SAMPLE ITEMS FOR BEHAVIORAL OBJECTIVES

Statistics and Biometry 200

First Preliminary Exam

by

Jon Angellotti

BU-728-M (Addendum) April, 1981

Abstract

Sample items are presented to accompany selected objectives listed in the Aid and Guide Package. Examples are listed according to section heading and objective number previously presented in the Behavioral Objectives Packet. Objectives that require only a restatement or redefinition of information presented in lecture or in the text are accompanied by the phrase DEFN. Solutions for the sample test items are provided at the end of the examples.

Paper No. BU-728-M (Addendum) in the Biometrics Unit, Cornell University, Ithaca, New York 14853.

Statistical Concepts

1. DEFN
2. DEFN
3. DEFN
4. DEFN

Measurement

1. DEFN
2. DEFN
3. (a) The known causes of a measurement are referred to as (assignable/non-assignable) causes.

   (b) The unknown causes of a measurement are referred to as (assignable/non-assignable) causes.

   (c) A bias in measurement that remains constant for all responses is known as a

   1. statistic 2. systematic error 3. random error
   4. foolish blunder

   (d) Bias in measurement is an example of an (assignable/non-assignable) cause.

   (e) Identify the assignable causes in the following list:

   1. true population mean 2. random error
   3. systematic error 4. bias
   5. deviation of sample mean from true population mean

4. DEFN
5. DEFN
6. Identify the degree (high/low) of accuracy for each of the following; draw an appropriate representation.

   1. low precision, zero bias 2. high precision, high bias
   3. low precision, high bias 4. high precision, zero bias

Data Collection

1. DEFN
2. DEFN
3. DEFN
4. Identify each of the following examples as a meaningless statistic, an unknowable statistic, an eccentric theory statistic, a preposterous statistic, a far-fetched statistic built from a dubious cluster, or an uncritical statistical projection of a trend.
   (a) The city of Atlanta is 65% cleaner today than it was one year ago.
   (b) If grade inflation continues at present rates, the average cumulative average of the graduating class of 1999 will be 4.21.
   (c) American college students spend $12.63 each per week on beer.
   (d) The average American family is composed of 1.7 adults, 2.3 children and 3.45 pets.
5. DEFN

Principles of Scientific Investigation

1. DEFN
2. DEFN
3. DEFN
4. DEFN
5. DEFN
6. Identify the following examples as being either inductive or deductive inference.
   (a) Kurt, Chris and Jon are midgets.
   Kurt, Chris and Jon are professional wrestlers.
   $\therefore$ All midgets are professional wrestlers.

(b) All statistics students understand hypothesis testing.

Eugene is a statistics student.

$\therefore$ Eugene understands hypothesis testing.

(c) Ithaca is a college town.

Ithaca never has sunny days.

$\therefore$ College towns never have sunny days.

(d) People in Tennessee love country music.

Jeremiah is from Tennessee.

$\therefore$ Jeremiah loves country music.

7. DEFN

8. DEFN

9. DEFN

10. Identify the treatments in the following examples.

(a) In an attempt to increase crop yields, fertilizer containing 20% more organic nutrients was applied to experimental vegetable fields.

(b) To determine the effects of caffeine on living organisms, researchers force-fed 400 mg. tablets of the pure drug to laboratory rats.

(c) In an attempt to increase corn yields, experimenters developed a hybrid corn plant and then tested it under standard field conditions against standard varieties.

11. DEFN

12. Which of the following examples are absolute experiments? comparative experiments?

(a) The effects of fluoridated vs. non-fluoridated water in relation to adolescent tooth decay were studied.

(b) Amount of time spent studying was investigated in relation to cumulative gpa.

(c) Corn yields were studied for plots fertilized with either chemical or natural fertilizers.

13. (a) The selection of treatments for a given experiment is known as (treatment/experiment) design.

(b) The arrangement of treatments for a given experiment is known as (treatment/experiment) design.

14. (a) The smallest unit to which a treatment is applied is an (experimental/observational) unit.

(b) The smallest unit on which a record or measurement is made is an (experimental/observational) unit.

