Department of Statistics

Class: FY M.Sc (Data Science) **Subject: Statistics**

Practical : V) Testing of hypothesis **Date:**

Q.1 In 64 randomly selected hours of production , the mea and standard deviation of acceptable pieces produced by an automatic stamping machine are 1038 & 146 resp. At 5% level of significance can one reject the null hypothesis that population mean is 1000?

Q.2 The following data shows the distribution of digits in the numbers chosen at random form the telephone directory.

Digit	Frequency	Digit	Frequency
0	1026	5	933
1	1107	6	1107
2	997	7	972
3	966	8	964
4	1075	9	853

Q.3. A random sample of size 1000 of school children from rural areas shows the average height to be 150 cm and a s.d of 45.2 cm.
A similar of 800 students form urban schools has average height 146 cm with s.d of 37.3 cm. Can we conclude that students in rural areas are taller than students in urban areas?

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Page No
Date

(38)

Practical - 05

Q.1) →

$H_0 = \mu = 1000$

$n = 64$

$\bar{x} = 1038$

$SD = \sigma = 146$

$\alpha = 0.05$

$$z = \frac{\bar{x} - \mu_0}{SD/\sqrt{n}}$$

$$= \frac{1038 - 1000}{146/\sqrt{64}}$$

$$= \frac{38}{18.25}$$

$Z_{cal} = 2.0822$

$|Z_\alpha| = 1.96$

$\therefore$ ~~$Z_\alpha \rightarrow$~~

$\therefore Z_\alpha < Z_{cal}$

H_0 rejected

The hypothesis that population mean is 1000 is rejected.

Q.2) → Sol^n:

H_0 : The digit may be taken to occur equally frequently in the directory

H_1 : the digit may not be taken to occur equally frequently in the directory

Digit	Oi	Ei	Oi^2/Ei
0	1026	1000	1052.6
1	1107	1000	1225.4
2	997	1000	994
3	966	1000	933.1
4	1075	1000	1117.2
5	933	1000	870.4
6	1107	1000	1225.4
7	972	1000	944.7
8	964	1000	929.2
9	853	1000	727.6
	10.000		9.992~~6~~

Q.3) → Let $H_0 = \mu_1 = \mu_2$

$H_1 = \mu_1 > \mu_2$

Given = $n_1 = 1000$, $n_2 = 800$

$\overline{x}_1 = 150$ cm, $\overline{x}_2 = 146$ cm

$\sigma_1 = 45.2$ cm, $\sigma_2 = 37.3$ cm

α = 5% level of significance = 0.05

$$z = \frac{\overline{x}_1 - \overline{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

$$= \frac{150 - 146}{\sqrt{\frac{(45.2)^2}{1000} + \frac{(37.3)^2}{800}}}$$

Page No
Date

$$= \frac{4}{\sqrt{3.78215}}$$

$$\therefore Z_{cal} = 2.0567$$

For $\alpha = 0.05$ critical value is

$Z_{\alpha} = 1.64$

Here $|Z_{cal}| > Z_{\alpha}$

i.e $2.0567 > 1.64$

Conclusion :

We reject H_0 at 5% level of significance

i.e :- Students in urban areas are taller than students in other areas.

Soln.

To Test the hypothesis:

H_0: The digits occur equally frequently against

H_1: The digits do not occur equally frequently

Under the assumption that H_0 is true the expected frequency for each digit would be

$$E_i = \frac{1}{10} \times 10000 = 1000$$

To test H_0 against H_1 we use the χ^2 - statistic given by

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

$$= \sum_{i=1}^{n} \frac{O_i^2}{E_i} - N$$

Where $N = \Sigma O_i = \Sigma E_i = 10000$

Digit	O_i	E_i	O_i^2 / E_i
0	1026	1000	1052.676
1	1107	1000	1225.449
2	997	1000	994.009
3	966	1000	933.156
4	1075	1000	1117.249
5	933	1000	870.489
6	1107	1000	1225.449
7	972	1000	944.784
8	964	1000	929.296
9	853	1000	727.609
Total	10000	10000	10020.166

$$\chi^2_{cal} = 10020.166 - 10000$$

$$= 20.166$$

$$\chi^2_{table} = \chi^2_{(9, 0.01)} = 21.666$$

$$\chi^2_{cal} = 20.166 < \chi^2_{table} = 21.666$$

We accept H_0 at 1% level of significance.