# Assignment 3 – Part 2 - Solution

**1. Due Date & Time: Tuesday, July 23th, 2013 by 23:59 hrs.**
**2. You MUST upload this part of the Assignment on MyStatLab in "pdf" format.**
**3. You MUST also attach the Printed/ Signed "Integrity Statement".**
**4. Use MiniTab if or Excel if you have to. However you should cut and paste your result and sufficient explanation.**
**5. You should provide detailed explanation for each of your solution. You must show your complete manual calculation if the question involves using formula or any kind of calculations.**
**6. This Assignment covers weeks 10-11 for chapters 3, 10.1 – 10.8.**

**Question 1.** Sampling distribution of the proportion (Show your calculation in detail)

A recent survey found that 42% of IT professionals monitor employees trying to access video stream of the NCAA Men's Basketball Tournament. A random sample of 75 IT professionals was selected. What is the probability that between 40% and 48% of this sample will monitor employees trying to access video stream of the NCAA Men's Basketball Tournament?

**Solution:**

$$n\pi = (75)(0.42) = 31.5 \geq 5$$

$$n(1-\pi) = (75)(1-0.42) = 43.5 \geq 5$$

$$\sigma_p = \sqrt{\frac{\pi(1-\pi)}{n}} = \sqrt{\frac{(0.42)(1-0.42)}{75}} = 0.0570$$

$$z_{0.48} = \frac{p-\pi}{\sigma_p} = \frac{0.48-0.42}{0.0570} = 1.05$$

$$z_{0.40} = \frac{p-\pi}{\sigma_p} = \frac{0.40-0.42}{0.0570} = -0.35$$

$$P(0.40 < p < 0.48) = P(-0.35 < z < 1.05) = 0.8531 - 0.3632 = 0.4899$$

**Question 2.** (Show your calculation in detail)

Franklin Township has 730 registered Democrats residing in the voting district. According to the voting records, 37% participated in the last local election. A random sample of 180 registered Democrats was selected. What is the probability that 54 or fewer of these individuals voted in the recent election?

*Hint : finite population correction factor for the proportion sampling distribution*

**Answer:**

$$\frac{n}{N} = \frac{180}{730} = 0.247 > 0.05 \rightarrow \text{Use the finite population correction factor.}$$

$$n\pi = (180)(0.37) = 66.6 \geq 5$$

$$n(1-\pi) = (180)(1-0.37) = 113.4 \geq 5$$

$$p = \frac{x}{n} = \frac{54}{180} = 0.30$$

$$\sigma_p = \sqrt{\frac{\pi(1-\pi)}{n}}\sqrt{\frac{N-n}{N-1}} = \sqrt{\frac{(0.37)(1-0.37)}{180}}\sqrt{\frac{730-180}{730-1}} = 0.0313$$

$$z_{0.30} = \frac{p-\pi}{\sigma_p} = \frac{0.30-0.37}{0.0313} = -2.24$$

$$P(p \leq 0.30) = P(z \leq -2.24) = 0.0125$$

**Question 3.** (Show the graph and interpret the result)

According to a Research Center, 83% of Canada adults are using the Internet in January 2012. To verify this percentage, a random sample of 150 adults was selected of which 137 use the Internet.

Determine the interval that contains 95% of the sample proportions from this sampling distribution and conclude whether or not this sample supports the findings of the Research Center.

*Hint : sampling distribution of the proportion, testing a claim*

**Solution :**

$$n\pi = (150)(0.83) = 124.5 \geq 5$$
$$n(1-\pi) = (150)(1-0.83) = 25.5 \geq 5$$
$$\sigma_p = \sqrt{\frac{\pi(1-\pi)}{n}} = \sqrt{\frac{(0.83)(1-0.83)}{150}} = 0.0307$$
$$p_U = \pi + z\sigma_p$$
$$p_U = 0.83 + (1.96)(0.0307) = 0.890$$
$$p_L = \pi - z\sigma_p$$
$$p_L = 0.83 - (1.96)(0.0307) = 0.770$$
$$p = \frac{x}{n} = \frac{137}{150} = 0.913$$

Because the sample proportion does not fall with this interval, the sample does not support the findings of Pew Research Center.

**Question 4.** Sampling distribution of the mean, Central limit theorem

According to the Bureau of Transportation Statistics, the average round-trip domestic airfare was \$362 in 2011. Assume that the standard deviation for domestic airfare in 2011 was \$88. A random sample of 60 round-trip airfares from 2011 was selected. What is the probability that the average airfare from this sample is between \$340 and \$355?

**Answer :**

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{\$88}{\sqrt{60}} = \$11.35$$

$$z_{355} = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{\$355 - \$362}{\$11.35} = -0.62$$

$$z_{340} = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{\$340 - \$362}{\$11.35} = -1.94$$

$$P\left(\$340 < \bar{x} < \$355\right) = P\left(-1.94 < z < -0.62\right) = 0.2676 - 0.0262 = 0.2414$$

**Question 5.**

According to College Board, the average out-of-state tuition for a four-year public college was \$20,770 for the 2011-2012 academic year. There are a total of 629 four-year public institutions in the Country. Assume that the standard deviation for the tuition for these colleges is \$2,100. A random sample of 55 four-year public colleges was selected. What is the probability that the average tuition from this sample is less than \$21,000?

