The Islamic University of Gaza
Faculty of Commerce
Department of Economics and Political Sciences

An Introduction to Statistics Course (ECOE 1302)
Spring Semester 2011

Chapter 7 - Sampling and Sampling Distributions

Practice Exam - Solution

Instructors: Dr. Samir Safi   Mr. Ibrahim Abed

SECTION I: MULTIPLE-CHOICE

1. Sampling distributions describe the distribution of
   a) parameters.
   b) statistics.
   c) both parameters and statistics.
   d) neither parameters nor statistics.

2. The Central Limit Theorem is important in statistics because
   a) for a large n, it says the population is approximately normal.
   b) for any population, it says the sampling distribution of the sample mean is approximately normal, regardless of the sample size.
   c) for a large n, it says the sampling distribution of the sample mean is approximately normal, regardless of the shape of the population.
   d) for any sized sample, it says the sampling distribution of the sample mean is approximately normal.

3. Which of the following statements about the sampling distribution of the sample mean is **incorrect**?
   a) The sampling distribution of the sample mean is approximately normal whenever the sample size is sufficiently large ($n \geq 30$).
   b) The sampling distribution of the sample mean is generated by repeatedly taking samples of size n and computing the sample means.
   c) The mean of the sampling distribution of the sample mean is equal to μ.
   d) The standard deviation of the sampling distribution of the sample mean is equal to σ.

4. Which of the following is **true** about the sampling distribution of the sample mean?
   a) The mean of the sampling distribution is always μ.
   b) The standard deviation of the sampling distribution is always σ.
   c) The shape of the sampling distribution is always approximately normal.
   d) All of the above are true.

5. Sales prices of baseball cards from the 1960s are known to possess a skewed-right distribution with a mean sale price of $5.25 and a standard deviation of $2.80. Suppose a random sample of 100 cards from the 1960s is selected. Describe the sampling distribution for the sample mean sale price of the selected cards.
    a) Skewed-right with a mean of $5.25 and a standard error of $2.80
    b) **Normal with a mean of $5.25 and a standard error of $0.28**
    c) Skewed-right with a mean of $5.25 and a standard error of $0.28
    d) Normal with a mean of $5.25 and a standard error of $2.80

6. For sample size 16, the sampling distribution of the mean will be approximately normally distributed
    a) regardless of the shape of the population.
    b) **if the shape of the population is symmetrical.**
    c) if the sample standard deviation is known.
    d) if the sample is normally distributed.

7. For sample sizes greater than 30, the sampling distribution of the mean will be approximately normally distributed
    a) **regardless of the shape of the population.**
    b) only if the shape of the population is symmetrical.
    c) only if the standard deviation of the samples are known.
    d) only if the population is normally distributed.

8. Which of the following is NOT a reason for the need for sampling?
    a) It is usually too costly to study the whole population.
    b) It is usually too time consuming to look at the whole population.
    c) It is sometimes destructive to observe the entire population.
    d) **It is always more informative by investigating a sample than the entire population.**

9. A sample of 300 subscribers to a particular magazine is selected from a population frame of 9,000 subscribers. If, upon examining the data, it is determined that no subscriber had been selected in the sample more than once,
    a) the sample could not have been random.
    b) **the sample may have been selected without replacement or with replacement.**
    c) the sample had to have been selected with replacement.
    d) the sample had to have been selected without replacement.

10. A telemarketer set the company's computerized dialing system to contact every 25th person listed in the local telephone directory. What sampling method was used?
    a) Simple random sample
    b) **Systematic sample**
    c) Stratified sample
    d) Cluster sample

11. Which of the following sampling methods will more likely be susceptible to ethical violation when used to form conclusions about the entire population?
    a) Simple random sample
    b) Cluster sample

c) Systematic sample
d) **Convenient sample**

12. At a computer manufacturing company, the actual size of computer chips is normally distributed with a mean of 1 centimeter and a standard deviation of 0.1 centimeter. A random sample of 12 computer chips is taken. What is the standard error for the sample mean?
    a) **0.029**
    b) 0.050
    c) 0.091
    d) 0.120