15. Identify the experimental and observational units, and treatments in each of the following examples:

(a) Beef cattle were fed grain coated with vitamin supplements. Upon slaughter, a gross body weight was obtained for each carcass.

(b) Rats were injected with chemical neurotoxins. Following 2 months of injections, their brains were removed, sectioned and then investigated for tissue deterioration.

(c) Fertilizer with 20% more net phosphorous was applied to a 100 meter square plot, while standard fertilizer was applied to an identical plot. Corn plants were grown on both plots. Following harvest, individual kernels were examined to determine if increased phosphorous increased kernel size.

16. DEFN

17. Consider the following description of a problem and its solution. Note that each sentence is to be associated with only one step but that zero to several sentences may be associated with a given step.

1. Suppose that a peculiar new disease breaks out on a university campus.
2. The disease is largely confined to graduate students and the main symptom is the occurrence of fits of uncontrollable laughter.
3. Suppose further that you have been given the assignment of finding the cause of this bizarre affliction so that it can be brought under control.
4. You decide that your first step would be to determine what characteristic or activity the afflicted students have in common.
5. This is a large university so that you could not possibly do a thorough-going case study for all students.
6. In order to cut some corners, you decide to select a random sample of students who show the peculiar symptom and a random sample of students who do not.
7. You set up some broad hypotheses, based upon your knowledge and past experience, to explain, tentatively, what might be causing the compulsive laughter.
8. You remember reading stories about laughing gas and can't help noting certain similarities between the behavior of the people in these stories and the behavior of the afflicted graduate students.
9. You set up a broad hypothesis along lines of "The afflicted students are breathing something that is producing the uncontrollable laughter."
10. You decide to use this tentative hypothesis to determine what characteristics or activities are relevant to your problem.
11. Also, you note that afflicted students appear to have a characteristic in common – they are taking classes from Professor R. E. Tort.
12. Tort himself has also been a victim of occasional laughing spells, you discover.

13. You are not certain that Professor Tort or his experiments are related to the affliction; the students and Tort might have other things in common as well.
14. Still, you conclude that you have an idea worth pursuing.
15. You say to yourself, "If I can demonstrate that all those students with the affliction are enrolled in Professor Tort's chemistry classes and that they have nothing else in common, I can conclude that there is something about these particular chemistry classes that is related to the laughing sickness."
16. You take a random sample of 50 graduate students who are not taking Professor Tort's chemistry course and 50 who are currently enrolled.
17. During the conduct of your survey, you check each of the 100 students for number of "fits of uncontrollable laughter" both before and after attending chemistry lectures and chemistry labs.
18. From the results of the survey, you find that one of the 50 not enrolled showed these symptoms while 49 out of 50 of those enrolled in the laboratory sections had the symptoms.
19. Furthermore, you checked class rolls and found that the one student not showing the symptoms was not attending the laboratory.
20. You also find that Professor Tort is making laughing gas to earn extra income, and that some of it is escaping into the laboratory where the students work.
21. You write your findings in a letter to your boss.

Steps in the conduct of an investigation

1. A clear and precise statement of problem.
2. Formulation of hypotheses.
3. Evaluation of problem and hypotheses.
4. Design of the investigation.
5. Calibration and standardization of measuring instruments.
6. Conduct of the investigation.
7. Summarization and interpretation.
8. Final report.

From the above list, complete questions 1 to 21.

1.	Sentence 1 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
2.	Sentence 2 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
3.	Sentence 3 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
4.	Sentence 4 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
5.	Sentence 5 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
6.	Sentence 6 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
7.	Sentence 7 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
8.	Sentence 8 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
9.	Sentence 9 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
10.	Sentence 10 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
11.	Sentence 11 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
12.	Sentence 12 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
13.	Sentence 13 refers to step number	(a) 1	(b) 2	(c) 3	(d) 4	(e) 5
14.	Sentence 14 refers to step number	(a) 3	(b) 4	(c) 5	(d) 6	(e) 7
15.	Sentence 15 refers to step number	(a) 3	(b) 4	(c) 5	(d) 6	(e) 7
16.	Sentence 16 refers to step number	(a) 3	(b) 4	(c) 5	(d) 6	(e) 7
17.	Sentence 17 refers to step number	(a) 3	(b) 4	(c) 5	(d) 6	(e) 7
18.	Sentence 18 refers to step number	(a) 3	(b) 4	(c) 5	(d) 6	(e) 7
19.	Sentence 19 refers to step number	(a) 4	(b) 5	(c) 6	(d) 7	(e) 8
20.	Sentence 20 refers to step number	(a) 4	(b) 5	(c) 6	(d) 7	(e) 8
21.	Sentence 21 refers to step number	(a) 4	(b) 5	(c) 6	(d) 7	(e) 8