*Hint : finite population correction factor for sampling distribution of the mean*

**Solution:**

$$\frac{n}{N} = \frac{55}{629} = 0.087 > 0.05 \rightarrow \text{Use the finite population correction factor.}$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}\sqrt{\frac{N-n}{N-1}} = \frac{\$2,100}{\sqrt{55}}\sqrt{\frac{629-55}{629-1}} = (\$283.02)(0.9561) = \$270.60$$

$$z_{21,000} = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{\$21,000 - \$20,770}{\$270.60} = 0.85$$

$$P\left(\bar{x} < \$21,000\right) = P\left(z < 0.85\right) = 0.8023$$

**Question 5.** Central Limit Theorem, testing a claim

According to a report by Capital Economics, the average monthly mortgage payment in Ottawa in 2011 was $1,002. Assume that the standard deviation for monthly mortgage payments in Ottawa is $168. To confirm these results, a random sample of 55 homeowners in Ottawa was selected and found to have an average monthly mortgage payment of $1,030. Do the results of this survey support the report by Capital Economics?

**Solution:**

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{\$168}{\sqrt{55}} = \$22.64$$

$$\bar{x}_U = \mu_{\bar{x}} + z\sigma_{\bar{x}}$$

$$\bar{x}_U = \$1,002 + (1.96)(\$22.64) = \$1,046.37$$

$$\bar{x}_L = \mu_{\bar{x}} - z\sigma_{\bar{x}}$$

$$\bar{x}_L = \$1,002 - (1.96)(\$22.64) = \$957.63$$

Because 1,030 is between these limits, the results of this survey do support the report by Capital Economics.

**Question 6.**

It is generally believed that electrical problems affect about 14% of new cars. An automobile mechanic conducts diagnostic tests on 128 new cars on the lot.

a) Describe the sampling distribution for the sample proportion by naming the model and telling its mean and standard deviation.

b) What is the probability that in this group over 18% of the new cars will be found to have electrical problems?

**Answer :**

a. We can assume these cars are a representative sample of all new cars, and certainly less than 10% of them. We expect 14% × 128 = 17.92 successes (electrical problems) and 86% × 128 = 110.08 failures (no problems) so the sample is large enough to use the sampling model N(0.14, 0.031).

b. $z = \dfrac{\hat{p} - p}{SD(\hat{p})}$ , about 10%

**Question 7.**

Suppose that it is believed that 40% of adults have a company pension. If 100 adults are surveyed,

a) What is the probability of finding a sample with less than 30 adults having a company pension?

b) What is the probability of finding no more than 45 adults having a company pension?

**Answer :**

a ) $z = \dfrac{\hat{p} - p}{SD(\hat{p})}$ $SD(\hat{p}) = \sqrt{\dfrac{pq}{n}} = \sqrt{\dfrac{(0.4)(0.6)}{100}} = 0.048989$

$P(x < 0.30) = p(z < \dfrac{(0.30 - 0.40)}{0.048989} = -2.04) = 0.5 - 0.4793 = 2.07\%$

b) $z = \dfrac{\hat{p} - p}{SD(\hat{p})}$ $p(x<.45) = p(z < \dfrac{(0.45 - 0.40)}{0.048989} = 1.02) = 0.5 + 0.3461 = 84.61\%$

**Question 8.**

Deanna has been hired to visit the local shopping mall to conduct a survey about the upcoming political election. She needs to select respondents at the mall and ask them questions about their voting tendencies. Deanna decides to position herself by the only entrance to the mall and select every $10^{th}$ shopper entering the mall to participate. Which of the following sampling techniques best describes Deanna's method?

A) cluster
B) probability
C) simple random
D) systematic

**Answer:** D

**Question 9.**

John is the manager at a fast food restaurant and would like to determine the average number of cars waiting for their order in the drive-through line during his hours of operation. Every day at noontime, he counts the number of cars in the drive-through. Because of the lunchtime traffic, his survey overestimates the actual average throughout the day. This error is due to

A) sampling error.
B) nonsampling error.
C) nonprobability error.
D) periodicity.

**Answer:** D

**Question 10.**

Susan would like to conduct a survey of homeowners in the Meadowbrook neighborhood to get their opinions on proposed road modifications in the area. Which of the following is an example of a cluster sample?

A) Susan randomly chooses two streets in the neighborhood and selects every home on these streets.
B) Susan selects the first 20 homes that she passes as she walks into the entrance of the neighborhood.
C) Susan selects every third house on each street in the neighborhood.
D) None of these choices describes a cluster sample.

**Answer:** A

**Question 11.**

Susan would like to conduct a survey of homeowners in the Meadowbrook neighborhood to get their opinions on proposed road modifications in the area. Which of the following is an example of a stratified sample?

A) Susan randomly chooses two streets in the neighborhood and selects every home on these streets.
B) Susan selects the first 20 homes that she passes as she walks into the entrance of the neighborhood.
C) Susan selects every third house on each street in the neighborhood.
D) Susan ensures that her sample contains a number of two-story, split-level, and ranch homes in her sample that corresponds to the number of homes in the neighborhood.

**Answer:** D

**Question 12.**

Consider the following population which represents the years of teaching experience of the 24 full-time business faculty at Wesley College.

| | | | | | |
|---|---|---|---|---|---|
| 3 | 8 | 2 | 8 | 11 | 7 |
| 4 | 12 | 9 | 9 | 4 | 8 |
| 3 | 4 | 10 | 11 | 5 | 3 |
| 7 | 8 | 4 | 15 | 8 | 5 |

Using the first row of data as a sample, the sampling error is ________.

A) -1.20
B) 0.80
C) -0.50
D) 1.40

**Answer:** C