

# Student Information

Name : SOLUTION

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## Answer 1

a)

$\sigma = 2.7$ ,  $\bar{X} = 8.68$  and  $\alpha = 0.05$ . Using these, we can calculate the asked confidence interval as follows:

$$\bar{X} \pm (z_{\alpha/2}) * (\frac{\sigma}{\sqrt{n}}) \approx \mathbf{8.68 \pm 1.76}$$

b)

$\Delta = 1.25$ ,  $\sigma = 2.7$  and  $\alpha = 0.05$ . For desired  $\Delta$  we use:

$$n \geq (\frac{z_{\alpha/2}\sigma}{\Delta})^2$$

We get  $n \approx \mathbf{17.92}$ . Hence, the smallest sample size is **18**.

## Answer 2

a)

For Leyla's claim (increase): Alternative hypothesis:  $H_1: \mu > 20,000$  TL

For Mecnun's claim (no change): Null hypothesis:  $H_0: \mu = 20,000$  TL

b)

We will conduct a one-sample z-test since we have the population standard deviation and the sample size is sufficiently large ( $n = 50$ ). At a 5% level of significance ( $\alpha = 0.05$ ), the critical z-value for a one-tailed test is approximately 1.645.

Calculating z:

$$z = \frac{22,000 - 20,000}{\frac{3,000}{\sqrt{50}}} \approx \mathbf{4.714}$$

Since  $\mathbf{4.714} > \mathbf{1.645}$ , we reject the null hypothesis. Thus, we have sufficient evidence to reject Mecnun's claim, indicating that the average monthly revenue has changed compared to last year.

c)

In this case, the calculated p-value is practically **0** ( $p < 0.0001$ ). This low p-value indicates strong evidence against the null hypothesis and provides very strong support for rejecting Mecnun's claim.

d)

Null hypothesis:  $H_0$ : The average monthly revenue of their store is not higher than that of the competitor's store ( $\mu_{l\&m} \leq \mu_c$ ).

Alternative hypothesis:  $H_1$ : The average monthly revenue of their store is higher than that of the competitor's store ( $\mu_{l\&m} > \mu_c$ ).

In this case, we will use a two-sample Z-test. At a 1% level of significance ( $\alpha = 0.01$ ),  $z_\alpha$ , for a one-sided hypothesis, is -2.326.

Calculating the z:

$$z = \frac{(22,000 - 24,000)}{\sqrt{\frac{3,000^2}{50} + \frac{4,000^2}{40}}}$$
$$\mathbf{z \approx -2.626}$$

Since **-2.626 < -2.326**, we **cannot reject the null hypothesis**. Thus, we don't have sufficient evidence to support the claim that the average monthly revenue of their store is now higher than that of the competitor's store.

## Answer 3

a)

$H_0$ : There is no association between gender and coffee preference.

$H_A$ : There is an association between gender and coffee preference.

There are 100 males and 100 females in survey, total 200 individuals.

$$\chi_{obs}^2 = \frac{(52 - 34.5)^2}{34.5} + \frac{(16 - 39.5)^2}{39.5} + \frac{(32 - 26)^2}{26} + \frac{(17 - 34.5)^2}{34.5} + \frac{(63 - 39.5)^2}{39.5} + \frac{(20 - 26)^2}{26}$$

$$\chi_{obs}^2 = 8.88 + 13.98 + 1.38 + 8.88 + 13.98 + 1.38 \approx \mathbf{48.48}$$

Next, we compare the calculated  $\chi^2$  value with the critical value from the chi-square distribution table with  $df = 2$  and significance level 0.05.

Since P-value < 0.001, we **reject** the null hypothesis. Therefore, we conclude that there is a significant association between gender and coffee preference.