExamBuilder* system translates the font names into the appropriate local font identification numbers. Hence, the PICT graphics stored in *ExamBuilder* questions can be transferred with font integrity into an exam document with any system. As a further precaution, use *MathWriter's* File/Preferences command to provide a warning if a *MathWriter* document requires a font that is not currently available to your operating system.

Multiple Choice Format...

This command (Figure 3.14) allows you to specify whether you want *EB* to scramble the ordering of the response alternatives and which numbering format it should use when forming an exam.
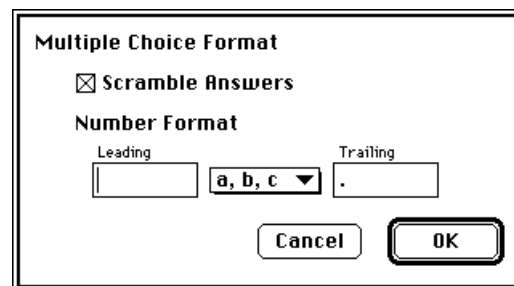

Fig 3.14 Multiple Choice Format

Scramble

4. Check "Scramble Answers" (Figure 3.14) to shuffle the sequence of the alternatives in multiple-choice questions when they are transferred. If unchecked, the transferred sequence matches the sequence of the stored questions.

Numbering

5. Use the Number Format pop-up menu (Figure 3.15) to select one of the five formats for numbering the alternatives. Edit the boxes ("Leading" and
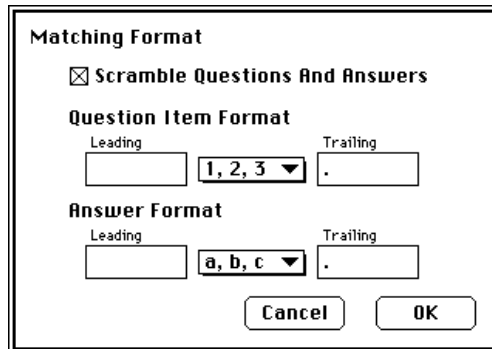
"Trailing") to specify any text that should precede or follow the numbers such as parentheses, brackets, dashes, periods, etc.
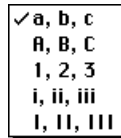
Fig 3.15
Number formats

Matching Format... command

Specify in the dialog box (Figure 3.16) whether you want *ExamBuilder* to scramble the questions and answers and which numbering format to use for the questions and answers.

Fig 3.16 Matching format dialog box

Scramble

6. Check "Scramble Questions and Answers" to randomize the sequence of the answers and questions as they are transferred (Figure 3.16). If unchecked, the transferred sequence matches the sequence of the stored question and the answer key utilizes the pairing of questions and answers in the question file.

Numbering

7. Use the pop-up menus (same as Figure 3.15) to select one of the five formats for numbering the question and the answer lists. Edit the boxes ("Leading" and "Trailing") to specify text, if any, that should precede or follow the numbers of the questions and the answers.

Select a question

8. Select a question for transfer into the document.

Since the Entire Question view displays only one question at a time, it is the *de facto* selected question when visible. In the other two views, you must click on a question to select it. *ExamBuilder* preserves "what you see is what you get" operation by allowing you to select displayed questions, i.e., **you do not simply select questions by number from a printed list**. In the Summary view the highlighted question, not a checked question, is the selected question. Note: Use File/File Info to review the history of the book, its name, the names of its banks, and the number of questions in each. This is also the place to lock (write-protect) the question file to prevent accidental modifications.

Transfer a question

9. Transfer the selected question into the *MathWriter* document in one of two ways:

• Click the icon ⊞ ⌗ (at the bottom left corner of the *EB* window) that depicts transfer *into* a document. (The companion icon denotes transfer from a document and is used when creating the questions, as discussed later.)

•Select Question/Transfer To Document or use the keyboard equivalent ⌘ *T*.

Repeat steps **8** and **9** for each question you wish to transfer manually.

Save the exam

10. Switch to *MW* (click on the exam document window, select File/Switch To MathWriter or type ⌘ *M*), save the exam document, perform any additional formatting desired, save the document again, and then print it.

ExamBuilder can print the book, but *MW* prints the exams you build. We recommend that you always save the exam file before printing as a precautionary measure because exam documents are RAM-resident **only** until you create a file.

 Multiple choice and matching questions frequently need some manual tabbing for correct alignment. The editing and printing of exam files is discussed later in this chapter.

Automatic exam building

In addition to building an examination manually, you can also produce an examination automatically from questions you select — either by tagging (or marking) the questions to be used and then letting *ExamBuilder* transfer copies of the selected questions into a *MathWriter* exam document, or by letting *ExamBuilder* select questions. Random selection is especially useful when creating multiple versions of an examination. The formatting options discussed for manual generation are also available to automatically generated exams.

Automatic exam generation offers several powerful additional capabilities. The first is the ability to shuffle the *order* of the marked questions. *Exam-Builder* can sort the marked questions by difficulty, point value, and question type. Exam questions can be *selected   randomly* from the book according to user-defined criteria. The *selection   criteria* can be the number of questions from a Bank, the difficulty level, the point value, and the question type. You can mark individual questions for *exclusion* from the selection process.

ExamBuilder can also construct multiple versions of an examination. In its simplest form this means scrambling the order of the questions on the examination. Questions can also be sorted by difficulty, by point value, and by type. Each exam version is stored in a separate *MathWriter* file.

ExamBuilder can also produce a listing (or log) of the questions used in each examination and a cross-reference listing of the examinations on which each question appears. This means, for example, that you can track the use of questions and later identify the examination versions that included an inappropriate question. This also means that you can produce another set of exams using the same questions after they have been edited.

Because of the many combinations of options supported and because you may have a few preferred combinations, *ExamBuilder* supports a customization technique. You can create "Build Choices" to save and later quickly configure the Build Exam dialog box for the same named combination of options (File∕Build) appropriate to your needs.

Build an exam automatically with user-selected questions

Startup

1. Activate *MathWriter*.

Choose a destination file

2. Select an exam template (File∕New submenu) such as Exam.def.

Ordinarily you will prepare your own template file and save it using *MW's* File∕Save As[1] with the MW Default file type before using *ExamBuilder*. Recall that such files appear automatically in the New submenu if stored in the system folder or in the folder with *MW*. You can create custom templates according to your own preferences and needs. See page 26 for additional details.

Cross-references will be used extensively in this chapter for brevity.

Open *EB*

3. Select *ExamBuilder* from Windows∕Modules or use ⌘⌥ 1.

This opens the *ExamBuilder* window and changes the menu bar (Figure 3.9).

Choose a source file

4. Open the file, "EB Demo.book" in this example, using File∕Open Book.

ExamBuilder provides three alternative ways to extract questions from a question file automatically—marked (user-designated) questions, randomly using user-designated selection criteria, and, after editing, re-using a set of questions selected in a previous session as identified in a log file.

Selecting questions

5. Individually select questions by clicking the selection fields (see page 21) as you scroll through the questions:

The bank

5a. Select the question bank, "Samples", for this example, from the Bank menu. The names of the banks in this book appear at the end of the Bank menu. Selecting one deselects the previously selected one.

---

[1] This notation means select Modules on the Windows menu.

The view

5b. Select one of the three views. Use the Question/View command or the keyboard equivalents (see page 27).

Unmark all questions

5c. Select Edit/UnMark All Questions to assure that no questions remain unintentionally selected.

Choose questions

5d. To select a question, bring it into view by scrolling (the question number is in the scroll box); by using the First, Last, Previous, and Next commands on the Question menu; or by using the keyboard equivalents (⌘ <, ⌘ >, ⌘ -, or ⌘ + respectively) and then clicking in the check box (Figure 3.13). The check mark is displayed in all three views. After selecting the subset of questions you wish to use in this examination,, proceed to the next step.
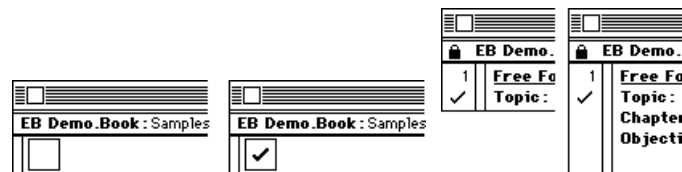
Fig 3.13 Unmarked and marked questions

Select the Build Exam command

6. Select File/Build Exam (⌘ E) to access the dialog box (Figure 3.14).

This is the master dialog box for controlling the building of examinations automatically. Here you specify the source of questions, the file destination of the generated examination(s), the formatting options, the use of an audit trail of questions, and whether the questions should be scrambled and/or sorted. In future sessions you will likely use a "Build Choices" set to reestablish these conditions with a single command. Consider each of these categories—Customize, Source, Destination, Special.
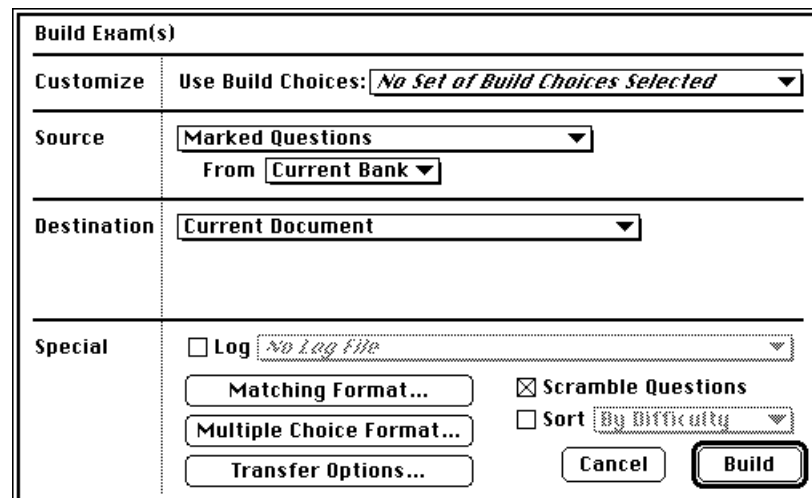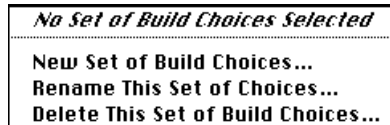
Fig 3.14 Build Exam(s) dialog box

Customize commands

No Build Choices set now exists if this is the first time you have used the ExamBuilder system. The pop-up menu (Figure 3.15) contains commands to create a new named set of choices, to rename the currently selected set of choices, and to delete the currently selected named set of choices. To use this feature, name and save your frequently used sets of choices; to quickly reestablish this same combination of Build Dialog choices later, simply select the set by name; then if desired, edit this configuration and save as a new set.

```
┌─────────────────────────────────┐
│ No Set of Build Choices Selected │
├─────────────────────────────────┤
│ New Set of Build Choices...      │
│ Rename This Set of Choices...    │
│ Delete This Set of Build Choices...│
└─────────────────────────────────┘
```

Fig 3.15 Build set pop-up menu

Source commands

Questions used on exams may be drawn from the set of user-marked items, randomly selected from the book according to user-specified criteria, or taken from a previously used set and reconstituted after some of the questions in the book have been edited.

Marked questions

7. Since we are creating an examination using the questions selected above in step 5, select Marked Questions from the source pop-up menu (Figure 3.16); the other choices, Random Questions and Select Log File..., are discussed later in this chapter. Make sure that Current Bank (rather than "All Banks") is selected. To designate another single bank as "current" use the Banks menu.

```
┌────────────────────┐  ┌───────────────┐
│ ✓Marked Questions  │  │ ✓Current Bank │
│  Random Questions  │  │  All Banks    │
│  Select Log File...│  └───────────────┘
└────────────────────┘
```
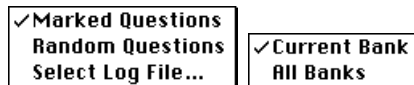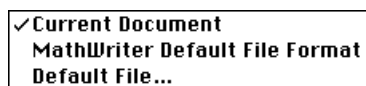
Fig 3.16 Source of questions pop-up menu

Destination commands

ExamBuilder transfers all the selected questions into an exam file. You can use the current MW file if only one exam is to be created. Multiple exams can be created using copies of the MW startup default file or a user-designated Default File. The startup file is the file displayed at startup and is designated using the Preferences dialog box of the File menu. In each case these default files need to have been configured especially as an exam template. This usually means placing tabs at fixed intervals, by double-clicking on the ruler, and formatting a user-defined variable for automatic question numbering using Variables Format of the Format menu.

You must choose among three categories to designate the destination exam file (Figure 3.17). In step 2 you anticipated this choice by opening an exam template, so select current document here.

```
┌─────────────────────────────────┐
│ ✓Current Document               │
│  MathWriter Default File Format │
│  Default File...                │
└─────────────────────────────────┘
```

Fig 3.17 Destination file categories

8. Identify the current *MathWriter* document by selecting "Current Document" from the Destination pop-up menu (Figure 3.17). Note: The other possibilities are to create a user-specified number of files in "MathWriter Default File Format" with an assigned sequence of names or to use an unopened, user-selected Default File. These options will be discussed later in this chapter.

Special commands

This category covers miscellaneous operations performed during the transfer process: create a listing (log) of questions used, establish the format for numbering of matching and multiple-choice questions, set typeface transformation rules, choose whether questions and/or answers, and point counts are transferred, and whether the questions are transferred as a stream of editable characters or as PICTs.

9. Set the Special options as follows:

Log

9a. Do not check the box for creating a log file (Figure 3.18); this will be discussed later. Note: If checked, the options would be New File... and Existing File....

☐ **Log** | No Log File   ▼ |
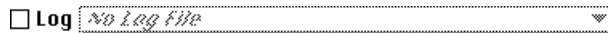
Fig 3.18 Log option

Matching Format

9b. If you have included matching questions, click the Matching Format... button (Figure 3.14) to specify whether you want the questions and answers to be scrambled; specify the question item and answer formats (Figure 3.19). The "leading" and "trailing" boxes allow you to provide surrounding text or characters. Five number format choices are provided (Figure 3.19).
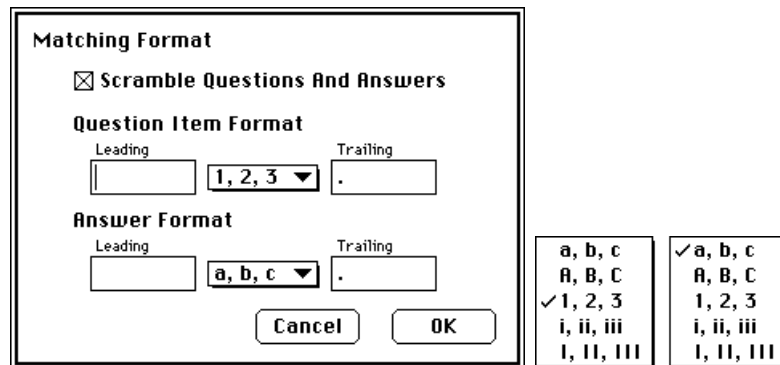
Fig 3.19 Matching format dialog box and numbering formats

Multiple-choice Format

9c. If you have included multiple-choice questions, click the Multiple Choice Format... button (Figure 3.14) to specify whether you want the answers to be scrambled (Figure 3.20), to specify the layout arrangement of the answers, and to specify the numbering format.
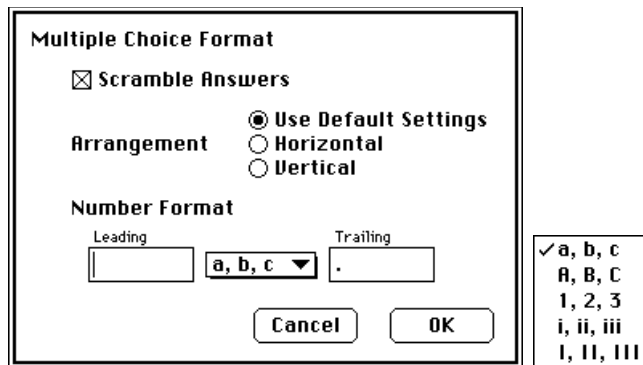
Fig 3.20 Multiple choice format dialog box and numbering formats

Transfer Options   9d. Set the transfer options (Figure 3.21) that control the transformations and content choices you want exercised during examination construction.

Preserving the font attributes is preferred because the choice and placement of mathematical symbols varies among fonts and changes might distort the content. Check only "questions" to produce an exam. The answers can be printed separately for scoring purposes or in combination with the questions for distribution to the students after the exam. The unified answer key choice provides a composite answer key when multiple versions of an exam of multiple-choice questions are created.
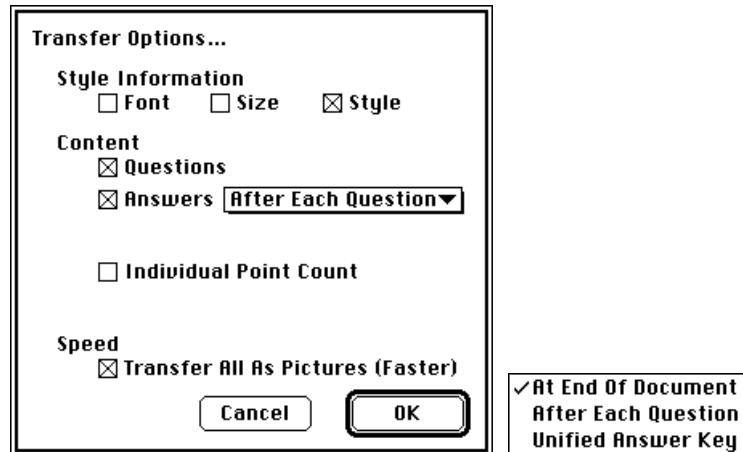
Fig 3.21 Transfer options dialog box and placement of answers

Scramble   9e. If you wish to scramble the ordering of the marked questions, check the Scramble Questions box.

Sort   9f. If you want *ExamBuilder* to sort the questions when being assembled, check the Sort box and select a pop-up category: By Difficulty, By Point Value, or By Type.

