UNIVERSITY OF KARACHI

Probability and Statistical Methods

BSCS-306

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Semester No: **2nd**

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ASSIGNMENT 08

HYPOTHESIS TESTING - 01

QUESTION : 01

DATA :-

$n = 100$

$\bar{x} = 29.8$

$s = 6.6 = \sigma$

$\alpha = 0.05 = 95\%$, $Z_{tab} = 1.96$

~~$\mu = 31.5$~~

$H_0 = \mu = 31.5$

$H_A = \mu \neq 31.5$

SOLUTION :-

$$Z_{cal} = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

$$= \frac{29.8 - 31.5}{6.6 / \sqrt{100}}$$

$$Z_{cal} = -2.57$$

$Z_{cal} < -Z_{tab}$, $Z_{cal} > Z_{tab}$

$-2.57 < -1.96$, $-2.57 > 1.96$

We'll reject H_0 in favour of H_A.

Hence proved that the average impg rating with the new engine is different then that of old engine.

QUESTION : 02

DATA :-

$H_0 = \mu = 77$. $\quad 1 - \alpha = 95\%$.

$H_A = \mu \neq 77$. $\quad Z_{tab} = 1.96$.

$n = 50$

$\bar{x} = 84$

$S = \sigma = 28$.

SOLUTION :-

$$Z_{cal} = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

$$= \frac{84 - 77}{28 / \sqrt{50}}.$$

$$Z_{cal} = 1.76 .$$

$Z_{tab} < Z_{tab}$, $\quad Z_{cal} > Z_{tab}$

$1.76 < -1.96$, $\quad 1.76 > 1.96$.

we will accept H_0 in favour of H_A. concluding there is no change in costomer satisfaction

QUESTION : 03

DATA :-

$H_0 = \mu = 4.3\% = 0.043$.

$H_0 = \mu \neq 4.3\% = 0.043$.

$n = 50$

$\bar{x} = 3.8\% = 0.038$

$\alpha = 0.05$, $Z_{tab} = 1.96$

$\sigma = 1.1\% = 0.011$

SOLUTION :-

$$Z_{cal} = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

$$= \frac{0.038 - 0.043}{0.11 / \sqrt{50}}$$

$$Z_{cal} = -3.2$$

$Z_{cal} < Z_{tab}$ $\quad$ $Z_{cal} > Z_{tab}$.

$-3.2 < -1.96$ $\quad$ $-3.2 > 1.96$.

We will reject H_0 in favour of H_a. Hence the analyst have to accept the claim made by magzine.

QUESTION : 04

DATA:-

H_0 : $\mu = 14.25$ $\alpha = 0.05$

H_A : $\mu \neq 14.25$

$n = 16$

$\bar{x} = 16.50$

$\sigma = 5.8$

SOLUTION:-

$$t_{cal} = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

$$= \frac{16.50 - 14.25}{5.8 / \sqrt{16}}$$

$$= 1.55$$

Now,

$$t_{(df-1,\ \alpha/2)} = t_{(15,\ 0.025)}$$

$$t_{tab} = 2.131$$

Since,

$t_{cal} < -t_{tab}$, $t_{cal} > t_{tab}$

$1.55 < -2.131$, $1.55 > 2.131$

Question : 05

DATA :-

H_0 : $\mu = 102.5$ hours

H_A : $\mu \neq 102.5$ hours.

$n = 25$

$\bar{x} = 107$ hours.

$\sigma = 10$ hours.

SOLUTION :-

$$t_{cal} = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

$$= \frac{107 - 102.5}{10 / \sqrt{25}}$$

$$t_{cal} = 2.25$$

Now,

$t_{(n-1, \alpha/2)}$

$t_1 (24, 0.025) = 2.064$

$t_2 (24, 0.005) = 2.797$

$t_{cal} < t_{tab}$, $t_{cal} > t_{tab}$

$2.25 < -2.064$ $2.25 > 2.064$

$t_{cal} < t_{2\text{-}tab}$, $t_{cal} > t_{tab}$

$2.25 < -2.797$ $\quad 2.25 > 2.797$.

we'll accept H_A at $\alpha = 0.05$.