18. List the principles of scientific investigation which are associated with each of the steps of data collection.

Steps of data collection	Principles of scientific investigation
1. Why collect data?	a. clear statement of problem
2. What data are to be collected?	b. formulation of hypotheses
	c. critical analysis of problem
3. How are data to be collected?	d. design of investigation
4. Where/when are data to be collected?	e. calibration and standardization
	f. conduct of investigation
5. Who is to collect data?	g. summarization and interpretation
6. Description of collected data.	h. written report
7. Disposal of data.	
8. Conclusions.	

Survey and Survey Design

1. (a) The smallest unit used in obtaining a sample survey is a(n)

   1. observational unit 2. smallest unit 3. sampling unit

   4. experimental unit 5. probability element

   (b) A list of every sampling unit in a given universe is a(n)

   1. descriptive list 2. sampling frame 3. probability sample

   4. experimental list 5. census

2. Identify the sampling unit, observational unit, and sampling frame in each of the following examples:

   (a) A medical study is undertaken to determine glucose blood levels of overweight individuals. A list of members of a local weightwatchers is obtained and selected individuals are requested to denote a blood sample.

(b) A study is undertaken to determine the psychological stress of school on Cornell students. A list of students living in dormitories is obtained, and a sample of students selected for psychological testing.

3. DEFN

4. DEFN

5. The following is a description of a survey that was conducted in New York in Fall, 1952. The sentences are numbered and you are to select appropriate sentences for each of the 13 steps in a survey as listed below. Note that some of the choices are groups of sentences and that ALL sentences in a group must pertain to that step if it is the correct choice. Some sentences may apply to more than one step.

   1. A study begins with an idea.
   2. The New York State Agricultural Mobilization Committee was confronted with the problem of reviewing how well farm policies and programs were serving New York farm families and of obtaining farmers' ideas on the various programs.
   3. It had been suggested that this be done through county meetings.
   4. The Committee questioned the value of this procedure because attendance would most likely not represent a cross-section of farmers.
   5. Also, it would be difficult to review programs and have sufficient time for a discussion of the problems and programs.
   6. They decided that a study was needed to obtain farmers' opinions and that this should be done through personal interviews with the farmer.
   7. The general objective of the study, "to find what farmers think about farm policies and programs", was divided into several specific objectives.
   8. From these specific objectives, specific questions were devised to meet these objectives.

9. The questions were tried with farmers (not in the final sample) to see whether they were understandable and unbiased; that is, whether the questions gave a farmer the opportunity to say what he actually did or thought without having the answer suggested.
10. Certain parts of the preliminary questionnaire were deleted because of the length of interview required.
11. It was decided to include those individuals who received 50% or more of their income from farming in all agricultural counties of New York.
12. Maps for the 56 agricultural counties of the State were available and each county had been subdivided into groups of 5 farms each, as per the above definition.
13. A simple random sample of these groups was obtained in each county and the proportion of units selected was constant; i.e., larger counties had a larger number of groups of 5 farms selected.
14. County agricultural agents and teachers of agriculture, after appropriate instruction, obtained the interviews from individual farmers.
15. Ten regional training sessions were held over the State; the leader would interview an agent and then the agents interviewed each other; then the agents held similar meetings in each county for the vocational teachers.
16. A single farm in the group of 5 was selected, and if this individual received 50% or more of his income from farming, he was interviewed.
17. If not, the interviewer went to the next individual on his list until two farmers had been interviewed.
18. The completed questionnaires were sent to Cornell, where they were summarized.
19. The answers to questions were punched on IBM cards for statistical computations and printed summary tables.