SECTION II: TRUE OR FALSE

1. The amount of time it takes to complete an examination has a skewed-left distribution with a mean of 65 minutes and a standard deviation of 8 minutes. If 64 students were randomly sampled, the probability that the sample mean of the sampled students exceeds 71 minutes is approximately 0.
True

2. The Central Limit Theorem is considered powerful in statistics because it works for any population distribution provided the sample size is sufficiently large and the population mean and standard deviation are known.
True

3. As the sample size increases, the standard error of the mean increases.
False

4. If the population distribution is unknown, in most cases the sampling distribution of the mean can be approximated by the normal distribution if the samples contain at least 30 observations.
True

5. If the amount of gasoline purchased per car at a large service station has a population mean of $15 and a population standard deviation of $4 and it is assumed that the amount of gasoline purchased per car is symmetric, there is approximately a 68.26% chance that a random sample of 16 cars will have a sample mean between $14 and $16.
True

6. If the amount of gasoline purchased per car at a large service station has a population mean of $15 and a population standard deviation of $4 and a random sample of 64 cars is selected, there is approximately a 95.44% chance that the sample mean will be between $14 and $16.
True

7. Suppose $\mu = 50$ and $\sigma^2 = 100$ for a population. In a sample where $n = 100$ is randomly taken, 95% of all possible sample means will fall between 48.04 and 51.96.
True

8. The Central Limit Theorem ensures that the sampling distribution of the sample mean approaches normal as the sample size increases.
True

9. For distributions such as the normal distribution, the arithmetic mean is considered more stable from sample to sample than other measures of central tendency.
True

10. The amount of bleach a machine pours into bottles has a mean of 36 oz. with a standard deviation of 0.15 oz. Suppose we take a random sample of 36 bottles filled by this machine. The sampling distribution of the sample mean has a standard error of 0.15.
False

11. The mean of the sampling distribution of a sample proportion is the population proportion, π.

True

12. The standard error of the sampling distribution of a sample proportion is $\sqrt{\dfrac{p(1-p)}{n}}$

where p is the sample proportion.

False

13. A sample of size 25 provides a sample variance of 400. The standard error, in this case equal to 4, is best described as the estimate of the standard deviation of means calculated from samples of size 25.

True

SECTION III: FREE RESPONSE QUESTIONS

1. The average score of all pro golfers for a particular course has a mean of 70 and a standard deviation of 3.0. Suppose 36 golfers played the course today. Find the probability that the average score of the 36 golfers exceeded 71. **0.0228**

2. At a computer manufacturing company, the actual size of computer chips is normally distributed with a mean of 1 centimeter and a standard deviation of 0.1 centimeter. A random sample of 12 computer chips is taken.
   a. What is the probability that the sample mean will be between 0.99 and 1.01 centimeters? **0.2736 using Table E.2**
   b. What is the probability that the sample mean will be below 0.95 centimeters? **0.0418 using Table E.2**
   c. Above what value do 2.5% of the sample means fall? **1.057**

3. The amount of pyridoxine (in grams) per multiple vitamin is normally distributed with μ = 110 grams and σ = 25 grams. A sample of 25 vitamins is to be selected.
   a. What is the probability that the sample mean will be between 100 and 120 grams? **0.9544 using Table E.2**
   b. What is the probability that the sample mean will be less than 100 grams? **0.0228**
   c. What is the probability that the sample mean will be greater than 100 grams? **0.9772**
   d. So, 95% of all sample means will be greater than how many grams? **101.7757**
   e. So, the middle 70% of all sample means will fall between what two values? **104.8 and 115.2**

4. The amount of time required for an oil and filter change on an automobile is normally distributed with a mean of 45 minutes and a standard deviation of 10 minutes. A random sample of 16 cars is selected.
   a. What would you expect the standard error of the mean to be? **2.5 minutes**
   b. What is the probability that the sample mean is between 45 and 52 minutes? **0.4974**
   c. What is the probability that the sample mean will be between 39 and 48 minutes? **0.8767**