Build an exam

10. Finally, click the Build button at the lower right corner of the Build Exam(s) dialog box (Figure 3.14), and *ExamBuilder* constructs the examination from the marked questions according to the specifications in the Build dialog box.

Automatic exam building with randomly selected questions

In this example you learn to instruct *ExamBuilder* to select questions at random, (optionally) scramble their ordering, and then transfer copies of the selected questions into exam files automatically.

The random selection and scrambling capabilities are useful for creating multiple versions of an examination. *ExamBuilder* randomly selects questions according to several criteria: by number of questions from each bank, difficulty level, point value, and question type. You can designate individual questions as temporarily inactive and, thereby, exclude them from the selection process.

In this section we also demonstrate *ExamBuilder's* capacity to produce a log listing of the questions used in each examination and a cross-reference listing of the examinations on which each question appears. This means that you can track any repeated use of questions and later identify the examination versions that included, for example, an inappropriate question.

There are numerous ways to produce examinations using *ExamBuilder*. Because you are likely to have strong preferences for a particular format, *ExamBuilder* facilitates customization of the building process. You can create and save build choices sets that later, when selected, quickly configure *ExamBuilder* to generate previously used combinations of "build" options appropriate to your needs.

All of these options are considered in this example.

The startup process is the same as described for the previous example (see page 26).

Startup

1. Activate *MathWriter* and select *ExamBuilder* from Windows/Modules.

This opens the *ExamBuilder* window.

Select the Build Exam command

3. Select Build Exam from the File menu (⌘ *E*) to access the master dialog box (Figure 3.22) that shows the choices relevant for this example. These choices have produced a different Build dialog box than shown in Figure 3.14.
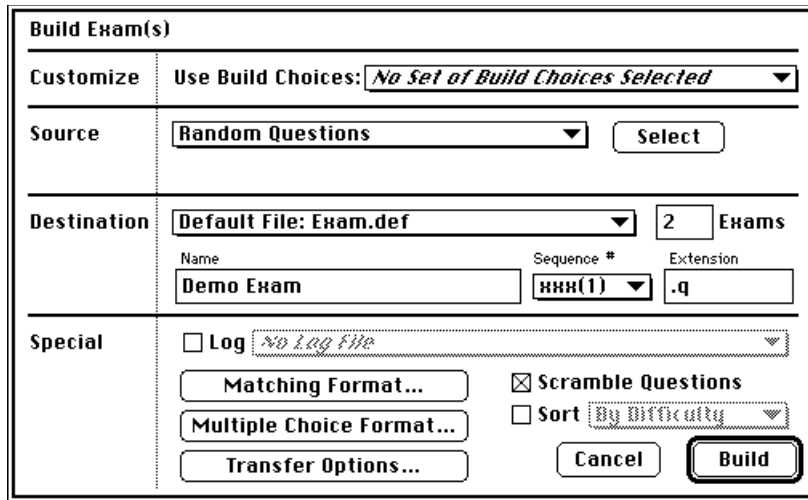
Fig 3.22 Build dialog box being used to automatically build an exam

Customize: Using a Build Choices set

(This paragraph is for completeness only — do not use Build Choices now.) **If you had previously saved the combination of options in this master dialog box as a Build Choices set, you could quickly recover these options by selecting that Build Choice file by name from the "customize" pop-up menu. If desired, you could use these choices as a starting point for further adaptation. Figure 3.23 shows a multiple choice template as having been selected. The names of user-defined sets appear in the top portion of the pop-up menu.**
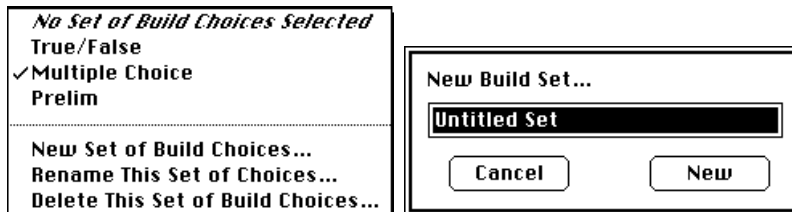
Fig 3.23 Sample menu of Build Choice sets and set naming dialog box

Create a build set

After selecting the options in the Build Exam box (Figure 3.22) appropriate to your needs, select New Set of Build Choices... (Figure 3.23) from the pop-up menu to obtain a dialog box for naming the set.

Supply a file name and click New or press *return*. The file name can contain spaces, but no colons. For convenience, avoid using an excessively long name.

Note: The "Rename This Set of Choices…" and "Delete This Set of Build Choices…" options are enabled when an existing build choices set is selected.

Source: random questions

4. Select Random Questions (Figure 3.22) from the source pop-up menu and a "Select" button appears.
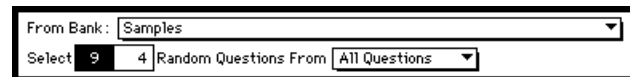
5. Click the "Select" button (Figure 3.22) to open a window (Figure 3.24) in which you can create an arbitrary number of selection panels to guide the random selection process.
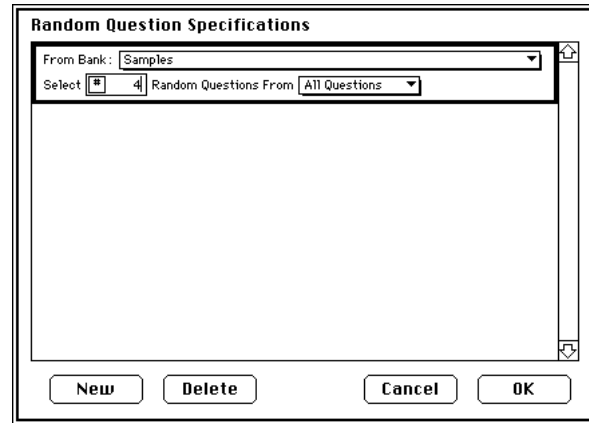
Fig 3.24 One illustrative selection panel

6. Click "New" (Figure 3.24) to create a selection panel for this scrolling window (Figure 3.25).

Fig 3.25 A selection panel

6a. Select a Question Bank (such as "Samples" in Figure 3.26) from this book using the pop-up menu. Note: To select a different book use File/Open Book.

6b. Use another pop-up menu on the panel to specify the category from which you want to select questions randomly—All Questions, Difficulty Level, Point Value, and Question Type (Figure 3.26).

6c. Use the category's companion pop-up menu (when any choice other than All Questions is selected) to specify an additional qualifier (Figure 3.26).

6d. Specify the number of questions you want to select that meet your conditions. The maximum number of questions that satisfies the selection criterion is displayed in white characters on black background to the immediate left of the dialog box in which you specify the number you want to select (Figure 3.26).
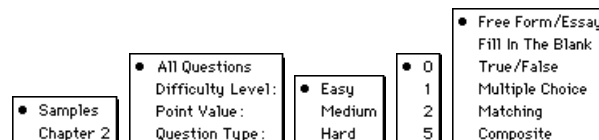
Fig 3.26 Question category

6e. For additional selection sets, click "New" and repeat 6a-6d. All such panels of sets of conditions will select additional questions.

6f. To remove any sets of conditions, click on a panel to select it and then click the "Delete" button (see Figure 3.24).

6g. When satisfied with the combination of conditions, Click "OK".

Destination exam files

Because you want to be able to create multiple examinations, *ExamBuilder* must be able to create exam files as needed. You can choose either MathWriter Default File Format or a specific Default File... as the template for these files. You must supply a family name for the files and *ExamBuilder* supplies a distinguishing sequence number.

7. Select a destination file type using the a pop-up menu (Figure 3.27). If you choose Default File..., you must also locate a specific template file. The choice "MathWriter Default File Format" is already a uniquely identified file—the one you previously selected using File/Preferences in MW.

7a. Specify the number of exams. ☐1 ☐ Exams

7b. Provide a family name for the destination files (Figure 3.27), replacing "Untitled".

Name	Sequence #	Extension
Untitled	xxx(1) ▼	.q

Fig 3.27 Name destination files

7c. Use the sequence number pop-up menu (Figure 3.27) to specify a one, two, or three-digit sequence number and a starting value (Figure 3.28); "xxx" means pad the number on the left when necessary to assure three digits.

```
 x
 xx
✓xxx
─────
 Starting At...
```

```
Starting Number...
┌──────────────────┐
│1                 │
└──────────────────┘
( Cancel )   ( OK )
```

Fig 3.28 Sequence number pop-up menu and dialog

An identifying file extension becomes a part of the file name. (Note: The extension is not limited to three characters.)

Special transfer options

The special options allow you to create a log of questions used on each exam and a cross-reference list organized by question.

Log file

1. Click on the Log check-box and choose either New File... or Existing File... from the pop-up menu. Each option branches to a standard file dialog.

You can examine the log file created during the "Build" process with the File/Examine Log Files command as discussed on page ??. *ExamBuilder* creates log files from the exam file using the markers (stored as special memo notes) associated with the questions.

Other options

The remaining options (Matching Format..., Multiple Choice Format..., Transfer Options..., Scramble Questions, Sort) in the Build dialog are identical to the commands discussed in connection with automatically building an examination with user-selected questions (see pages 36 and 37) and will not be repeated here.

Create a Build Choices set

In case you decide to reconstruct the same set of choices in a subsequent session, create a Build Choices set so you can quickly restore this combination of options.

1. After selecting the Build options appropriate to your needs, as you have done so far (Figure 3.22), select "New Set of Build Choices…" from the pop-up menu (Figure 3.23) and name the set, as discussed on page 39. The file name can contain spaces, but no colons. *ExamBuilder* automatically stores the Build Set in the ExamBuilder Prefs file for use in subsequent sessions. The "Rename This Set…" and "Delete This Set…" options are enabled only if a Build set exists and is selected.

Build the examinations

Click "Build" to create the examination(s) from the questions randomly selected according to the conditions prescribed. When *ExamBuilder* completes the exam(s), control returns to *MathWriter*.

Log files

Log files preserve a record of the questions used in an examination. Log files are created from the markers or memos (Table 3.2) attached to the questions when they are transferred into the exam document. If these markers are not removed while you are editing the exam document, several uses can be made of this information:

• When you place a global point total marker in an exam document using Edit/Insert Point Count, *ExamBuilder* tallies the points automatically.

> *ExamBuilder* does NOT update the point total if you subsequently add questions, if you delete the markers, or if you edit the assignment of individual points in the exam. The count is taken from the hidden, uneditable question markers **only** when the total point count command is used.

• The log file reports the origin of the questions used (book, bank, and question number within the bank). If you discover a flawed question in an exam, this information allows you to locate the question.

• A log file lets you reuse the same questions again to reconstruct the same set of questions on each examination after editing some of the questions in the file.

• Using the cross-reference file derived from the log file, you can locate all versions of the examination that include a specific inappropriate question.

Table 3.2 Marker content

Marker	Line	Contents		
▣	1	"ExamBuilder™", module name		
	2	Book:Bank (Directory ID)		
	3	Question Number		
	4	Question Type		
	5	Point Value		
	6-8	if Multiple Choice:	6	Question Order
			7	Correct Answer
		if Matching:	6	Item Order
			7	Answer Order
			8	Correct Answers
▯ if Matching	1	"ExamBuilder™"		
	2	Correct Answer for Item		

Log file contents

Table 3.3 illustrates the structure of a tab-delimited *ExamBuilder* log file. The line numbers have been added for convenience. Each log file can contain any number of build sessions.

The contents of a log file are taken from question markers. If you delete those markers, the log file and the total point count will be incorrect. Otherwise, the removal of the markers does not affect the printed exam.

Line 1 is the session description line; it contains the name of the session, number of exams, and the date and time the session was started.

Lines 2 and 11: Example1.Test and Example2.Test are the names of the exam files. *ExamBuilder* created the file name using a family name "Example", a sequence number "1", and a file extension ".Test". The number of questions is also included here. The number of questions per file could vary if you use scenario or composite questions, since random selection of questions within one of these groupings often produces the inclusion of other questions.

Lines 3, 5, 7, 9, 12, 14, and 16: The descriptor *book:bank* gives the origin of the question. Note that the questions were scrambled in this example session. The questions were taken from the EB Demo.book, which has two banks (Chapter 2 and Samples)

Lines 4, 6, 8, 10, 13, 15, and 17: These are the question numbers within the book and bank listed in the preceding lines. If a question is multiple-choice, then the answer appears in parentheses. If a question involves matching, then the list of answers appears in parentheses.

Table 3.3 Log File Example

1. Example Session (2 Exams) 2/5/91 10:22 AM
2.   Example1.Test (6 Questions)
3.   EB Demo.Book:Chapter 2
4.   2 (a)
5.   EB Demo.Book:Samples
6.   3
7.   EB Demo.Book:Chapter 2
8.   3(b)
9.   EB Demo.Book:Samples
10.   5(c b d e a) 2 1
11.   Example2.Test (6 Questions)
12.   EB Demo.Book:Samples
13.   3 5(d e b c a)
14.   EB Demo.Book:Chapter 2
15.   3(a) 1(d)
16.   EB Demo.Book:Samples
17.   2 1

Create a log file

1. Open an exam document in *MathWriter*.

2. Activate *ExamBuilder*.

3. Select File/Log Document. A file locating sequence follows (Figure 3.29). Choose a new or existing log file for the named open document.
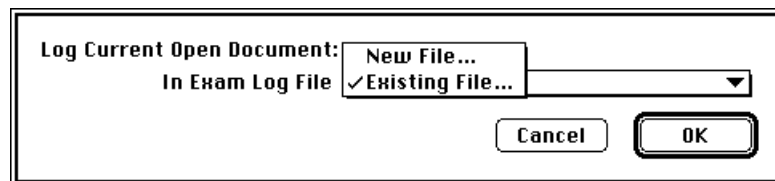
Fig 3.29 Name a log file

4. Name this log session (Figure 3.30) and press continue. A log file can contain multiple log sessions (see Table 3.3).

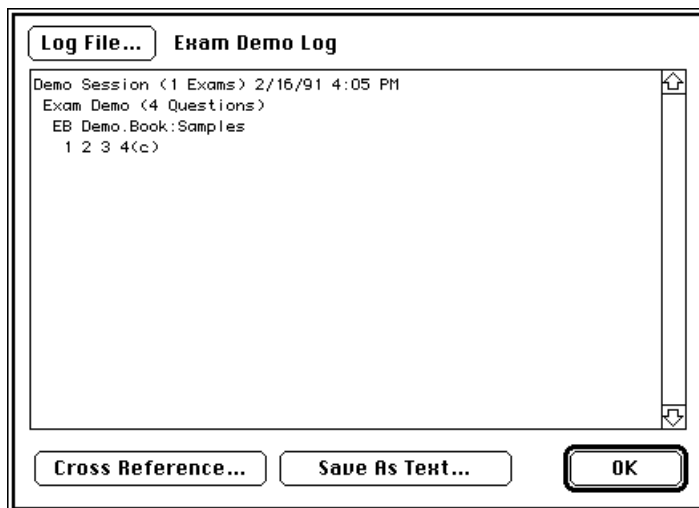**Log This Session As...**

Demo Session

Cancel   Continue

Fig 3.30 Name the log session within a log file

At this point *ExamBuilder* constructs a log file by extracting the required data from the hidden markers (Table 3.2) in the exam file.

Examine log files Let's review the Log files created either during a Build Exam command or as a separate action as just discussed.

1. Select Examine Log Files... on the File menu.

2. Open the file "Exam Demo Log." If desired, click the Log File button (Figure 3.31) to open yet another log file.

Log File...   Exam Demo Log

Demo Session (1 Exams) 2/16/91 4:05 PM
 Exam Demo (4 Questions)
  EB Demo.Book:Samples
   1 2 3 4(c)

Cross Reference...   Save As Text...   OK

Fig 3.31 Review a log file

Refer to the Appendix for a discussion of the contents of this file. You can generate two text files using this Log file.

Cross-reference file 3. Click the Cross Reference... button shown in Figure 3.31.

This tab-delimited cross-reference file identifies the examinations that contain each question.

Text version of log files 4. Click the Save As Text button to generate a text file of the contents of the log file. This is a tab-delimited file that can be read by other standard applications such as a spreadsheet.

Reconstruct a set of examinations

In the event you discover a flaw in a question (such as an ambiguity) which has been used in creating a set of examinations, or a topic not covered in lecture, you can use the log file to identify the versions affected. A new set of examinations can be constructed using the old log file and the edited questions.

Use "Select Log File..." from the Build Exam dialog box's source pop-up menu after modifying the question or marking it as inactive from the Entire Question view.

Edit and Print an Examination

ExamBuilder derives much of its power from the editing, formatting, and printing capabilities supplied by its host because the exams are produced as *MathWriter* documents. Printing exams, whether they were created manually or automatically, requires a knowledge of *MathWriter* operation, so a brief "Guided Tour" of *MathWriter* is supplied on the distribution disk. The online help window also contains a terse summary of the commands.

Ordinarily, you will need to edit the exam very little if you use a template or default document appropriate to your needs. You may have to adjust the tab settings and tab text to align it properly, especially if you are using multiple choice and matching questions that require columnar alignment.

The page numbering variables must be placed in a header or footer. Use of the variable for total page count lets students quickly determine whether a page is missing. Three date variables are provided — one variable posts the file creation date, another reports the current date, which changes each time the file is opened (and provides a means for reporting automatically the date the document is printed), and a third, undocumented form that does not vary, but reports the date you placed the variable in the document. To access this third form, press the *option* key while you select the current date variable from the Palettes menu.

Creating and Modifying a Book of Questions

This section describes how to modify or create a new book of questions. The capacity for modifying and adding to a publisher-supplied book of questions is an important aspect of *ExamBuilder*. We assume that you are familiar with the process, discussed in the previous section, for creating examinations from an existing question file.

Creating a book

We assume that you know the content of the questions, have produced any required graphics (bit-mapped, object, or encapsulated PostScript), and have placed them in a Scrapbook. If you have enough memory, the graphics program and *ExamBuilder* can both be available under MultiFinder.

1. Start *MathWriter* **and open** *ExamBuilder.*

"No Open Book" appears at the top of an otherwise blank window.