QUESTION 06

DATA

$H_0 = \mu = 12.4\% = 0.124$

$H_a = \mu \neq 12.4\% = 0.124$

$n = 100$

$\bar{x} = 14.1\% = 0.141$

$\sigma = 2.6\% = 0.026$

$\alpha = 0.05$, $z = 1.96$

SOLUTION:-

$$z_{cal} = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

$$= \frac{0.141 - 0.124}{0.026 / \sqrt{100}}$$

$$= 6.538$$

$z_{cal} < z_{tab}$ $\quad$ $z_{cal} > z_{tab}$.

$6.538 < -1.96$ $\quad$ $6.538 > 1.96$

we will reject null hypothesis which is H_0

QUESTION : 07

DATA :-

$H_0 : p = 12\% = 0.12$, $q = 0.88$

$H_A : p \neq 12\% = 0.12$

$n = 100$

$x = 17$

$\alpha = 0.05$ $\quad Z_{tab} = 1.96$.

$\hat{P} = \frac{x}{n} = \frac{17}{100} = 0.17$

SOLUTION :-

$$Z_{cal} = \frac{\hat{P} - p}{\sqrt{Pq/n}}$$

$$Z_{cal} = \frac{0.17 - 0.12}{\sqrt{(0.12)(0.88)/100}} = 1.53$$

$Z_{cal} < Z_{tab}$ $\quad Z_{cal} > Z_{tab}$

$1.53 < -1.96$ $\quad 1.53 > 1.96$.

we will accept null hypothesis.

QUESTION : 08

DATA :-

$H_0 : \mu = 250$

$H_A : \mu \neq 250$

$n = 20$

$\bar{x} = 235$

$\sigma = 85$

$\alpha_1 = 0.05$ $\quad z_1 = 1.96$

$\alpha_2 = 0.01$ $\quad z_2 = 2.576$

SOLUTION :-

$$z_{cal} = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

$$= \frac{235 - 250}{85 / \sqrt{20}}$$

$$z_{cal} = -0.789$$

$z_{cal} < z_{1-tab}$ $\quad z_{cal} > z_{1tab}$.

$-0.789 < -1.96$. $\quad -0.789 > 1.96$.

We'll accept null hypothesis at $\alpha = 0.05$

$z_{cal} < z_{2-tab}$ $\quad z_{cal} > z_{2tab}$.

$-0.789 < -2.576$ $\quad -0.789 > -2.576$.

We'll accept null hypothesis at $\alpha = 0.01$

QUESTION : 09

DATA :-

$H_0 : P = 56\% = 0.56$. $q = 0.44$

$H_a : P \neq 56\% = 0.56$.

$n = 500$

$x = 298$

$\alpha = 0.01$, $Z_{tab} = 2.576$.

$\hat{P} = \frac{x}{n} = \frac{298}{500} = 0.596$

SOLUTION :-

$$Z_{cal} = \frac{\hat{P} - P}{\sqrt{PQ/n}}$$

$$= \frac{0.596 - 0.56}{\sqrt{(0.56)(0.44)/500}}$$

$Z_{cal.} = 1.62$.

$Z_{cal} < Z_{tab}$, $Z_{cal} > Z_{tab}$.

$1.62 < -2.576$ $1.62 > 2.576$

Since test statistic is not in rejection region so we'll accept null hypothesis (H_0).

QUESTION : 10

DATA :-

$n = 41$

$\alpha = 0.01$

$H_0 : P = 7\% = 0.07$, $q = 0.93$

$H_A : P < 0.07$

$x = 4$ (only 4 individuals save above 7%)

$\hat{P} = \frac{x}{n} = 0.0975$.

SOLUTION :-

$$Z_{cal} = \frac{\hat{P} - P}{\sqrt{Pq/n}}$$

$$= \frac{0.097 - 0.07}{\sqrt{(0.07)(0.93)/41}}$$

$$Z_{cal} = 0.69$$

Z_{tab} according to one tail = 2.236.

Now,

$Z_{cal} < -Z_{tab}$

$0.69 < -2.236$.

We can't reject null hypothesis H_0.

There isn't enough evidence to show that the individuals save less than 7%.

QUESTION : 11

DATA:-

$n = 24$

$\bar{x} = 0.12$

$S = \sigma = 0.2$

$\alpha = 0.05$

$H_0 : \mu = 0$

$H_A : \mu > 0 \quad$ or $\quad \mu < 0$

SOLUTION:-

$$t_{cal} = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

$$t_{cal} = \frac{0.12 - 0}{0.2 / \sqrt{24}}$$

$$t_{cal} = 2.93$$

Now, $t_{tab} = t_{(23, 0.025)}$

$= 2.069$

Since,

$t_{cal} < t_{-tab}$, $t_{cal} > t_{tab}$

$2.93 < -2.069$ $2.93 > 2.069$

We will reject H_0 in favour of H_A i.e $t_{cal} > t_{tab}$. Stocks in this industry group earn above the market average at a certain time period.