20. The findings of the survey were reported to the Committee, were released to the press, and were published in Cornell Extension Bulletin 864 for the people of the State.

21. Some of the findings of the study were:

(a) farmers felt the need to participate in decisions about, and local control of, farm programs;

(b) farm programs should be reviewed, through surveys such as this one;

(c) opinions were influenced by whether or not they had participated in a program;

(d) farmers were confused by the number and size of agencies;

(e) farmers approved of most programs, but opposed price supports and production adjustment;

(f) a significant change in acceptance of some newer ideas and programs was revealed; and

(g) education appeared to influence opinions more than size of farm business.

Steps in the survey	Sentence Numbers
1. Definition of population or universe to be surveyed.	a) none b) 1-2 c) 3-4 d) 5-6 e) 7-10
2. Definition of sampling frame - list or description of individuals in a population.	a) none b) 1 c) 2 d) 3 e) 11
3. Definition of information sought in precise terms.	a) none b) 1 c) 2 d) 3-6 e) 7-8
4. Determination of whether or not information sought is already available.	a) none b) 1 c) 2 d) 3 e) 6-10
5. Procurement of pertinent information only.	a) none b) 1-2 c) 3 d) 4-6 e) 7-8
6. Determination of sample size, observational unit, sampling unit, group of sampling units - stratum.	a) none b) 1-3 c) 4-6 d) 7-11 e) 12

Steps in the survey	Sentence Numbers				
7. Sample survey design.	a) none	b) 3,4,12,13	c) 6	d) 9	e) 14
8. Construction of questionnaire or reporting form.	a) none	b) 5	c) 6	d) 7	e) 8-10
9. Training of interviewers, recording of answers.	a) none	b) 11	c) 12	d) 13	e) 14-15
10. Determination of what to do with "not-at-homes", "refusal-to-answer", "unable-to-answer", etc.	a) none	b) 2	c) 3	d) 4-5	e) 6-8
11. Conduct the survey.	a) none	b) 13	c) 14	d) 15	e) 16-18
12. Summarize and interpret results.	a) none	b) 16	c) 17	d) 20	e) 18,19,21
13. Written report.	a) none	b) 16	c) 17	d) 18,19	e) 20

6. DEFN

7. Identify each of the following as a specific type of non-probability survey design.

   (a) Joe Gerboni wishes to prove strong opposition exists to cuts in state aid to education, so he interviews 20 superintendents of schools that will lose state funding.

   (b) George Bagodonuts has a deadline to meet for an opinion survey, so he invites some friends over for pizza and beer, and has them fill out questionnaires.

   (c) Joe Gerboni claims to be an expert on roller derby, and therefore justifies his selection of retired clergymen as the correct sample to poll on the sport's popularity.

   (d) George Bagodonuts wants to obtain a public opinion survey on fast food chains, so he drives along Route 13 in Ithaca and conducts his survey at every other convenience restaurant.

8. DEFN

9. DEFN

10. DEFN

11. DEFN

12. DEFN

13. Identify each of the following examples as a specific type of probability survey design.

    (a) All N elements of a population are given an equal and independent chance of being chosen for a sample of size n.

    (b) All N elements of a population are divided into k subpopulations. From each of these subpopulations a sample of size n is selected, with each element of the subpopulation having an equal and independent chance of selection.

    (c) All N elements of a population are divided into k subpopulations. k/2 of these subpopulations are randomly selected, and from these samples of size n are selected, with each element of a selected subpopulation having an equal and independent chance of being chosen.

    (d) A town is divided into k districts of equal size, from which k/2 districts are selected. A total of n households from each selected district are chosen, with each household in the district having an equal and independent chance of selection.

    (e) Every k^{th} individual on a listing of magazine subscribers is selected after a random start.

14. See 2 above.

15. Identify the strata and type of allocation represented in each of the following examples.

    (a) A survey is to be taken in the communities of Ithaca, Cortland and Auburn. Since the ratio of populations of the three communities is 3:2:1, the sample of 120 home owners will contain 60 home owners from Ithaca, 40 from Cortland, and 20 from Auburn.