File

New Book...	⌘N
Open Book...	⌘O
File Info...	
Preferences...	
Build Exam...	⌘E
Log Document...	
Examine Log Files...	
Page Setup...	
Print...	
Switch To MathWriter	⌘M
Quit	⌘Q

Fig 3.32 File menu

2. Use the File/Open Book (or ⌘ O) command (Figure 3.?) to open an existing Book or File/New Book (⌘ N) to create a new empty one.
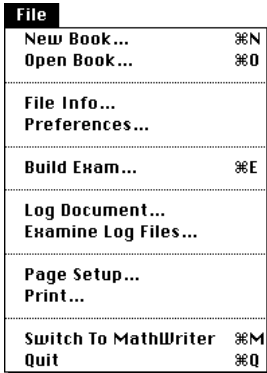
For a new file you must provide a name and destination.

2a. Supply a name for the file, e.g., "EB Demo2.book".

Optionally append ".book" to the name to identify this file as a book of questions.

2b. Select a disk drive and folder.

2c. Click "Save."

ExamBuilder automatically saves a question when you scroll to another; you need not execute a save command explicitly. In fact, no save command exists.

Before you can add questions, you must create and name a bank (a question file subcategory).

Bank

New Question Bank...
Rename Question Bank...
Delete Question Bank
Sort By ▶
✓Bank 1
Bank 2

Fig 3.33 Bank menu

3. Select Bank/New Question Bank... and supply a name.

A bank is an internal subset or group of questions used to restrict the random selection process when creating examinations. As you create each question bank, *ExamBuilder* appends its name to the Bank menu (Figure 3.?). To access a bank, select it by name from this menu; the current bank is indicated by a check mark. *EB* also enables the "Rename" and "Delete" options.

ExamBuilder stores the questions in the order assigned during entry; but if you are using the Long or Short Summary Views, selecting questions may be easier if you view them with a different display order. Use Bank/Sort By (Figure 3.34) to change the viewing order.
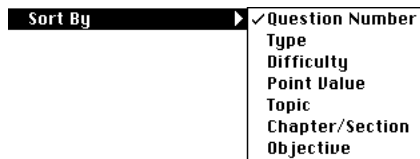
Sort By ▶	✓Question Number
	Type
	Difficulty
	Point Value
	Topic
	Chapter/Section
	Objective

Fig 3.34 Sort by submenu

Create questions from templates

Once you have created a new question bank, you need to insert a template within the desired sequence of existing questions a template appropriate to the question structure. This produces a framework for storage and retrieval. As discussed in the previous section, you use some of the fields to select questions when you are "building" an examination. The fields for these are common to all questions. Other fields contain the contents of the questions.

Since this is your first record, its position is the same whether you insert it using the "before" or "after" command.
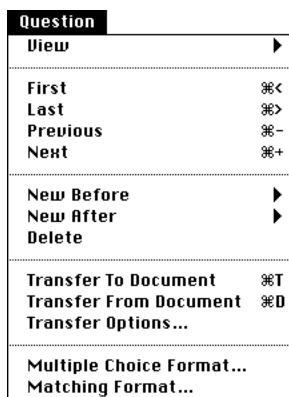
4. Select Question/New After (or New Before) (Figure 3.35) and drag to the desired question type (Figure 3.36).

An examination can contain any combination of question types in any sequence. Of course, common sense and respect for your students will dictate restraint.

The question types are shown in Figure 3.36, the New After submenu. Keyboard equivalents are provided for the more commonly used New After command, but not in the New Before submenu.

Fig 3.35 Question menu
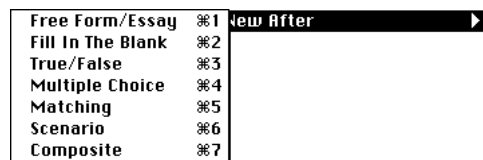
Fig 3.36 New After submenu

All question templates share the descriptive fields described at the beginning of this chapter (Figure 3.1). Supply data for as many of these fields as your needs and interests dictate; you can complete them now or later. Note: If you later open the book and wish to edit this question, select Question/View/Entire Question.

A multiple-choice template initially contains one field marked "Q" for storing the question and one marked "A" for storing an answer; you must add cells as needed (Figure 3.37).

5. To add another answer cell, place the insertion point in an answer cell and select New Before or New After (⌘ *J* or ⌘ *K*) from the Cell menu (Figure 3.38).

Note: You may set the default view for new question templates using Edit/Preferences (Figure 3.44).
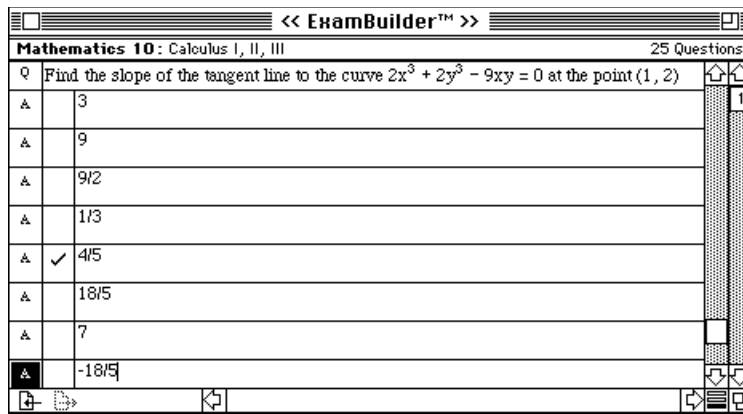
Fig 3.37 An example of a multiple-choice question

Fig 3.38 Cell menu

To identify the correct answer, even when the answers are scrambled, place a check ✓ in the second column (Figure 3.37) by clicking.

Free form

Free-form questions (Figure 3.39) have a single set of "Q" and "A" boxes of variable size. Use the Grow box to set the width; the height adjusts automatically to the contents.
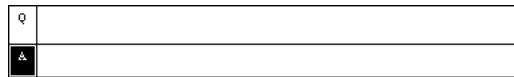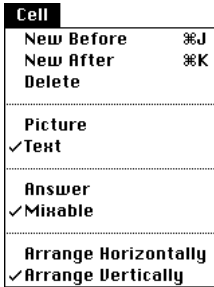

Fig 3.39 Free form question template

Fill-in-the- blank The fill-in-the-blank template (Figure 3.40) provides two "Q" regions—one before and one after the embedded blank. For a question having a leading blank, leave the first "Q" cell empty; for a trailing blank, leave the second "Q" cell empty. Click on the "Length" button to specify the length of the blank.

To create a question having multiple blanks, use New Before or New After on the Cell menu with the insertion point in the second "Q" box to create additional sets of "Q", "-", and "A" boxes.
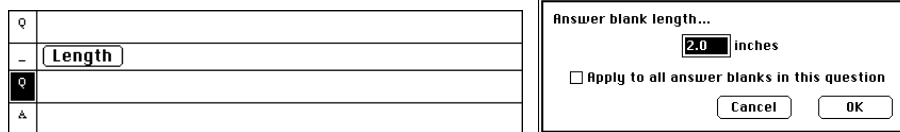
Fig 3.40 Fill in the blank question template

Multiple-choice Multiple-choice questions (Figure 3.41) initially have one question box and one answer box. Click within an "A" box and use "New Before" or "New After" on the Cell menu to add other "A" boxes. Place the insertion point within the cell

of the correct answer and select "Answer" from the Cell menu. If an answer cell must retain its position among the possible answers, e.g., "None of the above," place the insertion point within that cell and deselect "Mixable" to remove the check mark on the menu adjacent to that command; this places a dark border around the box in the second column to indicate that the response is NOT mixable, i.e., its position in the list is fixed even if you select the scramble option when building exams.

Fig 3.41 Multiple-choice question template

Matching

A matching question (Figure 3.42) begins with an introductory statement "Q" cell and is completed by one or more "Item-Answer" pairs. With the insertion point within an "I-A" cell, use the "New Before" or "New After" command on the Cell menu to add others as needed. Place the correct match for the "I" cell in its companion "A" cell; *ExamBuilder* will handle the scrambling.

Fig 3.42 Matching question template

Scenario and Composite

Both the scenario and composite questions (Figure 3.43) provide space for an introductory statement. A light or a solid shading in the thin rectangle to the left of a scenario or composite question, respectively, identifies it as that question type. When you add a new question immediately following either type, *ExamBuilder* asks you if the new question is to be attached to the preceding scenario or composite question.

Fig 3.43 Scenario and composite question templates

Creating and storing the contents of questions

Descriptive fields

1. Before entering the text for the descriptive fields (topic, chapter/selection, objective, point value), assign a default font and font size using Preferences... on the File menu (Figure 3.44). Remember the distinction between screen and LaserWriter fonts and select the font according to your printer type. The built-in LaserWriter fonts are identified by underlines in Style/Text Fonts.
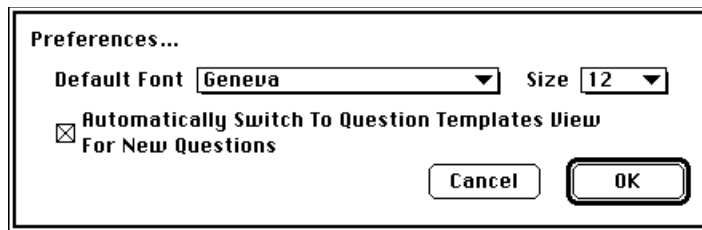
Preferences...

Default Font `Geneva` ▼   Size `12` ▼

☒ **Automatically Switch To Question Templates View For New Questions**

[Cancel]   [**OK**]

Fig 3.44 Preferences... on the *EB* File menu

Text within the cells

2. To enter text in a text only cell, simply click within the cell and type. Word wrap and cell-height increases occur automatically as text is typed into the cell. The Font, Size, and Style menus apply to text within the "Q" and "A" cells according to the usual Macintosh interface rules. Multiple typefaces can be included within a cell (Figure 3.45). The text in a text-only cell can be typed directly into the cell and edited. Note: As discussed on page 23, each cell can contain either text or a PICT graphic. To store a composite of text, graphics, or mathematics in a cell, *EB* transforms the composite into a PICT; *EB* can transfer such a composite cell stored in PICT format into an exam document either in its compressed PICT format or translate it back into its original, editable format (see pages 11, 30, and 52). To transfer a mathematical expression from *MW* into *EB* or any other standard applications via the Clipboard, use Edit/Copy Other/Copy As Picture rather than the usual Edit/Cut or Edit/Copy command.
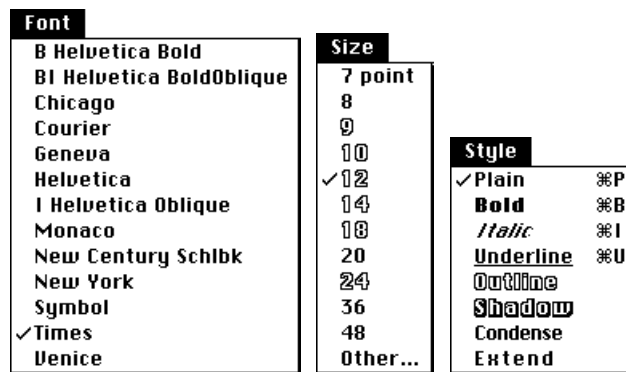
Font
- B Helvetica Bold
- BI Helvetica BoldOblique
- Chicago
- Courier
- Geneva
- Helvetica
- I Helvetica Oblique
- Monaco
- New Century Schlbk
- New York
- Symbol
- ✓Times
- Venice

Size
- 7 point
- 8
- 9
- 10
- ✓12
- 14
- 18
- 20
- 24
- 36
- 48
- Other...

Style
✓Plain	⌘P
Bold	⌘B
Italic	⌘I
Underline	⌘U
Outline	
Shadow	
Condense	
Extend	

Fig 3.45 Typeface menus

Mathematics

3. Create mathematical expressions involving built-up structures and any text associated with those cells within *MathWriter* by the usual process, then select them and paste them into *ExamBuilder*. To transfer the selection, click in the *ExamBuilder* window to make it the active window and transfer the selection using Transfer From Document on the Question menu (or ⌘ *D*). You can also click the ⬜→ icon in the bottom corner of the *ExamBuilder* window to effect the transfer of the selection.

Graphics

4. Transfer graphics, including mathematics and any text to made a part of the graphic (bit-mapped, object, and encapsulated PostScript), into a question cell just as described for mathematical expressions. You can also paste a graphic from the Clipboard into a cell.

> A cell contains either all text or all graphics. Unlike a text cell, a picture cell's dimension is fixed by the size of the included graphic; so if you need wide margins on your exam, make your graphics narrow. Text stored in graphic format (PICT) will be visually indistinguishable from a text cell. The Font, Size, and Style menus, of course, do not apply to graphics. To verify the contents of a cell as picture or text, select the cell and see which item is checked on the Cell menu.

Edit menu

The Edit menu (Figure 3.46) applies to selected text, to selected questions in the short or long summary views, and to the entire contents of a cell — whether a picture or text. When you select a question in summary view, *ExamBuilder* highlights the question. When you select a cell in entire question view, *ExamBuilder* highlights the associated "Q" or "A" box.

Edit		**Edit**		**Edit**	
Undo	⌘Z	Undo	⌘Z	Undo	⌘Z
Cut	⌘H	Cut Question	⌘H	Cut	⌘H
Copy	⌘C	Copy Question	⌘C	Copy Cell	⌘C
Paste	⌘U	Paste	⌘U	Paste Cell	⌘U
Clear		Clear		Clear	
Paste Before		Paste Before		Paste Cell Before	
Select All	⌘A	Select All	⌘A	Select All	⌘A
UnMark All Questions		UnMark All Questions		UnMark All Questions	
Clear Document		Clear Document		Clear Document	
Insert Point Count		Insert Point Count		Insert Point Count	

Fig 3.46 Edit menu

Book statistics

5. Select File/File Info… to get information about the book file (Figure 3.47): the creation date, modification date, number of question banks, and number of questions in each bank. Check the "Locked" check-box to prevent changes—-accidental or otherwise—to the questions in this book.

Book: EB Demo.book		**Locked** ☐
Creation Date:	Mon, Aug 13, 1990	
Modification Date:	Wed, Jun 26, 1991	
Question Banks: 2		
Bank		**Questions**
Samples		13
Chapter 2		12
	OK	

Fig 3.47 File Info dialog

Print the book After creating a book of questions, you can print a copy for verification and archival purposes. *ExamBuilder* supports both the ImageWriter (Figure 3.48) and LaserWriter (Figure 3.49). The printing process parallels that for *MathWriter*. Each printer type has its own page setup and print dialog. Note: Normally the exam template will be configured for your printer type; but if change the printer type with Chooser or change to a different computer having a different choice, remember to use Page Setup on File/Page Layout of *MW* to assure compatibility. If you make this change, scroll through the exam document to confirm format-readiness for printing.

ImageWriter
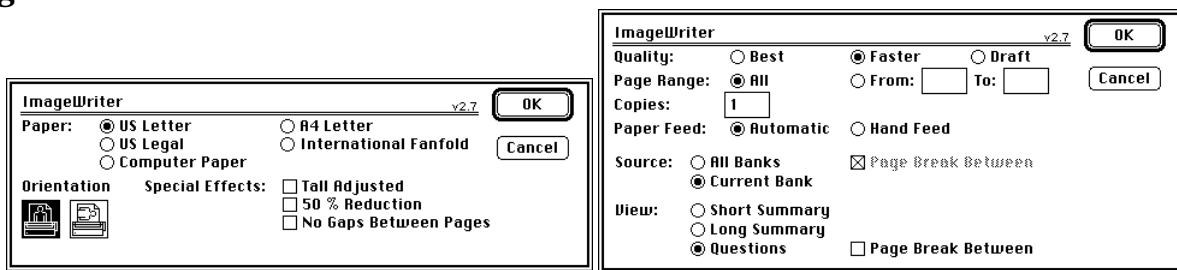
Fig 3.48 ImageWriter dialog boxes

LaserWriter
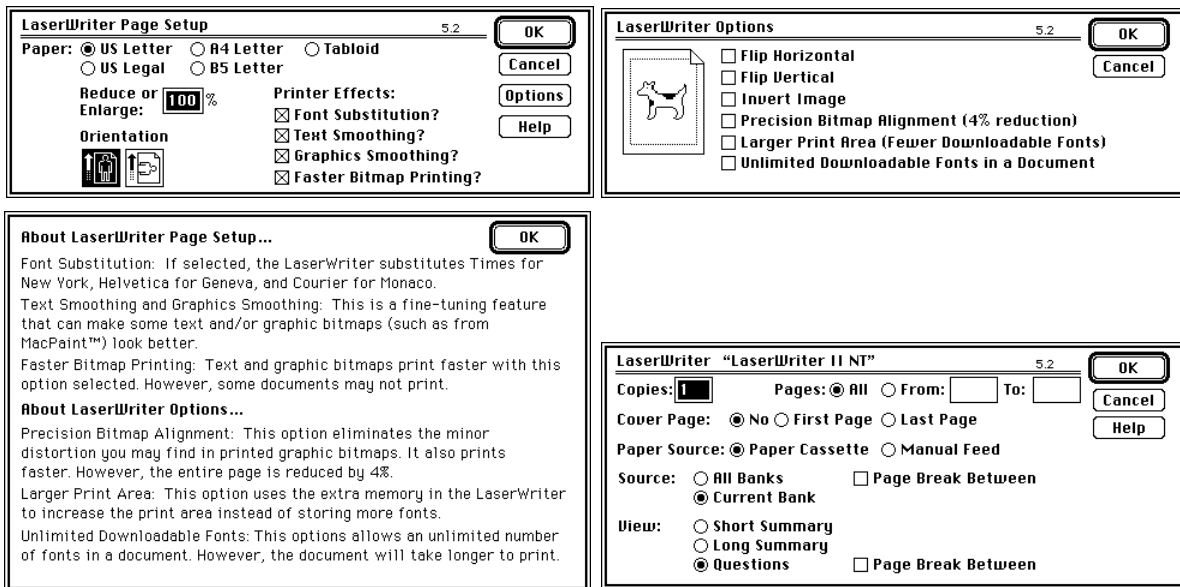
Fig 3.49 LaserWriter dialog boxes

These *EB* print dialogs behave in the expected manner.