5. The amount of bleach a machine pours into bottles has a mean of 36 oz. with a standard deviation of 0.15 oz. Suppose we take a random sample of 36 bottles filled by this machine.
   a. The probability that the mean of the sample exceeds 36.01 oz. is _____. **0.3446**
   b. The probability that the mean of the sample is less than 36.03 is _____. **0.8849**
   c. The probability that the mean of the sample is between 35.94 and 36.06 oz. is _____.**0.9836**
   d. The probability that the mean of the sample is between 35.95 and 35.98 oz. is _____.**0.1891**
   e. So, 95% of the sample means based on samples of size 36 will be between _____ and _____. **35.951 and 36.049 ounces**

6

6. To use the normal distribution to approximate the binomial distribution, we need _____ and _____ to be at least 5. $n\pi$ **and** $n(\pi - 1)$

7. T Assume that house prices in a neighborhood are normally distributed with standard deviation $20,000. A random sample of 16 observations is taken. What is the probability that the sample mean differs from the population mean by more than $5,000? **0.3174 using Table E.2**

TABLE (A)

Times spent studying by students in the week before final exams follow a normal distribution with standard deviation 8 hours. A random sample of 4 students was taken in order to estimate the mean study time for the population of all students.

a. Referring to Table (A), what is the probability that the sample mean exceeds the population mean by more than 2 hours? **0.3085**
b. Referring to Table (A), what is the probability that the sample mean is more than 3 hours below the population mean? **0.2266**
c. Referring to Table (A), what is the probability that the sample mean differs from the population mean by less than 2 hours? **0.3830 using Table E.2**
d. Referring to Table (A), what is the probability that the sample mean differs from the population mean by more than 3 hours? **0.4532 using Table E.2**

TABLE (B)

According to a survey, only 15% of customers who visited the web site of a major retail store made a purchase. Random samples of size 50 are selected.

a. Referring to Table (B), the average of all the sample proportions of customers who will make a purchase after visiting the web site is _____. **0.15 or 15%**
b. Referring to Table (B), the standard deviation of all the sample proportions of customers who will make a purchase after visiting the web site is _____. **0.05050**
c. Referring to Table (B), what proportion of the samples will have between 20% and 30% of customers who will make a purchase after visiting the web site? **0.1596**
d. Referring to Table (B), what proportion of the samples will have less than 15% of customers who will make a purchase after visiting the web site? **0.5**
e. Referring to Table (B), what is the probability that a random sample of 50 will have at least 30% of customers who will make a purchase after visiting the web site? **0.0015**
f. Referring to Table (B), 90% of the samples will have less than what percentage of customers who will make a purchase after visiting the web site? **21.47%**
g. Referring to Table (B), 90% of the samples will have more than what percentage of customers who will make a purchase after visiting the web site? **8.536 using Table E.2**

TABLE (C)

According to an article, 19% of the entire U.S. population have high-speed access to the Internet. Random samples of size 200 are selected from the U.S. population.

   a. Referring to Table (C), the population mean of all the sample proportions is _____. **19% or 0.19**
   b. Referring to Table (C), the standard error of all the sample proportions is _____. **0.0277**
   c. Referring to Table (C), among all the random samples of size 200, _____ % will have between 14% and 24% who have high-speed access to the Internet. **92.82 using Table E.2**
   d. Referring to Table (C), among all the random samples of size 200, _____ % will have between 9% and 29% who have high-speed access to the Internet. **99.97**
   e. Referring to Table (C), among all the random samples of size 200, _____ % will have more than 30% who have high-speed access to the Internet. **0.0000 or virtually zero**
   f. Referring to Table (C), among all the random samples of size 200, _____ % will have less than 20% who have high-speed access to the Internet. **64.06 using Table E.2**
   g. Referring to Table (C), among all the random samples of size 200, 90 % will have less than _____% who have high-speed access to the Internet. **22.55 using Table E.2**
   h. Referring to Table (C), among all the random samples of size 200, 90 % will have more than _____% who have high-speed access to the Internet. **15.45**