ECON 0150 | Fall 2024 | Homework 6 Solutions

Question 1

The quality control department tests whether average defects = 300 with sample $n = 900$, $\mu = 295$, $S = 60$. Given:

$$\sigma_{\bar{x}} = \sigma/\sqrt{n} = 60/\sqrt{900} = 2 \tag{1}$$

the test statistic is:

$$Z = (\bar{x} - \mu)/\sigma_{\bar{x}} = (295 - 300)/2 = -2.5 \tag{2}$$

Since $1 < 2 < |Z| < 3$, we can reject H_0 with 68% and 95% confidence, but not 99.7%.

Answer: C) Both I and II

Question 2

With $n = 700$, $\mu = 295$, $S = 70$:

$$Z = (295 - 300)/(70/\sqrt{700}) = -1.89 \tag{3}$$

a) Since $1 < |Z| < 2$, we can only reject H_0 at significance level 0.32 (corresponding to 68% confidence).
Answer: A) I only

b) With $|Z| = 1.89$:

- Can reject at 68% confidence ($|Z| > 1$)
- Cannot reject at 97.5% confidence ($|Z| < 2$)

  Answer: A) I only

c) Cannot reject at confidence levels above 68% since $|Z| < 2$.

Answer: D) Neither I nor II

Question 3

Testing $H_0 : \mu = 30$ vs $H_a : \mu \neq 30$

- n = 250, $\bar{x} = 29.55$, S = 5
- $Z = (29.55 - 30)/(5/\sqrt{250}) = -1.42$
- p-value = $2P(Z < -1.42) = 0.156 > \alpha = 0.1$

Therefore, fail to reject H_0 at $\alpha = 0.1$

Answer: C) Do not reject H_0

Question 4

95% CI is ($2,181,260, $5,836,180)
Since $3,000,000 falls within this interval, we cannot conclude the mean exceeds $3,000,000 with 95% confidence.

Answer: D) I cannot conclude that the mean exceeds $3,000,000 at the 95% confidence level

Question 5

a) Null hypothesis (H_0): $\mu = 120$
Alternative hypothesis (H_a): $\mu \neq 120$

b) From data:

- n = 100
- $\bar{x} = 121$
- s = 6.323
- $\sigma_{\bar{x}} = 6.323/\sqrt{100} = 0.632$

Test statistic: $Z = (121 - 120)/0.632 = 1.582$

c) No, cannot reject at 95% confidence since $|Z| = 1.582 < 2$

d) p-value = $2P(Z > 1.582) = 0.114$. We can find this value using python. Examples in the notebook on the Part 3 page.

e) We can reject H_0 at confidence levels below 88.6%. Since p-value = 0.114:

- Significance level $\alpha > 0.114$
- Confidence level = $1 - \alpha < 0.886$ or 88.6%