Performance Tips

Enhancing speed and performance

MathWriter is remarkably easy to learn and use because the screen image is a faithful representation of the document to be printed. MathWriter continually uses all of the c*urrently a*vailable information to format the screen, even when you are creating complicated mathematical expressions. To the maximum extent possible MathWriter assumes responsibility for the complex formatting details, freeing you to concentrate on the substance of your examination. This high level of interactive visual support requires considerable computational power.

For best performance:

• Transfer exam questions as pictures (text, math, and graphics).

• Use existing RAM effectiv*ely: a) S*et Application Memory Size to utilize the available memory using Get Info on the File menu at the MultiFinder level. The memory allocated is used by *MW*, your open document, and *EB*. You should allocate at least 2000K bytes, although a minimal configuration is 1000 Kilobytes. *b)* With severe RAM limitations, operate under Finder, rather than MultiFinder.

• Disable features not currently needed. *a)* Use the Black & White *s*e*t*ting for the Monitor using the Control Panel. Color is marginally useful and significantly impacts speed. *b)* Toggle the Auto Math features off (⌘ *E*) when not entering a mathematical expression.

• Use multiple, smaller documents if the memory utilization indicator on the status bar exceeds 90%. Also have only necessary documents open simultaneously when RAM is limiting.

• Configure the document window and floating windows to minimize overlap, thereby reducing complicated screen refreshing.

• When possible, add text at the end of paragraphs to reduce screen refreshing time.

• Use ExamBuilder Module with the more powerful word processors — MathWriter/Educational and MathWriter/Professional. Additional features include: spell-checker, thesaurus, hyphenation, math-science-engineering dictionary, revision tracking, interactive library, memo notes, sidebars, background pictures, user styles, overview, multiple columns, auto-italics in mathematical expressions, tab on user-selected character, line numbering, color, character editor for cropping, sizing, and positioning of graphics, find/replace for text, typeface, and mathematics, a font table for access to all characters by mouse, support for additional modular extensions,

4 Command Guide

This chapter provides a guide to *ExamBuilder* and *MathWriter* commands, moving left-to-right to each main menu and top-to-bottom within a menu. For clarity, all menu commands are displayed here using undimmed type.

ExamBuilder Commands

 File Edit Bank Question Cell Font Size Style
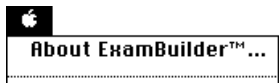
Fig 4.1 *ExamBuilder* menu bar

Apple Menu

**Fig 4.2
About ExamBuilder**

The Apple menu (Figure 4.2) hosts the About ExamBuilder window (Figure 4.3) which identifies the program, the copyright notice and the publisher's address. (End-user support is provided by the publisher, not the developer.)

ExamBuilder™   Version 1.0

A MathWriter™ 2.0 Module

Published exclusively by :   **Created by :**
Wadsworth, Inc.   Cooke Publications, Ltd.
10 Davis Drive   221 Langmuir Lab
Belmont, CA 94002   Cornell Business and Technology Park
(415) 592-2350   Ithaca, NY 14850
Corporate Testing: **(800) 327-0325**

Project Director :   J. Robert Cooke
Programming & Design :   E. Theodore Sobel
Manual :   J. Robert Cooke
Functional Design Advisory : David Cassel, Edith Cassel, Steven Holzner

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Fig 4.3 About window

File menu

The file menu (Figure 4.4), according to interface standards, is always located adjacent to the Apple menu.

File		
New Book...	⌘N	Create a question file
Open Book...	⌘O	Open a question file
File Info...		Question file statistics and lock
Preferences...		Global font preferences
Build Exam...	⌘E	Dialog box for building examinations automatically
Log Document...		Audit trail of question usage and cross-references
Examine Log Files...		
Page Setup...		Print question file (not an exam file)
Print...		
Switch To MathWriter	⌘M	Exit control
Quit	⌘Q	

Fig 4.4 The File menu

Let's examine each of the File menu commands.

New Book...
(⌘ N)

This menu command allows you to create a new book of questions. You must supply a name and destination for the file of questions you intend to store.

Open Book...
(⌘ O)

The Open Book... command provides access to previously created *ExamBuilder* question files. The usual techniques are available for navigating among disks, folders, and files. Only one file can be open at a time.

> Note that the File menu does not contain a Save or Save As... command because *ExamBuilder* saves records automatically.

File Info...

The File Info... dialog box characterizes the file (book name, creation date, modification date, number of banks, names of banks and number of questions in each) and permits you to protect the file from accidental modification. When a file is locked using this command, a lock icon appears in the *EB* window to the left of the file and bank name.

Preferences...

Preferences... sets the default font and text size used within *ExamBuilder* questions. With "Open New Questions Automatically" you may ask that *ExamBuilder* present each a new template in entire question view, rather than a summary view.

Build Exam...
(⌘ E)

Build Exam... is the most powerful and most complex command in *Exam-Builder*. This dialog box controls the automatic creation of examinations—which questions are used, the nature and destination of the output examination files, and the formatting that occurs during the exam building process. This

command also directs the creation of an audit trail of question usage for automatically created exams and provides a convenient means for establishing combinations of frequently used menu options. An alternative, manual approach to exam building is handled separately.

Log Document...   Log Document... creates a log file for an existing exam file, whether it was created using the Build command or manually, and whether created in one or in multiple sessions. However, as discussed on page 42, you must not have deleted the question markers.

> WARNING: The question number is a relative number. If you insert or delete questions in the bank, the number of all higher numbered questions is affected. If you must maintain a correspondence between a printed copy of the questions and a log file, or between a log file (see File/Log File) and answer keys, add new questions at the end of the bank and simply mark retired questions as inactive in the full view of the question. of course these changes can be made only if the file is not locked by the system or using File Info.

Examine Log Files...   Examine Log Files... allows you to display a log file on-screen, transform it into an editable text file, and produce a cross-reference index of question usage.

Page Setup...   Page Setup... establishes printer and paper configuration parameters *ExamBuilder* prints the question file, while *MathWriter* prints the exams you build. Before using the Page Setup command, you may need to use Chooser in the Apple menu to select a different printer type. The Page Setup dialog depends upon your choice of printer — ImageWriter or LaserWriter.

Print...   In the Print dialog box you select or assign print quality, page range, number of copies, paper feed, bank, view of the questions, and page breaks.

Switch To MathWriter (⌘ *M)*   This command provides mouse and keyboard (⌘ *M)* access to *MathWriter*. You can also click in an inactive *MathWriter* or *ExamBuilder* document window to switch between them.

Quit (⌘ *Q)*   The termination command is always the last command on the File menu. It closes any open *ExamBuilder* documents and returns control to *MathWriter*.

Edit menu

The Edit menu (Figure 4.5) provides commands for cutting, copying, and pasting text, graphics, cells and entire questions, as well as some miscellaneous editing commands.

```
┌─────────────────────────┐
│ Edit                    │
├─────────────────────────┤
│ Undo              ⌘Z    │   Undo last command
│                         │
│ Cut Question      ⌘H    │   Standard tools for
│ Copy Question     ⌘C    │     interaction with
│ Paste Text        ⌘U    │     the clipboard.
│ Clear                   │     Applies to text,
│ Paste Before            │     graphics, cells, and
│ Select All        ⌘A    │     questions.
│ UnMark All Questions    │   Global command to
│                         │     Mark/UnMark all questions
│ Clear Document          │   Erase receiving document
│ Insert Point Count      │   Count points currently in doc
└─────────────────────────┘
```

Fig 4.5 Edit menu

Undo *(⌘ Z)*	Undo reverses the immediately previous command.
Cut, Cut Cell, Cut Question *(⌘ X)*	Cut removes a highlighted text or graphics selection, a cell, or a question from the question file to the Clipboard. The name of the command changes according to its usage.
Copy, Copy Cell, Copy Question *(⌘ C)*	Copy copies a highlighted text and graphics selection, a cell, or a question from the *ExamBuilder* document to the Clipboard BUT does not remove the selection from the document. The name of the command changes according to its usage.
Paste, Paste Cell, Paste Question *(⌘ V)*	Paste copies the contents of the Clipboard to the location of the insertion point in the data base document.
Clear	Clear removes a highlighted text or graphics selection, a cell, or a question from the question file window BUT does not place a copy on the Clipboard. The Clipboard, therefore, is not disturbed. The Undo command can restore a selection removed unintentionally.
Paste Before	Paste Before provides the equivalent of an insertion point location between cells or questions when pasting the Clipboard contents. The Clipboard contents are placed in a region immediately preceding the cell or question where the insertion point is currently located (rather than replacing the contents of the cell or question where the insertion point is located).
Select All *(⌘ A)*	This command selects all objects text and graphics within the active region of the current window.
UnMark All Questions	UnMark All Questions globally removes selection marks from any and all questions in the current bank. Use this command to avoid inadvertent entries when you build an exam using marked questions.
Clear Document	Clear Document erases the body of the receiving exam file. Use this command to delete any existing material in the receiving exam document.

Insert Point Count	Insert Point Count tallies the points for all questions CURRENTLY in the receiving exam document. For a correct count, use this command after you have transferred all questions into the exam document and placed the insertion point in the exam document where the total point count is to be placed. The point count is calculated from the individual point count in the hidden, **uneditable** "question markers," not the individual point counts displayed in the exam document. See pages 42-43 for additional details on point counts.

Bank menu

Use the Bank menu (Figure 4.6) to create, rename, or delete question banks, which are subgroupings of questions within an *ExamBuilder* question file. The viewing order of a bank during scrolling is also set using this menu. You can also use this name to select which bank is displayed in the *ExamBuilder* document window. A book can contain an arbitrary number of banks and each bank can contain an arbitrary number of questions. In general, it is a good idea to group related questions within a bank so you can use the bank grouping in the selection of questions when building exams automatically.

Bank

New Question Bank...	Create, rename, and
Rename Question Bank...	delete sets or related
Delete Question Bank	questions within a book
Sort By ▶	Sort the questions in this bank by category for easier selection
✓ **Samples**	Select question
Chapter 2	banks in this book
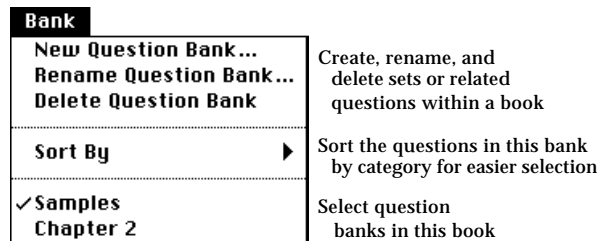
Fig 4.6 Bank menu

New Question Bank...	After you have opened an *ExamBuilder* book, use this command to open a new bank within the open book.
Rename Question Bank...	This command renames the currently selected bank. If necessary, select the bank to be renamed from the lower portion of the Bank menu before selecting this command.
Delete Question Bank	If the bank to be deleted is not the current bank, open the bank to be deleted by select its name from the Bank menu and then use this command. (This sequence is suggested by the absence of an ellipsis after the command name on the menu.)
Sort By	To simplify the task of manually selecting questions for an examination, use this command to specify a particular viewing order of the questions within the current bank when in the short or long summary view. The actual storage order in the file is unaffected.
Names of banks	The names of the banks in the current book are appended to the end of this menu. Select a bank name to make it the active bank.

Question menu

Once you have opened (or created) a book and a bank, with the Question menu (Figure 4.7) you can view full questions or shorter summaries. You can scroll through the questions by mouse or by menu. When a specific question has been located, you can delete it, add a new question before or after it, modify it or transfer the question into an exam file.

You can transfer individual selections, cells, and questions between *Exam-Builder* and *MathWriter* and perform various formatting tasks during the transfer process. Formatting options for manually transferred questions are provided in this menu; these options are provided from the File/Build Exam dialog box for questions transferred automatically.

Question	
View ▶	Select scope of view
First ⌘<	
Last ⌘>	Locate questions
Previous ⌘–	
Next ⌘+	
New Before ▶	Create and delete
New After ▶	templates for seven
Delete	types of questions
Transfer To Document ⌘T	Transfer text and pictures
Transfer From Document ⌘D	to and from the question
Transfer Options...	file according to defaults
Multiple Choice Format...	Numbering formats
Matching Format...	

Fig 4.7 Question menu

View

Use the View submenu of the Question menu to specify the level of detail you want revealed when you examine questions. The Short Summary, Long Summary, and Entire View choices provide increasingly greater detail. You can edit only when in using the entire question view, but manual selection (manual transfer and marking) of questions can be made while using either view.

First (⌘ <), Last (⌘ >), Previous (⌘ -), Next (⌘ +)

These commands provide mouse and keyboard scrolling through the questions. Vertical scroll bars provide alternative paging control.

New Before, New After

Use this command to add a template for a new question of one the seven supported types—free form/essay, fill-In-the-blank, true/false, multiple choice, matching, scenario, and composite. Place the new question template either immediately before or immediately after the currently selected question. New After selections can also be made by keyboard command.

Transfer To Document *(⌘ T)*

To create an examination in an exam document you must transfer individual questions (and answers) from a question file. Transfer To Document provides for the individual, manual transfer of questions you select.

Place the insertion point in the exam document to identify the destination point for the question transferred **before** you use the Transfer To Document command (by mouse or by keyboard). An icon at the base of the *EB* window provides alternate access to this command.

To transfer a question, scroll through the question file to locate and select a question. When in summary view, select a question by clicking on the question; when using the entire question view, question selection is *de facto*—the question in view is automatically selected.

Transferring a question as a graphic preserves its exact format and layout, and also provides a faster response, which may be important for use on the Plus and SE computers. It also makes it uneditable, however. The numbering scheme applied to the alternatives in multiple choice and matching questions during transfer are discussed below.

Transfer From Document *(⌘ D)*

This command transfers a selection from an exam document into a question template; this command is available by mouse from this menu and from the keyboard. Text can be entered directly by keyboard and formatted within an *ExamBuilder* question template. Mathematical expressions, however, must be created within *MathWriter* and transferred into a question as a picture, possibly grouped with text and graphics. Neither *EB* nor *MW* has editing capability for graphics, but graphics can be brought into a MW document or *EB* file via the Clipboard. Transfer From Document is available only when you make a selection in *MathWriter*.

Transfer Options...

This command applies to manual (not automatic) transfer of questions into an exam document. *ExamBuilder* can take the typeface of a question from context or preserve the attributes of the stored question. Questions and/or answers can be transferred. Answers can be placed at the end of the document, after each question, or in a unified answer key. The point value for a question can be transferred with a question.

Multiple Choice Format...

"Scramble Answers" shuffles the answers for multiple choice questions. [A similar command in Build Exam applies to automatic building an exam.] Five item numbering formats, as shown on page 37, are provided.

Matching Format...

Matching Format allows you to scramble the matching items and answers and to format the numbering of the items and answers, as shown on page 36.

Cell menu

The cell menu (Figure 4.8) deals with the component parts of questions, especially multiple-choice questions. Multiple choice and matching questions can have an arbitrary number of items attached; the first three commands of this menu allow you to add or delete these appended cells.

Each cell in a question, including the added cells, contains either text or a graphic. The multiple-choice question cell that contains the correct answer is identified by a check in the square adjacent to the correct cell in the entire question view. To identify the answer, either place the insertion point within the correct answer cell and select Answer on the Cell menu, or simply click in the second column (adjacent to the correct answer cell). Any multiple choice items that must not be scrambled, e.g, an item such as "none of the above," can be identified as non-mixable. Finally, multiple-choice items can be arranged in rows or in columns.

Fig 4.8 Cell menu

New Before *(⌘ J)*, New After *(⌘ K)* Use these commands to add an arbitrary number of new cells to multiple-choice and matching questions after creating the base template using Question/New Before or New After. Place the insertion point within an answer cell to enable this command.

Delete To remove a cell in multiple-choice and matching questions, place the insertion point in the target cell to identify it and then use this command.

Picture, Text Each *ExamBuilder* question cell can contain either editable text or a graphic. The nature of the contents of the currently selected cell is indicated by a check mark in front of one of these menu selections. Note that text and mathematics can be treated as a graphic, and even joined with a graphic, before being transferred into a cell.

Answer In a multiple-choice question, click in the column immediately following the item number or select Cell/Answer to identify the (only) correct answer.

Mixable

A multiple-choice cell is called mixable if its position can be scrambled or shuffled. An example of a nonmixable item is "none of the above."

Arrange Horizontally,
Arrange Vertically

Arrange the answer cells in rows or columns with this command.

Font menu

Use the Font menu (Figure 4.9) to assign a font to an existing selection or to specify the font of subsequently entered text. This list displays the names of the fonts currently available to the system. Use the Apple-supplied Font/DA Mover utility to change this list. Utilities such as SuitCase™ II provide a convenient alternative. User-created screen and LaserWriter fonts can be added too. Use the supplied Adobe Symbol font to assure well-formed brackets, etc., and to preserve the boldface attribute of the Greek symbols.

```
 Font
   Chicago
   Courier
   Geneva
   Helvetica
   Monaco
   New Century Schlbk
   New York
   Symbol
 ✓ Times
   Venice
```

Fig 4.9 Font menu: A sample list of fonts currently selectable

Size menu

Use the Size menu (Figure 4.10) to assign the font size attribute to existing text or to specify the size of subsequently entered text. The size entries listed in outline style are the sizes of the fonts that have stored bitmaps for screen display; the sizes in plain style are generated from the nearest size that is included. The generated sizes may appear ragged on the screen, but they print smoothly on the LaserWriter. Less frequently used font sizes in one pixel (one point or 1/72 inch) increments are also available .

```
 Size
   7 point
   8
   9
   10
 ✓ 12
   14
   18
   20
   24
   36
   48
   Other...
```
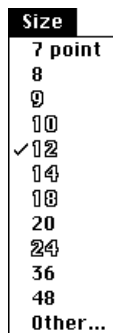
Fig 4.10 Size menu: Sizes in pixel increments up to 127 are selectable.

