Week 06 Quiz: Normal Confidence Intervals

Problem 1

A researcher is interested in estimating the mean blood alcohol content (BAC) of people arrested for driving under the influence. The sample consists of 250 individuals with a mean BAC of .145. Based on past data, the researcher assumes a population standard deviation of .065. What's the margin of error for a 90% confidence interval in this scenario?(Use Z since pop SD is known)

a) .0041
b) .0068
c) .107
d) .0080
e) Not enough information to compute the margin of error

Answer: B) $E = Z_{0.1/2}\, 0.065/\sqrt{250} = 1.645 \times \frac{0.065}{15.8} = 0.006767$

Problem 2.
A teacher administers a standardized math test to his class of 75 students. The mean score (out of 300 possible points) is 235. From previous studies, you know the population standard deviation is 28. Using the sample data given, calculate a 95% confidence interval for the population mean.

a) (234.1, 235.9)
b) (226.7, 243.3)
c) (228.7, 241.3)
d) (233.0, 237.0)
e) (200.0, 300.0)

Answer: C). This is based on the central limit theorem. $s_{\bar{X}} = 4/\sqrt{200}$=0.283, $\bar{X} \sim N(235, 0.283)$

Problem 3

A random sample of n = 600 measurements is drawn from a binomial population with probability of success .08. What is the sampling distribution of the sample proportion, $\hat{p}$.

A) N(.08; .011)
B) N(.92; .003)
C) N(.08; .003)
D) N(.92; .011)

Answer: A) $s_{\hat{p}} = \sqrt{0.08(1 - 0.08)/600} = 0.0111$

Problem 4

A publishing company is studying the sales of various franchises in their chain of stores. They draw a random sample of 75 stores in the chain and measure the average daily sales. They find that $\bar{x}$ = \$ 5670 and s = \$ 1750 . Calculate a 90% confidence interval for the sales of their stores, the mean daily sales.

a. ($2791.3 , $8548.8)
b. ($5337.6 , $6002.4)
c. ($5149.5 , $6190.5)
d. ($5410.9 , $5929.1)
e. ($3920.0 , $7420.0)

Answer: B) $s_X = \frac{1750}{\sqrt{75}} = 202.07$, the margin of error $E = Z_{(1-\frac{0.1}{2})} \times 202.07 = 1.645 \times 202.07 = 332.41$, the 90% CI: $(5670 - 332.41, 5670 + 332.41) = (5337.595, 6002.405)$

Problem 5

An insurance company checks records for 582 randomly selected accidents and notes that teenagers were at the wheel in 91 of them. When constructing a 95% confidence interval for the proportion of all auto accidents involving teenage drivers, what is the margin of error?

a. 0.0295
b. 0.0247
c. 0.0193
d. 0.0012
e. 0.0746

Answer: A) $\hat{p} = \frac{91}{582} = 0.156$. $Z_{0.975} = 1.96$. The margin of error is $E = 1.96 \times \sqrt{0.156(1 - 0.156)/582} \approx 0.0295$

Problem 6

You are told that a random sample of 150 people from Iowa has been given cholesterol tests, and 60 of these people had levels over the "safe" count of 200. Construct a 95% confidence interval for the population proportion of people in Iowa with cholesterol levels over 200.

A). $\hat{p} \pm 0.95\sqrt{\hat{p}(1-\hat{p})/150}, \hat{p} = \frac{60}{150} = 0.4$

B). $\hat{p} \pm 0.975\sqrt{\hat{p}(1-\hat{p})/150}, \hat{p} = \frac{60}{150} = 0.4$

C). $\hat{p} \pm 1.96\sqrt{\hat{p}(1-\hat{p})/150}, \hat{p} = \frac{60}{150} = 0.4$

D). $\hat{p} \pm 1.645\sqrt{\hat{p}(1-\hat{p})/150}, \hat{p} = \frac{60}{150} = 0.4$

Answer: C)

Problem 7

A range of values within which the population parameter is expected to occur is called:

(a) Confidence coefficient
(b) Confidence interval
(c) Confidence limits
(d) Level of significance

Answer: B)

Problem 8

A 95% confidence interval for the mean of a population is such that:

(a) It contains 95% of the values in the population
(b) There is a 95% chance that it contains all the values in the population.
(c) There is a 95% chance that it contains the mean of the population
(d) There is a 95% chance that it contains the standard deviation of the population

Answer: C)

Problem 9
If the population standard deviation σ is known and the sample size n is more than 30, the 95% confidence interval for the population mean μ is

A). $\bar{X} \pm Z_{0.975} \frac{s}{\sqrt{n}}$

B). $\bar{X} \pm Z_{0.95} \frac{s}{\sqrt{n}}$

C). $\bar{X} \pm Z_{0.975} \frac{\sigma}{\sqrt{n}}$

D). $\bar{X} \pm Z_{0.95} \frac{\sigma}{\sqrt{n}}$

Answer: C).

Problem 10
The average number of miles driven per day by a sample of 90 truckers was 540, with a standard deviation of 40 miles. What is the 99% confidence interval for the true mean number of miles driven by all truckers?

A. (496.2, 525.7)
B. (529.1, 550.9)
C. (563.4, 589.3)
D. (289.4, 325.6)

Answer: B).   The margin of error is $E = Z_{0.995} \frac{40}{\sqrt{90}} = 2.575 \times \frac{40}{9.487} = 10.86$
The 99% confidence interval is $(540 - 10.86, 540 + 10.86) = (529.14, 550.86)$

Problem 11
Using a 95% confidence level, find a confidence interval for estimating the true mean weight (μ) of all packages received by the parcel service given that a sample of 31 packages had a mean weight of 13.2 lb. and the standard deviation of all packages is s = 2.4 lbs.

A. 12.2lb<μ<14.2lb.
B. 12.4lb<μ<14.0lb.
C. 12.1lb<μ<14.3lb.
D. 12.5lb<μ<13.9lb.

Answer B) The margin of error is $E = Z_{0.975} \frac{2.4}{\sqrt{31}} = 1.96 \times \frac{2.4}{5.568} = 0.845$
The 95% confidence interval is $(13.2 - 0.845, 13.2 + 0.845) = (12.355, 14.05)$

Problem 12

A random sample of n = 600 measurements is drawn from a population with sample proportion .08. What is the margin of error of the 95% confidence interval for p?

A). 0.058
B). 0.217
C). 0.022
D). 0.0182

Answer C). $\sigma_{\hat{p}} = \sqrt{0.08(1-0.08)/600} \approx 0.01107. E = 1.96 \times \sigma_{\hat{p}} = 0.0217$

Problem 13

A random sample of n = 300 measurements is drawn from a population with sample proportion $\hat{p} = 0.43$. Which of the following is the correct 95% confidence interval of p?

A). $\hat{p} \pm 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{300}}$

B). $\hat{p} \pm 1.96\frac{\sqrt{\hat{p}(1-\hat{p})}}{300}$

C). $\hat{p} \pm 0.95\frac{\sqrt{\hat{p}(1-\hat{p})}}{300}$

D). $\hat{p} \pm 0.95\sqrt{\frac{\hat{p}(1-\hat{p})}{300}}$

Answer A).

Problem 14

Which of the following factors will NOT affect the width of a confidence interval?

(a) Sample size.
(b) Confidence level.
(c) Population standard deviation.
(d) Sample mean.

Answer: D)

Problem 15

The margin of error in a confidence interval represents:

(a) The distance from the sample mean to the upper limit of the interval.
(b) The standard deviation of the sample.
(c) The difference between the sample mean and the population mean.
(d) The probability that the population mean falls within the interval.

Answer: A