(b) A second survey is taken in the same three communities, but 40 home owners are selected from each community.

(c) A survey is to be taken of college students in Ithaca. It is decided to poll 1600 of the 16,000 students at Cornell and 200 of the 2,000 students at Ithaca College.

(d) A survey is to be taken of on-campus residents at East Podunk University. A sample of 800 students is selected; 200 students coming from each of the university's 4 dormitories

Response Equations

1. DEFN
2. DEFN
3. DEFN
4. DEFN
5. DEFN
6. DEFN

Random Allotment

Using the random digit table (p. 368 in Statistics and Society):

1. Obtain a random ordering of the numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.
2. Obtain a random ordering of the numbers 0, 1, 2, 3, ···, 16, 17, 18, 19.
3. Describe the procedure used to obtain the above random orderings.

SOLUTIONS

Measurement

3. (a) assignable

   (b) non-assignable

   (c) 2.

   (d) assignable

   (e) 1, 3, 4, 5

6. 1. low accuracy 2. low accuracy

   3. low accuracy 4. high accuracy

   (See Statistics and Society, p. 24, for correct representations.)

Data Collection

4. (a) I (b) VI (c) II (d) I

Principles of Scientific Investigation

6. (a) inductive

   (b) deductive

   (c) inductive

   (d) deductive

10. (a) fertilizer with 20% more organic nutrients.

    (b) 400 mg. tablets of pure caffeine.

    (c) hybrid corn plants, standard corn plants (control).

12. (a) comparative

    (b) absolute

    (c) comparative

13. (a) treatment

    (b) experiment

14. (a) experimental

    (b) observational

15.

	(a)	(b)	(c)
experimental unit	individual cattle	individual rat	100 meter square plots
observational unit	individual carcass	brain section	corn kernel
treatment	coated grain	chemical neurotoxins	fertilizer with 20% more P standard fert.

17.

1.	a	6.	d	11.	c	16.	b	21.	e
2.	a	7.	b	12.	c	17.	d		
3.	d	8.	c	13.	c	18.	e		
4.	a	9.	b	14.	a	19.	d		
5.	d	10.	c	15.	a	20.	d		

18.

1.	a,b,c	5.	d,f
2.	d,f	6.	d,f,h
3.	d,e,f	7.	h
4.	d	8.	g

Survey and Survey Design

1. (a) 3 (b) 2

2. (a) sampling frame = list of weightwatchers

   sampling unit = individual weightwatchers

   observational unit = blood sample

   (b) sampling frame = list of students living in dorms

   sampling unit = individual student

   observational unit = individual student

5.

1.	b	6.	e	11.	e				
2.	e	7.	b	12.	e				
3.	e	8.	e	13.	e				
4.	a	9.	e						
5.	d	10.	a						

7. (a) purposely biased design

   (b) convenience design

   (c) judgment design

   (d) haphazard design and/or purposely biased design

13. (a) simple random sample (srs)

   (b) stratified - srs

   (c) cluster - srs

   (d) area - srs

   (e) every k^{th} item after a random start

15. (a) strata = 3 communities; proportional allocation

   (b) strata = 3 communities; equal allocation

   (c) strata = student bodies of 2 colleges; proportional allocation

   (d) strata = 4 dormitories; equal allocation

Random Allotment

1. 3, 5, 8, 2, 7, 0, 4, 9, 1, 6

2. 17, 13, 2, 7, 15, 8, 9, 16, 12, 14, 19, 0, 4, 10, 18, 3, 1, 5, 11, 6

3. random order 1:

   read down column 1, ignoring repetitions of previously recorded numbers

   random order 2:

   using columns 1&2, 3&4, 5&6 to generate 2-digit random numbers; divide the generated number by 20; take the remainders as the elements in the random ordering; ignore repetitions of previously recorded elements.

   Ex.: 37 ÷ 20 = 1 rem 17 → 17

   53 ÷ 20 = 2 rem 13 → 13

   82 ÷ 20 = 4 rem 2 → 2

   etc.