Style menu

Use the Style menu (Figure 4.11) to assign the font style attributes to existing text or to specify the style of subsequently entered text. The plain attribute is special because it removes any combination of styles. Bold, Italic, Underline, Outline, and Shadow can be used in any combination. Condense and Expand removes or adds one pixel between characters, respectively.
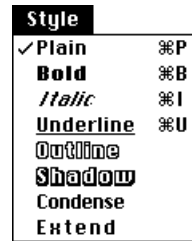
Fig 4.11 Style menu

MathWriter Commands

MathWriter provides the editing, formatting, and printing support for *ExamBuilder*. To utilize the full power of *ExamBuilder* you need to understand the host word processor. If your exams do not include mathematical expressions, you can safely ignore the discussion of those aspects. The ▒▒▒▒▒ menu commands are unavailable in this version.

MathWriter's Main Screen

The *MathWriter* screen is remarkably simple (Figure 4.12). The ruler is thin and is always at the top of the screen, never usurping window space in the body of the text nor scrolling out of view. You can even remove the ruler using the Format menu. The tab wells and paragraph alignment controls are at the right above the vertical scroll bar. At the bottom is the status bar. You can resize, drag, close, or scroll the document window in the customary Macintosh fashion.
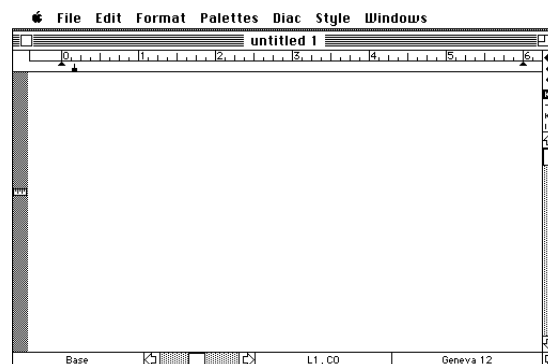
Fig 4.12 *MathWriter* main screen configured without mathematical tools

Ruler and tabs

MathWriter is paragraph-based; you create a paragraph by pressing the *return* key. The ruler displays the tab settings for the current paragraph, i.e., the paragraph with the flashing insertion point. The tab wells at the right of the document window, just above the vertical scroll bar, contain left, right, center, and decimal alignment tabs; this placement avoids a reduction in the critical vertical dimension of the screen, important for displayed equations. Double-click in the ruler to select ruler options for uniformly spaced tabs.

To place a tab, drag one from the well and pull it into the text area to decide its exact placement (or place it directly on the ruler). When released, the tab icon snaps to the ruler as if attached to a rubber band. To remove a tab, drag it off the **right** end of the ruler past the print boundary indicated by shading ▆ on the ruler. Double-click on a tab in the ruler to open a window for additional control or to choose a tab leader and alignment symbol.
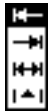
To obtain left, right, full, and center paragraph alignment, select the paragraphs and click on the icon. Alignment applies to the paragraph that contains the blinking insertion point or to multiple paragraphs of selected text. The usual text selection techniques such as dragging, shift clicking, etc., apply; however, to identify a paragraph for justification or tab placement, you only need to place the insertion point within that paragraph.

MathWriter automatically passes the ruler settings from one paragraph to the next when you press the *return* key. If you change the ruler settings, a small ruler icon on the left border of the window identifies ruler changes unless you use Hide Messages on the Format menu to hide this and other message icons such as memo notes and sidebar indicators.

The status bar

The status bar at the bottom of the document window (Figure 4.13) contains information about the position of the insertion point within a mathematical expression ("Base" in this figure) and the adjacent text. Figure 4.14 shows examples of the insertion point in mathematical expressions[1] and in a table. With the insertion point adjacent to the "1," the first up arrow indicates an exponent placement and the down arrow indicates that the exponent has a subscript. In the second example the cursor is adjacent to the subscript and the down arrow indicates this.

Fig 4.13 *MathWriter* status bar
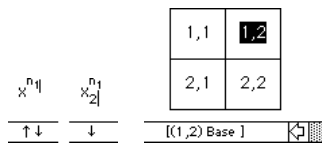
Fig 4.14 Insertion point position within a mathematical expression

---

[1] The Macintosh user interface standard specifies this command key. If you are accustomed to Command-P for print rather than plain, refer to the Appendix for reassignment instructions using *Cmd Key Switcher*.

When the insertion point is in a table or matrix, the status bar gives the row and column number of the element you are editing (Figure 4.14). A thin horizontal line at the far left and flush with the bottom of the "Base" panel (Figure 4.13) shows the fraction of RAM in use. The solid line represents actual usage and the dotted line represents the additional usage that can be purged by *MathWriter* if necessary. As mentioned earlier, *MathWriter* documents are memory resident so you should allocate as much memory as possible to *MathWriter* (using Get Info on the File menu at the Finder level).

Also on the status bar in Figure 4.13 are the horizontal scroll bar, the position of the insertion point within the document (line 1 and character 0) and the current font, font style, and font size (which are plain, Geneva, 12 point). During computation-intensive operations like reformatting or loading a file, a progress indicator appears in the typeface indicator box also. *MathWriter* reformats off-screen text when it is processing no new commands; you can follow its progress in the insertion point locator panel. The font typeface panel appears in inverse type (white letters on black background) when the automatic math options on the Style menu are in use.

The cursor

The *MathWriter* cursor changes to convey information about operations that are possible or in progress. The first row of Figure 4.15 contains the arrow, the I-beam, and the split I-beam cursors of the Character, Text, and Math Editors, respectively. The cursors of the second row indicate when the text cursor has moved into the main body of the manuscript, the header, or the footer, respectively. Because *MathWriter* allows you to edit these different sections of text without opening separate windows, you need to know into which portion of the document you have moved the cursor. The third row shows the search and the disk icons.

Fig 4.15
MathWriter **icons**

If you have trouble identifying the region in which the insertion point is located, select Show Layout on the Format menu. That displays the dotted lines that separate the different regions of the document (Figure 4.16) In addition, a pop-up window on the status bar at the bottom of the screen tells you whether you are in the body, header, or footer (Figure 4.17).
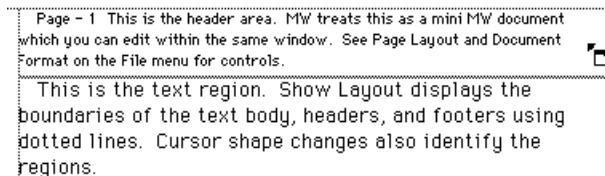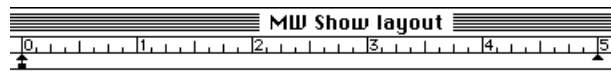
Fig 4.16 Layout lines
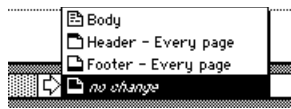
Fig 4.17 Pop-up cursor locator

Floating windows

Palettes window

The floating "Palettes" window contains the Greek alphabet and any rows of symbols from the Palettes pull-down menu that you choose. You can modify, move, or remove the floating Palettes window (Figure 4.18). It responds to the *s*hift key for uppercase Greek letters. To place the floating Palettes window on the screen, select it from the Windows menu. Then click on the name of a row in the Palettes menu, rather than on the specific symbols, to copy a row of symbols to the floating window. You can remove a row by clicking on it again in the Palettes menu. You can reposition the floating Palettes window by placing the cursor just below its Close box and dragging it.
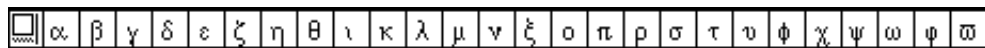
Fig 4.18 Greek alphabet in the Palette window

Templates window

Smart Templates[2], the templates in this window, format fractions, radicals, products, summations, integrals, set operators, special structures such as limits, grouping brackets, vectors and matrices, and tables. Each of the ten icons in the Templates window (Figure 4.19) contains two to ten options in pop-out menus.
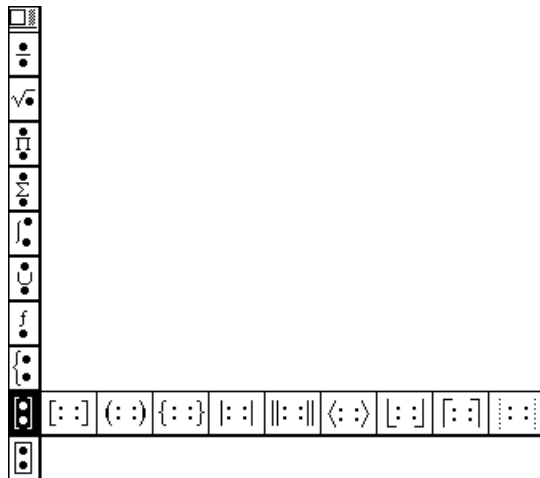
Fig 4.19 Templates window

To use the templates, click on the category icon to unfold the list and drag to select—just as you do with pull-down menus.

---

[2] You can safely ignore the mathematical tools in *MathWriter* if you do not require their use.

Alternatively, you can activate these menus from the keyboard. Press and hold *command* (⌘) and type a numeral key (1–9, use 0 for number 10) to select a menu (e.g., ⌘ *1* is the fraction menu). Then type the numeral displayed adjacent to the desired icon. If you do this *without* a pause, the menu does not unfold to remind you of the choices. Any invalid keystroke aborts the choice. (*MathWriter* displays tiny numerals within the specific icons when you use keyboard access.)

Pop-out menus
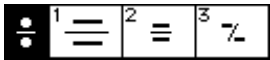
1. Of the fraction options (⌘ *1*) the first displays the numerator and denominator in the current font size. The second option immediately decreases the font size for smaller in-line expressions. The third option produces a slanted fraction line. *MathWriter* automatically draws the fraction bar long enough to accommodate the length of both the numerator and denominator and automatically centers the shorter expression. Press *enter* to move from the numerator to the denominator. Press *return* at any time to immediately return to the baseline.
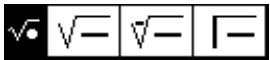
2. Three choices of radicals (⌘ *2*) are available. The first is the usual square root, the second allows you to supply a root, and the third is for long division. Press *enter* to move from within the radical to the second entry, the root. Press *enter* to leave the structure.
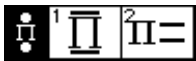
3. The product symbol template (⌘ *3*) allows you to place limits above and below the product symbol or to the right of the product symbol to conserve vertical space for in-line expressions. *MathWriter* automatically positions the cursor in the lower portion and reduces the font size. Supply the lower limit, and press the *enter* key to move to the upper limit. Supply the upper limit and press *enter* to return to the baseline to enter the function. The limits can be of arbitrary complexity. Use the split I-beam to edit within the limits. Press *enter* to move the insertion point to the base level.
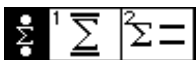
4. Like the product symbol template, the summation template (⌘ *4*) allows you to place the limits above and below the symbol or to the right to conserve vertical space for in-line expressions. *MathWriter* automatically positions the cursor in the lower index and reduces the font size. Supply the lower limit and press *enter* to move from the lower limit to the upper limit. Supply the upper limit and press *enter* to move to the baseline to supply the function. The limits of integration can be of arbitrary complexity. Use the split I-beam to edit within the limits. Press *enter* to move the insertion point to the base level.
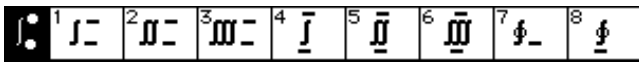
5. The integral (⌘ *5*) can be single, double, or triple, and you can place the limits either adjacent to or above the integral sign. Supply the lower limit and press *enter* to move to the upper limit. Supply the upper limit and press *enter* to move to the baseline, and then supply the integrand. The limits can be of arbitrary complexity. A contour integral is available. Press *return* to move the insertion

point to the base level; if desired, use the split I-beam tool to edit within the limits again. To resize the integral for larger integrands, use Calc Prev or | Size on the Format menu or ⌘ D with the insertion point positioned to the immediate right of the integrand.
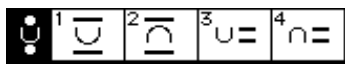
6. The union and intersection operators (⌘ 6) also accept limits. Press *enter* to move from the lower to the upper limit and again to move back to the baseline. Use the split I-beam to edit the limits.
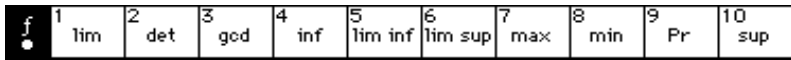
7. The special function menu (⌘ 7) contains constructs that include expressions centered below the operator name. Press *enter* to return to the baseline. Use the split I-beam to edit the limits.
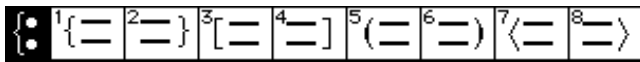
8. Grouping brackets (⌘ 8) include multiple rows grouped on the left or right with braces, brackets, parentheses, and angle symbols. Use the split I-beam to edit within the structure. Press *retur*n to change rows and *ta*b to change columns.
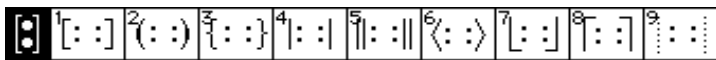
9. Vectors and matrices (⌘ 9) can have an arbitrary number of rows and columns. *MathWriter* provides various enclosing symbols. Use the *tab* key to change or create columns. Press *return* to change or create rows. *MathWriter* automatically formats the matrix as you type each keystroke. Use the split I-beam from the Tools window to edit inside a cell or within an expression inside the cell. Click inside a cell to outline it with a box (Figure 4.20). Click outside the structure or select the I-beam tool to return to normal typing. Click on the appropriate box in Matrix Format on the Format menu to specify the placement, line thickness and pattern, justification within cells or elements, and row and column spacing of cells.

To modify the format of previously typed expressions, simply select the expression before using the Matrix Format command. To add or delete a row or column, select a cell within that row or column and then use Insert or Delete from the Edit menu.

Fig 4.20
Edit inside structures
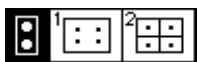
10. The last menu produces tables (⌘ 0). You can box the entire table or each cell individually. *MathWriter* treats tables as matrices with additional horizontal and vertical rules. Click on the appropriate box in Matrix Format on the Format menu to specify the placement, line thickness and pattern, justification within cells or elements, and row and column spacing of cells. To modify the format of previously typed expressions, simply select the expression before using the Matrix Format command. Use the split I-beam from the Tools window to edit a cell (outlined with a dotted box when you click within a cell) or an expression within the cell. Click outside the structure to return to normal typing. Press *option* to temporarily change from an I-beam to a split I-beam.
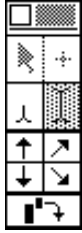
Tools window

**Fig 4.21
Tools window**

The floating Tools window (Figure 4.21) serves multiple purposes. Use the split I-beam cursor to place the insertion point inside an existing mathematical structure. The full I-beam allows you to place the insertion point in ordinary text. The small, vertical, up and down arrows move the insertion point above or below a symbol, reduce the font size, and center the subsequent input. The slanted up and down arrows position superscripts and subscripts. Clicking the bottom icon is equivalent to pressing the *enter* key and will move you out of superscript or subscript mode and back to the baseline or to the level on which the insertion point was before you clicked on the slanted up or down arrow.

Fig 4.22 MathWriter menu bar

The Apple menu

The Apple menu contains information about the application and provides access to the desk accessories (Figure 4.23). Use the Font/DA Mover to modify the list.
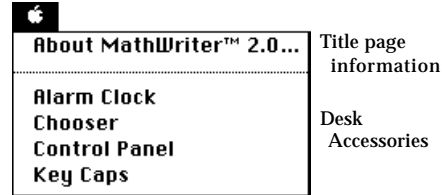
Fig 4.23 The menu

**About
MathWriter™
2.0**

Notice that sales and support are provided by the publisher, not the developer.
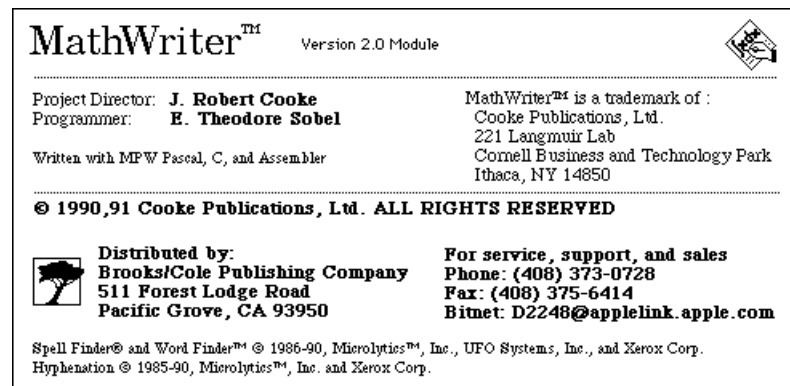
Fig 4.24 The About MathWriter 2.0 window

Desk Accessories   The names of desk accessories currently available to the system also appear on the Apple menu. Use the Font/DA Mover[3] to modify this list. See the Macintosh Utilities manual for a discussion of desk accessories.

The File menu

The File menu provides access to the file management commands, global and document-specific configuration commands, printing choices, and the exit command.

File		
New	▶	Create new documents from templates
Open...	⌘O	Open existing MW exam documents
Close	⌘W	Close the active MW exam document
Save	⌘S	
Save As...		Save active exam document
Save a Copy...		in various formats
Import Graphics File...		Insert a graphic from disk
Preferences...		Establish global MW preferences
Doc Info...		Characterize the active document
Page Layout...		Assign page characteristics
Doc Layout...		Assign page usage throughout the document
Doc Preferences...		Establish document specific preferences
Overview...		Not available in this version
Print...	⌘T	Print the active exam document
Quit	⌘Q	Terminate session

Fig 4.25 The File menu

New   You can create a "stationery" file for each distinctive type of document you use and designate one of the stationery files as the default, using Preferences on the File menu. When you choose from the submenu *MathWriter* creates a file from that particular stationery. For example, you can create a standard exam form that includes class identification, the current date, page counter, and automatic question numbering.

Open... (⌘ O)   Use Open... to open an existing file. Note: The three dots following the word "Open" indicate that you have to supply additional information to complete the command. A File Type pop-up menu allows you to screen for a specific file type. *MathWriter's* own format keeps the formatting and configuration information you chose when you created your document for subsequent printing and editing sessions. *MathWriter* automatically restores this environment when you open the file.

If you use the File Warnings option in the File/Preferences dialog box, *Math-Writer* issues a warning message if a font used in the file you open is not avail-

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[3] Skip this discussion of templates if you do not use mathematical expressions in your examinations.

[4] Or SuitCase™ II, for example.

able to your system. If a PICT graphic displays correctly in the originating *MathWriter* file, it will display correctly when opened on another computer having the required fonts installed. In contrast with conventional Macintosh word processors, *MathWriter* preserves file integrity, even when transmitted by network to a different computer, provided identical font files are used, since the font names, not just local font identification numbers are used.

Close *(⌘ W)*

To close the active file, use this command or click in the Close box at the top-left corner of the active window. If you have made changes since the last save, *MathWriter* gives you an opportunity to save a permanent copy of the document in a file. *Remember the RAM-resident copy will be lost unless you save it as a file!*

Save *(⌘ S)*

Save makes a disk copy of the active window document using the previously assigned file name and path. If you have a power failure, the computer will lose the memory-resident copy, so save your document frequently. We recommend using Auto save and Auto backup from Doc Preferences in the File menu. During a file-save operation the Auto backup command retains the previous version of the file by appending ".backup" to its name before making a new copy. If a ".backup" file already exists, *MathWriter* replaces it with the new ".backup" file. This approach assures that the two, and only two, most recent copies are preserved.

> *MathWriter* does not compute the size of a file before executing the save command. Therefore, if insufficient disk space is available to save a complete copy, the partial file (and the older copy) will be deleted and you will be prompted to insert a disk with sufficient space. **Save a copy IMMEDIATELY.**

Save As...

The Save As... command is similar in function to Save except that a window appears on the screen in which you can type a name for the file. This window also offers a pop-up list of allowable file types.

MathWriter™ 2.0 format

This format preserves your complete document and all document-specific configuration information. Always save a copy in this format; other formats may not preserve all the information needed to resume editing.

MathWriter Default File

The *MathWriter* Default File selection saves your *MathWriter* document configuration, placing it in the New submenu (on the File Menu) if saved in the system folder. This becomes "stationery."

TEXT file

Virtually every word processor can read or translate the TEXT file type. When *MathWriter* or any other word processor reads such a file, the file may not look on screen as it looked originally because TEXT preserves only limited formatting information. In particular, the character formatting (font, size, and style) and graphics are not preserved.

Save a Copy...   Save a Copy... allows you to save a snapshot of the current file, including the changes since the last save, under a different name, different file type, and different disk. It leaves you in the file (under the previous name) in which you were working before executing the command, however. This distinguishes it from Save As....

Import Graphics File...   Import Graphics File... allows *MathWriter* to read graphics directly from a file, without the need for the application in which you created the graphic.

Preferences...   Preferences... allows you set global defaults to configure *MathWriter* for your needs. In contrast with document-specific conditions set in Doc Preferences, Preferences... lets you establish a default configuration for the primary startup file and for the New command on the File menu. Your choices are stored in the "*MathWriter* Pref" file in the system folder.

An Auto Screen Refresh option provides supplemental, timed screen refreshing. Use ⌘ *option Z* for supplemental manual redrawing of the entire screen. A file warning option provides advisory messages and lists missing fonts when you open a file to assure file content integrity. The enable/disable status of automatic file saving is also noted when files are being opened.

Doc Info...   In the Doc Info... window you see that *MathWriter* automatically tracks the number of sessions, the creation date, the date last modified, and the size of your document file. The Abstract/Notes box lets you jot down notes about the file.

Page Layout...   The Page Layout... command on the File menu controls the page layout specifications for the document. A portrait illustrates your choices of columns, margins, etc. *MathWriter* measures the margins from the physical edges of the paper, not the edge of the print area. Page Setup lets you set paper size, reduction percentage, orientation, font substitution, text smoothing, graphics smoothing, and faster bitmap printing.

Doc Layout...   Doc Layout... of the File menu allows you to specify the placement of headers, footers, footnotes, and endnotes throughout the document by clicking on icons.

Doc Preferences...   Doc Preferences... offers a variety of options for your document. Styles 1 and 2 enable you to create and assign style combinations with a keystroke. Auto save and Auto backup are provided.

The Overview command is not available in this version.

Print... *(⌘ T)*[1]   Depending upon the choice of printer you made in the Chooser (Apple menu), when you click Print on the File menu, different choices exist. ***If your file has previously been set up for one printer and you choose the other, click Page Layout (File menu) and then click in the Page Setup box before printing.*** In general, you should choose a printer type before composing your document because your choice of fonts and sizing of graphics and equations may be affected.

Quit *(⌘ Q)*

This is the standard last menu item on the Macintosh File menu. Use this command or its command key equivalent ⌘ Q to terminate the application. *MathWriter* reminds you to save modified files of any type before terminating the program.

The Edit menu

The Edit menu (Figure 4.26) transfers formatted text and graphics, rulers, paragraph formats, styles, and text from one location to another. To access the entire Edit menu on a small screen, move the mouse to the small, triangular arrow at the bottom of the first portion of the menu and drag.

Edit		
Undo	⌘Z	Reverse action of last command
Cut	⌘H	Remove selection and copy to clipboard
Copy	⌘C	Do not remove selection but copy to clipboard
Paste	⌘U	Paste clipboard contents at insertion point
Clear		Remove selection but do not place on clipboard
Select All	⌘A	Select everything within this region
Copy Other	▶	Copy ruler, format, etc., without text
Paste Other	▶	Paste ruler, format, etc.
Show Selection		Scroll to insertion point
Revise Paragraph	⌘M	Not available in this version
UnRevise Paragraph		Not available in this version
Find/Replace...	⌘F	Not available in this version
Find Next	⌘G	Not available in this version
Replace Selection	⌘H	Not available in this version
Check Spelling...		Not available in this version
Thesaurus...		Not available in this version
Hyphenation	▶	Not available in this version
Insert	▶	Add a row or column to a table/matrix
Delete	▶	Remove a row or column from table/matrix

Fig 4.26 Edit menu

Undo *(⌘ Z)*

The Undo command restores the document to its status prior to the most recently executed command. Undo lets you explore alternatives as well as correct mistakes. Undo is not available for a few situations (such as within mathematical expressions).

Cut *(⌘ X),*
Copy *(⌘ C)*

The Cut and Copy commands are dimmed and disabled until you select the portion of text you want to act upon. The Cut command removes the selected material from the document and places it on the Clipboard for subsequent transfer to another location, while the Copy command simply copies the selected material to the Clipboard without disturbing the original. To view the contents of the Clipboard, pull down the Windows menu at the top of the screen until you reach Clipboard and then release the mouse. The Clipboard stores material from only one Cut or Copy operation at a time. Clear removes a

selection, but does not affect the Clipboard. The Clipboard remains intact even after you exit *MathWriter*, allowing you to transfer material to another application.

Paste *(⌘ V)*

Paste inserts into the document at the insertion point material previously cut or copied to the Clipboard.

Clear

Clear removes a selection from a document without placing a copy of that selection on the Clipboard. It is equivalent to pressing the *delete* key. Use this command to remove large blocks of text when memory is limited.

Select All *(⌘ A)*

Select All selects all of the material in that portion of your document (either the body, header, footer, footnote, sidebar, memo, etc., identified in the pop-up menu at the insertion point locator in the status bar) that contains the insertion point.

Copy Other

Unlike Cut, Copy, and Paste, which apply to the combination of types of textual and graphic material within a selection, you can choose various types of formatting information such as Ruler, Format, Ruler and Format, Style, and Picture and copy them using Copy Other. Copy Ruler, Copy Format, and Copy Ruler and Format relate to the paragraph containing the blinking insertion point. Copy As Picture (⌘ *shift [*) turns the selected material into a PICT format graphic element and places it on the clipboard. Use this command if you wish to transfer an equation to another application.

Paste Other

Paste Other, which complements Copy Other, pastes the information you retrieved with Copy Other into the document at the location of the insertion point.

Show Selection

Show Selection scrolls to the paragraph containing the blinking insertion point of the active window.

Revision tracking is not available in this version.

Revision tracking is not available in this version.

Find/Replace is not available in this version.

Find/Replace is not available in this version.

Find/Replace is not available in this version.

Spell-checking is not available in this version.

The Thesaurus command is not available in this version.

The Hyphenations command is not available in this version.

Insert, Delete Insert and Delete add or delete a row or column of a table or matrix that contains the insertion point. Use the Math Editor to place the insertion point within a table.

The Format menu

The Format menu (Figure 4.11) contains such commands as paragraph formatting, matrix formatting, and automatic numbering formatting. The basic unit of organization in *MathWriter* is the paragraph—created when you press the *return* key. The ruler always remains at the top of the window and never scrolls out of view. If desired, you can hide the Ruler.

Format		
Hide Ruler	⌘`	Display/Hide Ruler
Ruler Options	▶	Select unit of measurement
Paragraph Format...	⌘J	Borders, spacing, page breaks for paragraphs
Line Spacing...	⌘K	Generalized line spacing
Matrix Format...		Matrix/table spacing and formatting
Variables Format...		Numbering format (page, question, date, etc.)
Insert Memo		Not available in this version
Insert Column Break		Not available in this version
Insert Page Break		Manual page break (see Para. Format too)
Calc Prev ∫ or | Size	⌘D	Calculates height of integral and absolute value
Hide Layout		Display boundaries
Hide Messages		Display message icons in left margin
Show Invisibles		Display formatting characters
Hide Pictures		Hide pictures for scrolling speed

Fig 4.11 Format menu

Hide Ruler
Show Ruler *(⌘ `)* Hide Ruler toggles with Show Ruler. The Ruler displays the formatting information for the paragraph that contains the blinking insertion point. When you select the Hide Ruler command, the tab and justification controls from the vertical scroll bar disappear too.

Ruler Options Ruler Options lets you choose a ruler measured in inches, centimeters, or points.

Paragraph
Format... *(⌘ J)* To change the format of a paragraph, place the cursor within that paragraph to select it. You can shade paragraphs, place lines (borders) along the sides of paragraphs, and set the vertical spacing before and after paragraphs. In this window you can also link paragraphs, begin a new page with a particular paragraph, or prohibit a paragraph split over a page break. Use the Page break before option to force the text that immediately follows the insertion point to appear on the first line of the following page. No icon is associated with Page break before. Use this dialog box to verify the existence of or to remove it.

Line Spacing...
(⌘ *K*)

With Automatic line spacing enabled, *MathWriter* automatically spaces lines to include the maximum size of such expressions as mathematical equations. Mostly fixed means that *MathWriter* allows simple subscripts and superscripts to protrude into the "leading" between the lines. The Fixed choice lets you set the spacing using four buttons: Single, 1-1/2, Double, and Other.

Use automatic line spacing while composing a manuscript when you do not want to be concerned with making a choice. If your writing includes in-line expressions, you may wish to modify the line spacing subsequently to achieve greater uniformity. Never compose variable-height mathematical expressions with fixed line spacing because portions of the line may be displayed improperly and inadequately refreshed.

Matrix Format...

This command controls matrix and table formatting. Placement, Line type, alignment of elements within the matrix, and the spacing of rows and columns is selected here. *MW* reformats a matrix with each input keystroke.

Variables
Format...

Variables Format... on the Format menu lets you select formatting options for such variables as the date, time, and page number. These variables automatically appear in the text in the form that you choose here. Show Invisibles (Format menu) displays a dotted box around these variables. Variables for creation date, current date, creation time, current time, page number, number of pages, equation number, sub-equation number, equation cross-reference, and question number are provided.

The Insert Memo command is not available in this version.

The Insert Column Break command is not available in this version.

Insert Page Break

This command forces a page break. Use Show Invisibles to locate a hidden character marker. To remove one, click to the right of it (at top of page) and press *delete*. See Paragraph Format for an alternative method.

Calc Prev   or |
Size (⌘ *D*)

Use this command to automatically size the   or | symbols. After you enter the integrand, press ⌘ *D* to resize the integral sign.

Show Layout/
Hide Layout

Show Layout toggles with Hide Layout to reveal or hide the boundaries of the headers, footers, margins, etc. Cursor changes also indicate the boundaries.

Hide Messages/
Show Messages

Hide Messages toggles with Show Messages, and they display or hide the markers for paragraph ruler changes in the left margin. You may adjust the File/Print dialog box to allow these markers to be printed.

Show Invisibles/
Hide Invisibles

Show Invisibles toggles with Hide Invisibles and provides access to or hides the hidden formatting characters, such as tabs, line breaks, page breaks, end of paragraphs, and spaces (⬦ ⏎ 🔁 ▯ ¶). To remove these markers, click just before the ***next*** character (NOT just after the marker) and press *delete*.

Hide Pictures/
Show Pictures
Hide Pictures toggles with Show Pictures and suppresses or produces the display of pasted graphics in order to produce faster scrolling. A rectangular placeholder preserves the page layout.

The Palettes menu

The Palettes menu (Figure 4.12) displays all of the symbols from the Symbol font except the Greek alphabet, which is available when you click on the Palettes window (Windows menu). In addition, the Greek alphabet is immediately accessible from the keyboard. Press ⌘ *spacebar* to toggle between the current font and the Greek alphabet. Pull down the Palettes menu and move the cursor among the items in the window. The name of the character on which you place the cursor appears in the row at the bottom of the window. Click on a character to insert it into your document.

Fig 4.12 Palettes menu

You can copy any of these rows in the Palettes menu to the Palettes window. First select the Palettes window (Windows menu). This places the Greek alphabet at the bottom of the screen. Then pull down the Palettes menu and select Geometry. The Geometry row of characters appears at the bottom of the screen with the Greek alphabet. To remove Geometry from the screen, select it again from the Palettes menu. *MathWriter* marks each row that you copy to the Palettes window with a check.

The Diac menu

When you place the cursor immediately to the right of an alphabetical character, the diacritics on the top row of the Diac menu (Figure 4.13) become available. Note that the name of the diacritic on which you place the cursor appears in the row at the bottom of the window. Click to assign a diacritical mark to a character in the text. Use the Raise and Lower commands to adjust the height of these diacritical marks. Use Remove to remove a diacritic. Select one or more characters to enable the remaining operators. *MathWriter* automatically stretches these overbars, underbars, grouping brackets, etc., as needed. Use the split I-beam to edit within the structure. The Raise, Lower, and Remove commands apply to the structures while selected.
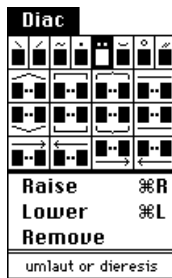
Fig 4.13 Diacritical menu

The Style Menu

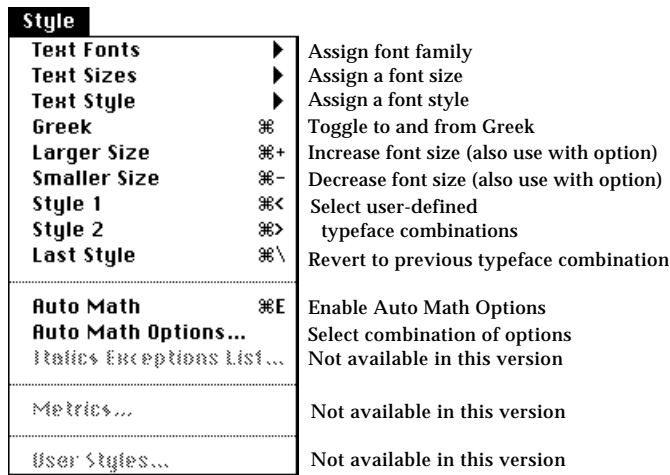The Style menu (Figure 4.14) contains menus for assigning fonts (typeface families), sizes, and styles.

Fig 4.14 Style menu

Text Fonts

The Text Fonts command provides access to a submenu that contains a list of fonts (Figure 4.15). The list depends upon those fonts currently available to the system. The laser fonts available to the LaserWriter Plus are underlined. If you press the *option* key while selecting text fonts, each font name appears in its respective style (Figure 4.?).
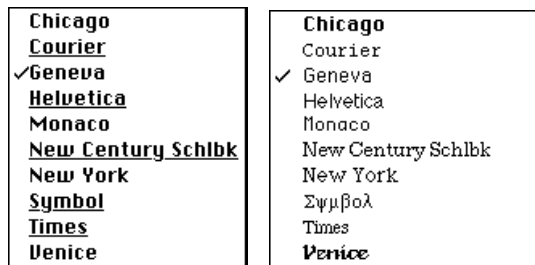
Fig 4.15 Text Font submenu and fonts listed using own font

MathWriter identifies the fonts internally by name, not just by ID numbers. When you open a file, *MathWriter* warns you if the entire set of fonts used in the document is unavailable to the operating system.   *MathWrite*r extends this machine independence to include any PICT graphics pasted into a *MathWriter* document.

Text Sizes

The Text Sizes submenu lists the sizes (Figure 4.16) and shows various standard font sizes. The outlined sizes identify the fonts with actual bitmaps available to the system. The system must create the other sizes, which will appear ragged on the screen and on ImageWriter output, but not on LaserWriter output. Macintosh System 7.0 addresses this problem.
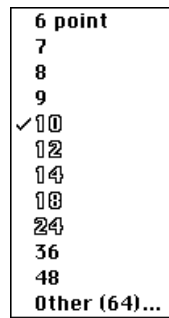
Fig 4.16 Text Sizes submenu

Text Style

The standard Text Styles (Plain, Bold, Italic, Underline, Outline, Shadow, Condense, and Extend) are available from this submenu (Figure 4.17). When you select Plain, all other styles are overridden.
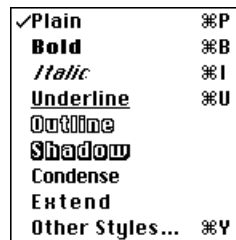
Fig 4.17 Text Style submenu

MathWriter has an enhanced set of Other Styles... (Figures 4.17 and 4.18).