QUESTION : 12

DATA :-

$P = 0.5$

$n = 100$

$\hat{P} = 0.58$

$\alpha = 0.05$ $\qquad Z_{tab} = 1.964$

$H_0 : P = 0.50$

$H_A : P > 0.50$

SOLUTION :-

$$Z_{cal} = \frac{\hat{P} - P}{\sqrt{PQ/n}}$$

$$Z_{cal} = \frac{0.58 - 0.5}{\sqrt{(0.5)(0.5)/100}} = 1.6$$

$Z_{cal} < Z_{-tab}$, $Z_{cal} > Z_{tab}$

$1.6 < -1.964$ $\qquad 1.6 > 1.964$

we can'not reject H_0 in favour of H_A.

QUESTION : 13

DATA :-

H_0 : $P = 0.1$ $\quad q = 0.9$

H_A : $P > 0.1$

$\alpha = 0.05$ $\quad Z_{tab} = 1.964$

$n = 100$

$x = 14$

$\hat{P} = \frac{x}{n} = \frac{14}{100} = 0.14$

SOLUTION :-

$$Z_{cal} = \frac{\hat{P} - P}{\sqrt{Pq/n}}$$

$$= \frac{0.14 - 0.1}{\sqrt{(0.1)(0.9)/100}}$$

$$Z_{cal} = 1.33$$

Since, $Z_{cal} < Z_{tab}$, $Z_{cal} > Z_{tab}$

$1.33 < -1.964$ $\quad 1.33 > 1.964$

Hence we'll accept H_0 in favour of H_A.

Question : 14

DATA :-

$n = 400$

$\alpha = 0.05$.

$H_0 : P = 0.30$

$H_A : P \neq 0.30$

$\hat{P} = 0.35$.

$Z_{tab} = 1.96$.

$q = 0.7$.

SOLUTION :-

$$Z_{cal} = \frac{\hat{P} - P}{\sqrt{PQ/n}}$$

$$= \frac{0.35 - 0.30}{\sqrt{(0.3)(0.7)/400}}$$

$$Z_{cal} = 2.18 .$$

$Z_{cal} < Z_{tab}$, $Z_{cal} > Z_{tab}$.

$2.18 < 1.96$ $2.18 > 1.96$

we will reject H_0 in favour of H_A .

QUESTION : 15

DATA :-

$n = 300$

$x = 18$

$\alpha = 0.05$ $\quad Z_{tab} = 1.964$

$H_0 : P = 0.03$ $\quad q = 0.97$

$H_A : P > 0.03$

$\hat{P} = \frac{x}{n} = \frac{18}{300} = 0.06$.

SOLUTION :-

$$Z_{cal} = \frac{\hat{P} - P}{\sqrt{pq/n}}$$

$$= \frac{0.06 - 0.03}{\sqrt{(0.03)(0.97)/300}}$$

$Z_{cal} = 3.04$

$Z_{cal} < Z_{tab}$, $Z_{cal} > Z_{tab}$

$3.04 < -1.964$ $\quad 3.04 > 1.964$

We will reject H_0 in favour of H_A.

Question : 16

DATA:-

$H_0 : \mu = 1600$

$H_A : \mu < 1600$

$\bar{x} = 1591.7$

$\sigma = 18.5$

$\alpha = 0.05$ $\quad Z_{tab} = 1.964$

$n = 35$

SOLUTION:-

$$Z_{cal} = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

$$= \frac{1591.7 - 1600}{18.5 / \sqrt{35}}$$

$$Z_{cal} = -2.65$$

$Z_{cal} < -Z_{tab}$ $\qquad$ $Z_{cal} > Z_{tab}$

$-2.65 < -1.964$ $\qquad$ $-2.65 > 1.964$

we will reject H_0 in favour of H_A.

(a) Consumer agency can conclude that the pet food company is underfalling packages for one of its brands. The president of company could prefer to use a lower level of significance which will reduces the probability for rejection of H_0: