Answers to Random Sampling   
**Answers Explained, Multiple-Choice**

1. **(E)** This study is not an experiment in which responses are being

compared. It is an observational study in which the airlines use split fare

calculations from a trial period as a sample to indicate the pattern of all

split fare transactions. They claim that this leads to “huge savings.”

2. **(D)** I and II can be considered part of the definitions of *experiment*

and *observational study.* A sample survey does not impose any treatment;

it simply counts a certain outcome, and so it is an observational study, not

an experiment.  
  
3(A) In an experiment a control group is the untreated group picked by

the researchers. It is usually best when the selection process involves

chance.

4. **(B)** The first study was observational because the subjects were not

chosen for treatment.  
  
5. **(E)** In a simple random sample, every possible group of the given

size has to be equally likely to be selected, and this is not true here. For

example, with this procedure it will be impossible for all the early

arrivals to be together in the final sample. This procedure is an example

of systematic sampling, but systematic sampling does not result in simple

random samples.

6. **(B)** Different samples give different sample statistics, all of which

are estimates of a population parameter. Sampling error relates to natural

variation between samples, can never be eliminated, can be described

using probability, and is generally smaller if the sample size is larger.

7. **(B)** The *Wall Street Journal* survey has strong selection bias; that is,

people who read the *Journal* are not very representative of the general

population. The talk show survey results in a *voluntary response sample*,

which typically gives too much emphasis to persons with strong opinions.

The police detective’s survey has strong response bias in that students

may not give truthful responses to a police detective about their illegal

drug use.

9. **(D)** This is not a simple random sample because all possible sets of

the required size do not have the same chance of being picked. For

example, a set of households all from just half the counties has no chance

of being picked to be the sample. Stratified samples are often easier and

less costly to obtain and also make comparative data available. In this

case responses can be compared among various counties. There is no

reason to assume that each county has heads of households with the same

characteristics and opinions as the state as a whole, so cluster sampling is

not appropriate. When conducting stratified sampling, proportional

sampling is used when one wants to take into account the different sizes of

the strata.

10. **(C)** It is most likely that the apartments at which the interviewer had

difficulty finding someone home were apartments with fewer students

living in them. Replacing these with other randomly picked apartments

most likely replaces smaller-occupancy apartments with larger-occupancy

ones.

11. **(E)** While the procedure does use some element of chance, all

possible groups of size 50 do not have the same chance of being picked,

and so the result is not a simple random sample. There is a very real

chance of selection bias. For example, a number of relatives with the

same name and similar long-distance calling patterns might be selected.

The typical methodology of a systematic sample involves picking every

*n*th member from the list, where *n* is roughly the population size divided

by the desired sample size.

12. **(A)** The natural variation in samples is called sampling error.

Embarrassing questions and resulting untruthful answers are an example

of response bias. Inaccuracies and mistakes due to human error are one of

the real concerns of researchers.

13. **(C)** Surveying people coming out of any church results in a very

unrepresentative sample of the adult population, especially given the

question under consideration. Using chance and obtaining a high response

rate will not change the selection bias and make this into a well-designed

survey.

**Answers Explained, Free-Response**

1. (a) Both studies were observational because no treatments were applied.

(b) Typical cell phone use today, especially among younger people, is

well over half an hour, so half an hour does not seem to be a reasonable

split between moderate and heavy use.

(c) This absolutely affects conclusions in that both studies look for

relationships with brain cancer. While voice conversation involves

holding the phone against one’s head, text messaging does not.

(d) The Denmark study looks at how many years individuals used their

cell phones, but not at the extent of daily use, while the WHO study does

consider daily usage.

2. There are many possible examples, such as Are you in favor of protecting the

habitat of the spotted owl, which is almost extinct and desperately in need of

help from an environmentally conscious government? and Are you in favor of

protecting the habitat of the spotted owl no matter how much unemployment

and resulting poverty this causes among hard-working loggers?

3. (a) To be a simple random sample, every possible group of size 25 has to be

equally likely to be selected, and this is not true here. For example, if there

are 40 students who always rush to be first in line, this procedure will

allow for only 2 of them to be in the sample. Or if each homeroom of size

20 arrives as a unit, this procedure will allow for only 1 person from each

homeroom to be in the sample.

(b) A simple random sample of the students can be obtained by

numbering them from 001 to 500 and then picking three digits at a time

from a random number table, ignoring numbers over 500 and ignoring

repeats, until a group of 25 numbers is obtained. The students

corresponding to these 25 numbers will be a simple random sample.

4. The direct telephone and mailing options will both suffer from undercoverage

bias. For example, especially affected by the legislation under discussion are

the homeless, and they do not have telephones or mailing addresses. The

pollster interviews will result in a convenience sample, which can be highly

unrepresentative of the population. In this case, there might be a real question

concerning which members of her constituency spend any time in the

downtown area where her office is located. The radio appeal will lead to a

voluntary response sample, which typically gives too much emphasis to

persons with strong opinions.

5. In numbering the people 0 through 9, each digit stands for whose coat

someone receives. Pick the digits, omitting repeats, until a group of ten

different digits is obtained. Check for a match (1 appearing in the first

position corresponding to person 1, or 2 appearing in the next position

corresponding to person 2, and so on, up to 0 appearing in the last position

corresponding to person 10).

6. (a) To obtain an SRS, you might use a random number table and note the first

two different numbers between 1 and 5 that appear. Or you could use a

calculator to generate numbers between 1 and 5, again noting the first two

different numbers that result.

(b) Time and cost considerations would be the benefit of substitution.

However, substitution rather than returning to the same home later could

lead to selection bias because certain types of people are not and will not

be home at 9 a.m. With substitution the sample would no longer be a

simple random sample.

(c) Corner lot homes like homes 1 and 5 might have different residents

(perhaps with higher income levels) than other homes.

7. (a) Method A is an example of *cluster sampling,* where the population is

divided into heterogeneous groups called *clusters* and individuals from a

random sample of the clusters are surveyed. It is often more practical to

simply survey individuals from a random sample of clusters (in this case, a

random sample of city blocks) than to try to randomly sample a whole

population (in this case the entire city population).

(b) Method B is an example of *stratified sampling,* where the

population is divided into homogeneous groups called *strata* and random

individuals from each stratum are chosen. Stratified samples can often give

useful information about each stratum (in this case, about each of the five

neighborhoods) in addition to information about the whole population (the

city population).