When processing the additional information needed for a color monitor, *MathWriter* will perform more slowly. To disable the color output, use the Monitor command in the Control Panel (on the Apple Menu).
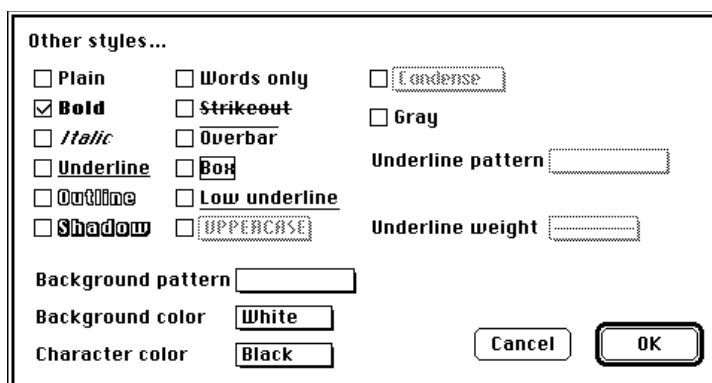
Fig 4.18 Other Styles

Greek *(⌘ spacebar)*	Because the Greek alphabet is so widely used in mathematics, science, and engineering, a dedicated menu command and key command for rapid access are provided. The Greek command is disabled by a selection from the text font submenu. For rapid changes, both the mouse and keyboard commands toggle between Greek (on the Symbol font) and the last font in use. The Last Style command on this menu plays the same role for all other fonts.
Larger Size *(⌘ +)*, **Smaller Size (⌘ -)**	Because one changes font size so frequently when typing mathematics, *Math-Writer* supplies special menu and keyboard commands for changing font size. You can easily step through the font sizes on the font size menu using these keyboard commands. When used with the *option* key (⌘ *option +* and ⌘ *option -*), these commands make smaller changes—one point steps, rather than cycling through the sizes on the menu.
Style 1 *(⌘ <)*, **Style 2** *(⌘ >)*	Use Style 1 and Style 2 let you apply two of your own style combinations. First, use the Doc Preferences...command to create these custom style combinations. (File menu).
Last Style *(⌘ \)*	The Last Style command provides a quick return to the immediate past style. This feature is especially useful when you must toggle between two styles, such as the frequent use of boldface notation for vectors and scalars.
Auto Math *(⌘ E)* **Auto Math Options...**	The next group of commands provides for automatic handling of two routine tasks associated with typing mathematics. Click on Auto Math Options... and select the options you want from the open window. Then, clicking on Auto Math (not just selecting the options) enables those choices. While composing a manuscript, use ⌘ *E* to toggle on and off the combination of features selected using Auto Math Options.

Auto Math Options include auto-bracket sizing (see Figure 4.19), and automatic replacement of arithmetic operators with the corresponding, better-formed characters from the Symbol font. For example, the plus sign in the Times font is larger than the Symbol plus sign.

When Auto Math is enabled, *MathWriter* automatically sizes brackets as you form an expression. If Auto Math is inactive while you create an expression, you can select an existing expression and then choose Auto Math, ⌘ *E*, to size the expression automatically.

$$(\frac{1+x}{1-x^2}) \qquad \frac{1+x}{1-x^2}$$

Fig 4.19 Parentheses typed without and with auto-sizing

The typeface indicator in the status bar at the bottom-right corner of the document window appears in inverse when Auto Math is active. If you turn this feature off, *MathWriter* runs faster.

The Italics Exception List command is not available in this version.

The Metrics command is not available in this version.

The User Styles command is not available in this version.

The Windows menu

The Windows menu (Figure 4.20) provides access to various windows—Tools, Templates, Palettes, Modules, Clipboard, Help, and any open document window. You can arrange the windows of the open documents for convenient access. The use of the Tools, Templates, and Palettes windows is discussed in detail at the beginning of this chapter.

Windows	
Clean Up Windows	Arrange exam document windows
Tools Window ⌘△	Show/Hide the Editors and
Tools ▶	subscript/superscript tools
Templates Window	Show/Hide the mathematical templates
Palettes Window	Show/Hide the Greek alphabet
Font Table Window	Typing aid not available in this version
Library Window	Interactive Library (glossary)
Library ▶	not available in this version
Modules ▶	Activate the *ExamBuilder Module*
Clipboard	Show/Hide the Clipboard window
Help ⌘?	Show/Hide the online Help
✓**untitled 1**	List/Select the open documents

Fig 4.20 The Windows menu

Clean Up Windows

Clean Up Windows "stacks" the document windows with a slight offset that makes the multiple filenames partially visible and allows you to make any file active by clicking within its window.

The floating windows (Templates, Palettes, and Tools) can remain active while a document window is active. To completely remove these windows, either click their Close boxes or reselect the window from the Windows menu. Scrolling will be faster if the floating windows do not obscure the document window, which would require the screen to be redrawn more often.

Tools Window

The Tools Window selection (*command tab*) displays or hides the floating Tools window (Figure 4.21). If you reposition the Tools window, *MathWriter* retains the new location of the window even if you temporarily remove the window.

Type ⌘ *tab* (⌘   ) to bring the Tools window (Figure 4.21) to the foreground. (We use   in the menu to denote the *tab* key.)
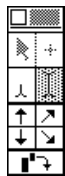
Fig 4.21 Tools Window

Tools

The Tools submenu provides menu access to two editors:

• Text Editor, identified by the traditional I-beam cursor

• Math Editor, identified by a split I-beam cursor and used for editing within mathematical expressions

Two editors are *not* available in this version of MW:

• Character Editor, identified by an arrow cursor and used for moving characters

• Sidebar Editor, identified by the "+" cursor, is not available in this version.

You can reach these tools from the Tools window or from the keyboard.
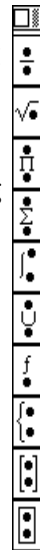
Templates Window

Fig 4.22 Templates Window

See the previous discussion of the Template Window on pages 67-69.

Palettes Window

The Palettes window (Figure 4.23) contains the Greek alphabet. Click on one of the letters of the alphabet to "type it." The character appears in your text at the location of the blinking insertion point. You can add palettes from the Palettes menu at the top of the screen. Pull down the Palettes menu

row name and release. This places that row of symbols at the bottom of the screen for easier access. To remove that row, pull down the Palettes menu and click on that row name again.
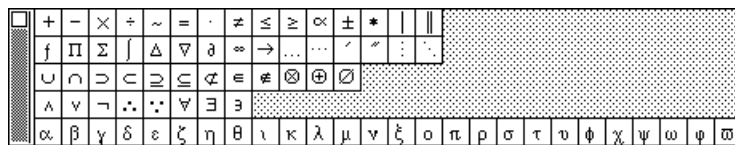
Fig 4.23 Palettes windows

The Font Table, which provides mouse access to every character, is not available in this version.

The Library and Library Window commands (an interactive glossary) are not available in this version.

Modules

The Modules submenu provides access to modular extensions of *MathWriter*. You can extend the scope of *MathWriter* by adding modules. This first module, disk-based *ExamBuilder,* can interact with the data structure of the active, RAM-based exam document, make calls to code within *MathWriter* (such as question numbering), and use *MathWriter* for formatting and output.

To add a module, simply place it in the system folder or in the same folder with *MathWriter. MathWriter* locates and incorporates such modules when you next open the application. To remove a module, exit from *MathWriter* and remove the module from its folder.

Clipboard

The Clipboard command on the Windows menu provides diagnostic access to the contents of the Clipboard used to transfer text and graphics between applications or from one location to another within a document. The mathematical expression in Figure 4.24 is shown as a PICT file because it was placed there using Copy As Picture (Copy Other submenu) on the Edit menu.
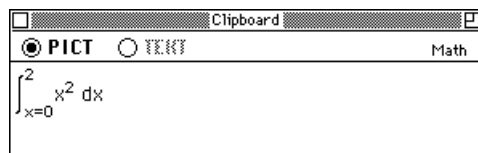
Fig 4.24 Clipboard window

Help (⌘ ?)

The Help window supplies online hints on the use of *MathWriter* features. Scroll through the list or select a topic to go directly to a specific topic.

(Names of Open Documents)

The final entries on the Windows menu are the names of open documents. Either click on an exposed portion of a document window or select it here by name to make it the front window on the screen. This version of *MathWriter* is arbitrarily limited to two open documents.

MathWriter Guided Tour

About the Exercises

The exercises that follow present step-by-step instructions for completing various common tasks. Some of the steps are numbered and are essential to completing the task. Others are simply suggestions for practice and are indicated with a • at the left text margin.Again, do not begin until you have made a working copy and have safely stored the master disks. The Symbol font is installed as part of the MathWriter application. If you wish to print *MathWriter* files, you must also install the appropriate print driver, select the driver using Chooser, and connect and prepare the printer for printing. Optionally, print these instructions.

Exercise 1: Reviewing a Short Memo

This first exercise describes how to open an existing file, navigating through a document, exploring the interface, printing the document, and quitting.

This exercise asks you to read through and work on the following hypothetical memorandum from the authors to new *MathWriter* users. As you move through the memorandum, which is the same in the manual and on the screen, the text will tell you what to do.

MEMORANDUM

Date: Nov. 15, 1990

To: *MathWriter* New Users

From: The Authors

Subject: *MathWriter* basic features — a first glimpse

We assume that you have a basic familiarity with the Macintosh interface as described in the materials supplied with your computer. Consequently, this first glimpse will describe the basic features you need to perform simple tasks with *MathWriter*—moving around within a document, formatting paragraphs, identifying typefaces, moving text, saving and printing a document, and ending a session.

108 Appendix

### Basic features

Move around within a document

After reading this paragraph, repeatedly drag and release the vertical scroll box to examine the entire document and then return here. The number in the scroll box identifies the page that appears in the document window when you release the mouse button. More precisely, it is the page visible at the **top** of the document window! *MathWriter* displays documents as "sheets of paper" and automatically paginates them.

Click *immediately above or below the scroll box to scroll* one complete screen vertically up or down.

Click *in the scroll arrows* to move a few lines, or press *option* when you click the scroll arrow to scroll a single line.

The boundary lines of the margins, the header, and the footer are visible because Show Layout in the Format menu has been selected (as a result, the menu choice now reads Hide Layout). The cursor changes shape when you move it from one work space where the blinking insertion point is located to another. If you move into the header, click, and then return to the main body, the cursor changes to and then back to .

Examine the ruler

Observe that the positions of the left margin marker (together with a left tab it looks like) and first line indent marker on the Ruler change when you place the cursor, first within this paragraph and then within the paragraph that precedes, "Examine the Ruler." In this paragraph the first line "indent" is to the left of the paragraph margin and produces a "hanging indent" to make the numbers conspicuous.

Notice that the ruler does not scroll from view; it always displays the particular conditions of the paragraph that contains the blinking insertion point. When you press *return, MathWriter* creates a new paragraph that inherits the ruler conditions of the previous paragraph. If you change the Ruler, a ruler icon appears in the gray left border unless you select Hide Messages on the Format menu.

ruler icon in the gray area (in the screen version)

Examine paragraph alignment

Click within this paragraph and then select each of the four paragraph alignment symbols just above the vertical scroll bar. As you click each symbol, the text of this paragraph changes alignment from left , to right , to aligned left and right , and to centered .

To place horizontal tabs on the ruler, drag them from the supply above the paragraph alignment icons. To remove a tab from the ruler, drag it past the *right* margin marker on the Ruler. Drag the symbol to reposition a tab. Click on the next blank line (paragraph) to see ◀ ▶ ◆ ◇ on the ruler.

Examine the status bar

Click inside the following words: "**Click Here.**" Notice that the status bar at the foot of the window indicates the typeface, in this case bold. Also, observe that *MathWriter* reports in the status bar the line number (measured from the beginning of the document) and character position (measured from the first character on that line) of the blinking insertion point.

Edit a footer in-context

Scroll if necessary and look at the contents of the footer. In the right corner find the word "(more)" and click between left parenthesis and the word "more." Then type "Continue for" to see how footers are edited. Backspace to correct any typing errors. If you backspace too far, the word "(more)" may jump to the beginning of the line. With the cursor placed right before the "m" in "more" press *tab* to restore the word to its original position.

Cut, Copy, and Paste

To observe editing with Cut, Copy, and Paste in the Edit menu, follow the instructions to change the sentence below from "Please move this word" to "Move this word, please."

"Please move this word."

Select *Please* using the mouse or using the arrow keys and shift key. With ⌘ *X* cut it from the text and with ⌘ *V* paste it after *word* (or use the Cut and Paste selections in the Edit menu). Then complete the editing by changing capitalization and punctuation.

Select Clipboard from the Windows menu to see a copy of the word *Please* placed there by the cut command. Click the Clipboard Close box (top-left corner) to close it.

Save the document

If this file were not locked, you could use Save on the File menu to save your document. However, you can rename the file and save a copy of the entire exercise in *MathWriter* format if you select Save As… from the File menu.

Print a copy of this document

To print the document, click on the Chooser command in the Apple menu. The

name of your printer should appear in the box User Name. If not, select Print from the File menu, make the selections necessary, and click OK in the print dialog box.

Summary

So far you have learned to:

•Scroll within a document and move the insertion point

•Locate headers and footers and edit them

•Create and format paragraphs (first line indent, tabs, leaders, and paragraph alignment)

•Locate the position of the insertion point and identify the typeface of the adjacent character to the left

•Cut, copy, and paste text

•Save and print a document

To end this and other *MathWriter* sessions, select Quit from the File menu.

The Exercise 1 file is write-protected, so exit without saving when prompted.

You may continue this guided tour:

Exercise 2: Input Tools

Word processors contribute a great deal to the task of perfecting a manuscript. In fact, this may be the important contribution a word processor makes to the writing process.

MathWriter supports both mouse and keyboard input for most commands. By pointing and clicking the mouse, the novice or infrequent user can easily and quickly use *MathWriter* without having to memorize commands. On the other hand, the experienced or power user will appreciate the speed afforded by keyboard commands. Whatever your level of experience, you can mix these approaches as you wish.

Online help

We hope that *MathWriter's* interface is sufficiently intuitive that you can work with minimal prompting. For those times when prompts would be useful, use the Help window as described here.

1.Select Help from the Windows menu (⌘ *?*).

The Help window presents a scrollable list of topics, including general information, step-by-step instructions for performing common tasks, and a menu/command summary. Select a topic from the list, scrolling if necessary, and click on the Help button or double-click on the topic. Use the « or » buttons to scroll to adjacent help screens, click Topics to return to the list of topics, click in your document window to return to it while leaving the Help window open, or click in the Help window Close box to put it away.

2.If the Help window is still open, click the Close box in the upper left corner of the window to put the Help window away.

Keyboard commands for type style changes

MathWriter has an extensive set of keyboard commands. Those that control type style changes are listed here.

Font Selection

⌘ spacebar — Toggles between the current font and the Symbol font (which contains the Greek alphabet and other mathematical symbols)

Font Size Selection

⌘ + — Next larger font size on size submenu
⌘ option + — Increase font size by one point
⌘ - — Next smaller font size on size submenu
⌘ option - — Decrease font size by one point

Font Style

⌘ P — Plain (and removes all other style attributes)
⌘ B — Bold
⌘ I — Italic
⌘ U — Underline
⌘ Y — Other styles (access to numerous other styles)

Font, Size, Style, Justification, Alignment

⌘ \ — Revert to immediately previous style
⌘ < — Style 1 of user-selected attributes
⌘ > — Style 2 of user-selected attributes
Use Doc Preferences... in the File menu to assign user-selected attributes.

Transfer of paragraph formatting

Each new paragraph automatically inherits the formatting of the preceding paragraph.

To transfer the Ruler, Format, Ruler & Format, and Style information from one paragraph to another:

1.Click within the originating paragraph

2.Make a copy of the desired information using Edit/Copy Other

3.Click within the destination paragraph

4.Paste the information using Edit/Paste Other

Using default documents

Many documents such as examinations contain repeatedly used formats for course identifications, etc. You might have a preferred font for these documents, depending upon esthetics or printer availability. A sample stationery file Exam.def is include with *ExamBuilder*. To speed the creation of such documents, create and use skeletal default files as follows.

1.Use the New command from the File menu (not a New submenu even if one is present) to open a blank, generic document.

2.Assign all global properties of this default (template) document. Change the existing defaults as desired. Some options are:

•Use File/Page Layout to set the choice of printer, printer options, margin sizes, and header and footer sizes.

•Use File/Doc Format to assign the placement of headers and footers within the document.

•Use File/Doc Preferences... to set font, font size, font style, paragraph alignment, and line spacing combinations for styles 1 & 2.

•If relevant, use the Format menu to assign ruler options, line spacing, matrix formats, and formats for the variables such as date, time, etc. *ExamBuilder* works best with fixed (uniformly-spaced) tabs.

•Use the Style menu to set the font, size, and style for the body of the document.

•Supply any text or graphics that you wish to appear in the default file.

3.Use Save As... on the File menu to turn your document into a default file; select MW Default File from the pop-up menu as the file type. Save the file in the same

folder with *MathWriter* or in the system folder so that *MathWriter* can immediately add this name to the New submenu list.[1]

To use copies of this template you need only select it from the New submenu. The file is immediately added to the New submenu list. When you select a default file from New, *MathWriter* automatically makes a copy of that file.

Palettes and Diac menus

The Palettes and Diacriticals menus are always available. Palettes provides mouse access to the characters of the Symbol font (except the Greek alphabet, which is available from the Palettes window), a few special characters, and the Variables. As you drag the cursor over the Palettes menu, your current choice appears on the bottom row.

The Variables include the following: creation date, current date (which you can use in a default file to obtain the current date automatically), creation time, current time, page number and total number of pages (which can appear only in headers and footers), equation numbers, subequation numbers, textual cross-reference to an equation, one set of user-defined variables analogous to equation numbering, and document file name. You can use these to dynamically number questions. The file name variable allows you to insert the name of the file into the text automatically so you can more easily maintain the correspondence between printed output and the *MathWriter* file used to print it. The file name variable provides the identification needed to match the answer key with the versions of the examinations.

MathWriter treats a dynamic variable as a single, uneditable entity whose format and style are set with Variables Format... on the Format menu. (The name of the user-defined variable and its starting number are also set using Variables Format... .) *MathWriter* automatically updates existing variables as you insert, delete, cut, and paste them.

The Diac menu supplies mouse access to the diacritical marks when the insertion point is immediately to the right of some alphabetic character. The horizontal grouping symbols are available only when you have selected one or more characters. To edit within a horizontal grouping, press the *option* key to obtain the split I-beam cursor.

Floating windows

The properties common to *MathWriter's* floating windows are discussed here; refer to Exercise 5 for more detail.

1.Select each of the four windows (Templates, Palettes, Tools, and Font Table) from the Windows menu.

---

[1] If no default files are present, the New command will not contain a submenu.

2.Place the cursor in the gray region adjacent to the Close box of each and move to a convenient location.

3.Explore each menu. Click on the I-beam in the Tools window to be sure that you are in text editing mode when you complete this.

4.Remove the floating windows by reselecting them in the Windows menu or clicking in their Close boxes.

Auto save

We recommend that you set the automatic file saving feature on Doc Preferences... of the File menu as insurance against file loss. The minor delay caused by Auto save can offset the inconvenience of retyping. The Auto backup command, also enabled on Doc Preferences..., preserves the immediate past copy of your document for even better protection.

We STRONGLY recommend that you use these protection features when composing original material at the keyboard.

Summary

In this exercise you have learned to use input aids to:

•use online help

•change typeface characteristics

•transfer rulers and other formatting from one paragraph to another

•create reusable default or template files (stationery)

•configure *MathWriter* for your particular needs

•use the floating windows

•enable the Auto saving feature to protect your files.

Exercise 3: Graphics

MathWriter supports the mixing of graphics such as pictures and figures with text. It can also import mathematical expressions as graphics, but a far more powerful approach to writing mathematics is described in Exercise 4. In addition to handling traditional bitmapped and PICT file types such as those created by MacPaint® and MacDraw®, *MathWriter* can also handle encapsulated PostScript files such as those created by Adobe Illustrator® or Mathematica®. It reads these graphics files directly as well as by using the usual transfer via the Clipboard.
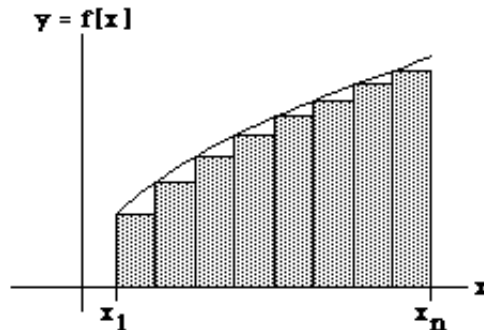
Fig.1 A Mathematica-created picture

MathWriter can resize, crop, and position these graphics. It treats a graphic as a tall character within a line of text. You can also apply various border designs and background patterns to sidebars.

Place a graphic **in a line of text**

1.To move a copy of the *MathWriter* icon from the above line, select it using the I-beam cursor and copy it to the Clipboard using Copy on the Edit menu or ⌘ *C*. (You could also use the Scrapbook or another application to place the graphic on the Clipboard.)

2.Place the insertion point at the destination location, somewhere in the document.

3.Use Paste Picture from the Edit menu to transfer the picture into the active *MathWriter* document.

4.Select the Character Editor by either clicking the arrow tool in the Tools window, selecting it from the Tools submenu of the Windows menu, or typing ⌘ *shift [*. The cursor will change into an arrow.

5.Click on the graphic to select it. A rectangular frame with square "handles" at the corners forms around the graphic.

6.To resize the selected graphic, use Scale Picture... in the Edit menu (now changed because the Character Editor tool was chosen) or drag one of the handles. To preserve the width-to-height ratio, press the *option* key while dragging a handle.

7.To crop the selected graphic, press ⌘ while dragging a handle. To crop all sides proportionally, press both *option* and ⌘ while dragging a handle.

8.To reposition the graphic vertically, select it, release the mouse button, and then drag it.

To adjust the vertical position of *any* text character use the Character Editor as described in step 8.

Summary

In this exercise you mixed graphics and text within a document, and you learned:

•To place graphics within a line of text.

•To resize and crop graphics.

MathWriter allows you to import graphics directly from a file, including high resolution, encapsulated PostScript files.

For a discussion of *MathWriter's* treatment of mathematical expressions, continue on to Exercise 4.

Exercise 4: Mathematics

In this exercise you learn to type two-dimensional mathematical expressions and to number equations automatically.

Mathematical expression editor

Preparing to write mathematics

Before we examine math writing features, you need to configure the *MathWriter* environment for these activities. If the Templates, Palettes, and Tools floating windows are not visible, select them from the Windows menu and drag them to a convenient working location.

The Templates window behaves as if it were a vertical menu bar; press on a template category and drag to select a specific template. Alternatively, you may type command (⌘) and the row number followed by the column number of a specific template. For example, ⌘ *2* and *1* selects the square root. If you pause before typing the column number, the selection menu pops out to prompt you. Typing other than one of the valid numerals aborts the command.

Exercises

Use the following instructions to explore the auto-formatting templates that were used to create the equation that follows step 4. Use the space that follows the equation as a place to experiment.

1.Select the root template by mouse (from the Templates pop-out menu) or by

keyboard (⌘ *1* and *1*) from the Templates window. The insertion point is positioned to receive the argument.

2.Type "(1 + sin *x*)". The root symbol expands automatically.

3.Press *enter* (not *return*) to exit the root.

Create $\sqrt{(1 + \sin x)}$.

Type here:

If you make a mistake or wish to modify the expression, press *option* to obtain the split I-beam cursor ⅄ to edit within the auto-formatting structure and click within the expression. You could also select the split I-beam from the Tools window or Tools submenu (Windows menu).

Suppose you wanted to square the sine term. Edit the expression below.

Edit this $\sqrt{(1 + \sin x)}$ to obtain this $\sqrt{(1 + \sin^2 x)}$

Edit this expression. $\sqrt{(1 + \sin x)}$

4.*Option click* within the mathematical expression immediately after "sin." This positions the insertion point in the square root structure.

5.Press ⌘ *]* or click on the arrow ↗ in the Tools window (Windows menu) pointing diagonally upwards (just below the I-beam tool) to create a superscript. This changes the vertical position of the insertion point and decreases the font size.

6.Type the exponent and press *enter* (not *return*).

7.Press *enter* to terminate the superscript entry.

Because this superscript structure is nested within the square root structure, you must press *enter* again to reach the baseline and recover the I-beam cursor of the text editor. Alternatively, you could press *return* at any point to reach the baseline immediately. This use of nested operations illustrates the general procedure for constructing a mathematical expression of arbitrary complexity.

Suppose you wish to attach a superscript to a superscript as in the next equation.

$$y = e^{x^2}$$

$$y =$$

1. Position the insertion point after the equals sign.

2. Type "e".

3. Press ⌘ *]* or click 🡕 and type "x".

4. Press ⌘ *]* again and type "2".

Observe that the leftmost display in the document status bar uses two up arrows ↑↑ to indicate that the insertion point is two levels removed from the baseline.

5. Observe the status bar as you press *enter* twice.

How would you type a subscript to a superscript, as in the next equation?

$$y_1 = e^{x^2_1}$$

$$y_1 =$$

1. Click to the right of the equals sign and add a space.

2. Type "e".

3. Press ⌘ *]* and type "*x*".

4. Press ⌘ *]* again and type "2".

5. Press *enter* once to return to the level of the "*x*". (Now there is only one up arrow in the status bar.)

6. Press ⌘ *apostrophe* or click on the arrow pointing downward 🡗 in the Tools window for a subscript.

7. Type *1* and press *enter* to return to the superscript level.

8. Press *enter* again to return to the baseline.

MathWriter reformats the expression after each keystroke so you need not count spaces before typing even the most complicated expression. Nesting to any depth is supported.

Remember to *option click* to place the insertion point within the expression.

Suppose you wish to type the error function that appears frequently in probability theory and heat conduction problems:

$$\text{erf}(x) = \frac{2}{\sqrt{\quad}} \int_0^x e^{-\quad^2} d$$

$$\text{erf}(x) =$$

In each example, position the insertion point without reminder.

1.To create a fraction, choose the first fraction template (⌘ *1* followed by *1* for the first template row and the second template column, or use the mouse). The second fraction template automatically reduces the font size.

2.Type "2" for the numerator and press *enter* to move to the denominator.

Always supply the numerator before the denominator. By using nesting, you can create numerators and denominators of arbitrary complexity.

3.Select the square root symbol (⌘ *2* and *1*).

4.Click on   in the Palettes window.

Use the mouse to select " " from the Palettes window or type ⌘ *spacebar* to toggle to the Greek alphabet, now noted in the status bar; type *p* to get pi; and then type ⌘ *spacebar* to toggle back to the previous font. The Greek alphabet is taken from the Symbol font; the characters have a mnemonic arrangement, "a" for   , "b" for   , etc. But if you cannot locate a character, use the Key Caps desk accessory or the Font Table window.

5.Press *enter* once to leave the root template and a second time to reach the baseline. To avoid your having to scroll, the sidebar is repeated here.

$$\text{erf}(x) = \frac{2}{\sqrt{\quad}} \int_0^x e^{-\quad^2} d$$

$$\text{erf}(x) = \frac{2}{\sqrt{\quad}} \int_0^x$$

1.Select the single integral template with the mouse or type ⌘ *5* and *1*.

2.Type "0", the lower limit of integration. (It could be any arbitrary expression.)

3. Press *enter* to move to the upper limit of integration and type "*x*".

4. Press *enter* to return to the baseline.

Use *option click* if you need to edit either limit.

5. Complete the integrand as in the previous example.

Close this file and open the file "Exercise 5b" to continue.

Here is another practice example.

$$V = \frac{4\,V_0}{\underset{n=0}{\sum}} \; \frac{1}{(2n+1)} \exp\left[-\;(2n+1)^2\;{}^2t\,/\,L^2\right] \sin \frac{(2n+1)\quad x}{L} \qquad\qquad [1]$$

As with the integral example in the previous example, use *enter* to move from the lower to the upper limit. The down-scaled infinity symbol is an idiosyncrasy of the Symbol font; use *option click* to select it with the split I-beam and increase its font size with   + or Text Size on the Style menu.

Try the next example with the special functions that have an argument centered below them. Use ⌘ *7* or click on *f* the Templates floating window to access the limit template. Get the "   " from the Palettes menu.

$$\lim_{x\;\;0} \frac{1 - \cos x}{x^2} = \lim_{x\;\;0} \frac{\sin x}{2x} = \lim_{x\;\;0} \frac{\cos x}{2} = \frac{1}{2} \qquad\qquad [2]$$

The Cut and Paste operations on the Edit menu apply to mathematical expressions, even when you use the Math Editor cursor. In this way you can frequently avoid retyping built-up expressions such as $\lim_{x\;\;0}$.

MathWriter automatically groups rows of expressions with a stretchable symbol as in the following exercise. Use the Palettes menu (or ⌘ *8* and *1*) and the Greek alphabet on the Palettes window (Windows menu) for the special symbols. Use *return* to create a new row.

$$y = \quad x \quad \begin{array}{l} x,\, x \quad 0 \\ -x,\, x < 0 \end{array} \qquad\qquad [3]$$

If you are using the Apple, rather than the Adobe, version of the Symbol screen font, the large brace in the above expression will be truncated, but it will print correctly in LaserWriter output. (Use Calc Prev   or | Size or ⌘ *D* to size the absolute value symbol from the Palettes menu to fit an expression; use the Character Editor to stretch it to an arbitrary size.)

MathWriter automatically formats matrices and other two-dimensional arrays. In order to create self-sizing parentheses for a tall fraction:

1.Pull down the Style menu to Auto Math Options… and release the mouse. A pop−out menu appears.

2.Click on Auto−bracket sizing if it is not checked and click OK. (This includes the auto-sizing feature in the set to be enabled in step 3.)

3.Now click on Auto Math in the Style menu (or press ⌘ *E*). This activates those items you have checked in the Auto Math Options window.

In general, activate Auto Math only while you are typing an equation and then toggle this feature off with ⌘ *E* to reduce the computational load.

$$[D] = \quad \frac{E}{1 - \mu^2} \qquad\qquad [4]$$

Type here $[D] =$

4.To complete equation [4], type an ordinary left parenthesis, select the fraction template (⌘ *1* and *1*), supply the numerator, press *enter*, type the denominator, press *enter*, and then type a ")".

5.Complete the expression below by adding the matrix.

$$[D] = \frac{E}{1 - \mu^2} \begin{matrix} 1 & \mu & 0 \\ \mu & 1 & 0 \\ 0 & 0 & \dfrac{1 - \mu}{2} \end{matrix} \qquad [5]$$

$$[D] = \frac{E}{1 - \mu^2}$$

6.To construct an array of any number of rows and columns just select the appropriate construct from the Templates window, in this case vectors and matrices (the next to last row on the Templates window), and create the elements. The first element corresponds to row one, column one.

7.Press *tab* to move to the next column (or to create the next column) in the same row.

8.Press *return* to move to the next row (or to create the next row) in the same column.

9.To move into an existing cell, use option click with the mouse or *shift* with the arrow keys.

MathWriter reformats the array as you type. Use Matrix Format... in the Format menu to set placement, line type, justification, and spacing of cells.

Pull down the Format menu to Matrix Format and release the mouse to view the formatting possibilities.

Any changes made in the Matrix Format when a matrix is selected apply to that matrix only; any changes made when no matrix is selected apply to all future matrix input.

As a final exercise, reproduce the following table.

a_{11}	123.456	$\sum_{i=0}^{4} (1/i^2)$
$\sqrt{\dfrac{1+x}{1-x^2}}$	Text	

1. Use ⌘ *0* and *2* to activate the table template. Create rows and columns just as in the matrix example. Use "0" for row "10".

The cells of a table can contain numbers, text, graphics, or mathematical expressions. Use Matrix Format... in the Format menu to change the defaults. When the insertion point is within a cell, you can insert or delete a row or column using Insert and Delete on the Edit menu.

Remember, *option click* to edit within a cell. The status bar indicates the row and column of the insertion point.

Technical support

In addition to the need for writing equations, technical writing places other special demands on a word processor. The increased complexity of input due to the enlarged set of fonts and symbols, font sizes, and font styles was discussed in Exercise 3. Now we will explain several other features of special importance.

Automatic numbering

Numbering equations and cross referencing them in the text is an important feature for writing math. Suppose you decide to assign a number to the first equation. Equation [1] then would become equation [2]. Without *MathWriter's* automatic numbering, you would have to find and increase all succeeding equation numbers and all cross-references to them in the text and elsewhere. *MathWriter* handles this task automatically. Even if you use cut and paste operations to edit your manuscript, *MathWriter* updates the numbering and linkages correctly. This assumes, of course, that you move both an equation and its associated equation number together.

Warning: If you remove an equation number which is linked to a cross- reference variable, the cross-reference number is no longer meaningful and is changed to a "?".

$$f(z) = \sum_{n=-}^{} {}_n(z - z_0)^n, \ r_1 < |z - z_0| < r_2$$

where $\quad {}_n = \dfrac{1}{2 \ i} \oint_C \dfrac{f(\ )\,d}{(\ -z_0)^{n+1}}, \ n = 0, \pm 1, \pm 2, \cdots,$ [6]

and the integral along *C* is taken in the positive direction.

Find the Laurent series expansion, in powers of z, for the function
$f(z) = \frac{1}{(z-1)(z-3)}$.

Observe that *f(z)* is analytic for all values of *z* such that $1 < |z| < 3$. We may find the $_n$'s of [6] by using the following device. [Pennisi, et al., *Elements of Complex variables*]

To add the equation number to the first equation, follow these steps:

1.Drag a right tab ◀ near the right margin.

3.Place the insertion point immediately to the right of the first equation, verify that you placed a tab near the right margin, and inspect the ruler. If necessary, add a right tab.

We centered the equation at the ruler position by a center tab. To avoid a contradiction, NEVER use centered paragraph alignment and a tab to number equations.

4. Press *tab* to position the insertion point at the right margin, and select equation number $\boxed{\Sigma\#}$ from the last row of the Palettes menu. (As you drag the cursor over each icon its name appears on the bottom row of the menu.) When you release the mouse button, *MathWriter* automatically calculates and assigns the equation number.

The new equation becomes number [6], the original equation becomes number [7], and *MathWriter* updates the cross-reference to the original equation in the last paragraph of text, too.

The program handles subequation numbering in an analogous manner. It numbers multiple parts of any equation, but you have to identify the linked variable by number, by relative number, or by pointing.

With Variables Format... in the Format menu you can assign such things as the variable style, format, and style of enclosing brackets for equation numbers.

MathWriter automatically updates all variables of this type throughout the document if you change any of the choices in Variables Format... (Format menu). You cannot edit these variables placed within the document as you would other character strings; you can only make changes using Variables Format... .

uSelect Show Invisibles from the Format menu to locate the dynamic variables identified by dotted boxes and Hide Invisibles to conceal them.

Automatic numbering of other entities such as questions is also possible. In addition, you can re-define this set of dynamic variables for other items, and

*MathWrite*r will automatically track them.

To create a "questions" user-defined category, follow these steps:

1.Select Variables Format... in the Format menu, and click Rename.

2.Assign a variable name, e.g., Questions, and select it in the scrolling window.

3.Select a numbering scheme; decide on no leading bracket and a trailing period; assign a starting number and delete the category label (e.g., select and press *delete*). Click OK. *MathWriter* adds this name to the icon.

4.Drag the mouse over the user-defined category on the Palettes menu to verify that the program has assigned the new name.

5. Select and adjust the parameters for the subquestion and question reference variables.

This completes the guided tour. Close this file and begin experimenting.