Statistics Assignment - 5

19 BCE 2105

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Q1. In a simple random sample of 600 men taken from a big city, 400 are found to be smokers. In another simple random sample of 900 men taken from another city, 450 are smokers. Do the data indicate that there is a significant difference in the habit of smoking in the 2 cities?

Sol^n

Manual Calc: we've:

$$P_1 = \frac{400}{600} = 0.67$$

$$P_2 = \frac{450}{900} = 0.5$$

$$P = \frac{P_1 n_1 + P_2 n_2}{n_1 + n_2} = \frac{400 + 450}{900 + 600} = 0.63$$

$$Z = \frac{P_1 - P_2}{\sqrt{PQ\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = \frac{0.07 - 0.5}{\sqrt{(0.63)(0.37)\left(\frac{1}{900} + \frac{1}{600}\right)}}$$

$$= \frac{0.17\sqrt{54000}}{(0.63)(0.37)\sqrt{1500}}$$

R-code:

```
> prop.test (c(400, 450), c(600, 900), alt = "greater")

2-sample test for equality of proportion with continuity correction.

data: c(400, 450) out of c(600, 900)
X-squared = 40.048, df = 1, p-value = 1.239e-10
alternative hypothesis : greater
95 percent confidence level :
0.1234019    1.0000000
sample estimates :
prop 1       prop 2
0.6666667    0.5000000
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Q2. The mean life of a sample of 400 fluorescent light bulbs produced by a company is found to be 1570 hours with a standard deviation of 150 hours. Test the hypothesis that the mean life time of the bulbs produced by the company is 1600 hours against the alternative hypothesis that it is greater than 1600 hours at 1% level of significance.

Sol^n:

Manual calc:

$\bar{x} = 1600$

$\sigma = 150$

$n = 400$

$\mu = 1570$

$$Z = \frac{(\bar{x} - \mu)}{\sigma/\sqrt{n}} = 4$$

at 1% significance level, $z = 2.58$

$\therefore Z_{calculate} > Z_{H_0}$

$\therefore H_0$ is rejected

R-console:

```
> xbar = 1570
> muo = 1600
> sigma = 150
> n = 500
> z = (xbar - muo) / (sigma * sqrt(n))

> z

> alpha = 0.01
> z.alpha = qnorm(1-alpha)
> z.alpha
```

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Q3. The life time of electric bulbs for a random sample of 10 from a large consignment gave the following data: Can we accept the hypothesis that the average life-time of bulbs is 4000 hours (with a significance level of 95%)?

Sol^n

R-console:

```
> a = c(4.2, 4.6, 3.9, 4.1, 5.2, 3.8, 4.3, 3.9, 4.4, 5.6)
> t.test(a, mu = 4, alt = "greater")
```

Q4. Two types of drugs were used on 5 & 7 patients for reducing their weight. Is there a significant difference in the efficacy of the two drugs? If not, which drug should you buy?

Sol^n:

Manual calc:

$H_0 \rightarrow \mu_1 = \mu_2$

$H_1 \rightarrow \mu_1 \neq \mu_2$

test statistics:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sigma\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$n_1 = 5$; $n_2 = 7$

$\bar{x}_1 = 12$; $\bar{x}_2 = 11$

$$S_1 = \sqrt{\frac{\Sigma x_1^2}{N} - \left(\frac{\Sigma x_1}{N}\right)^2}$$

$$= \sqrt{\frac{730}{5} - \left(\frac{60}{5}\right)^2}$$

$$= \sqrt{2}$$

$$S^2 = \frac{n_1(S_1)^2 + n_2(S_2)^2}{n_1 + n_2 - 2}$$

degree of freedom

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$$s^2 = \frac{5 \times (1.414)^2 + 7 \times (2.506)^2}{12 - 2}$$

$$S_2 = \sqrt{\frac{\Sigma x_2^2}{N} - \left(\frac{\Sigma x_2}{N}\right)^2}$$

$$= \sqrt{\frac{891}{7} - (11)^2}$$

$$= \sqrt{6.285}$$

$$= 2.506$$

$$s^2 = \frac{53.995}{10} = 5.3995$$

$$t_{cal} = \frac{12 - 11}{\sqrt{5.3995\left(\frac{1}{5} + \frac{1}{7}\right)}}$$

$$= \frac{1}{\sqrt{1.8512}} = 0.73$$

$\alpha = 5\%$ (to be taken)

$\Rightarrow \alpha = 0.05$

$t_{table} = 2.919$

$\because t_{cal} < t_{table}$

$\therefore$ H_0 accepted ; H_1 rejected.

R-console :

```
> x1 = c(10, 12, 13, 11, 14)
> x2 = c(8, 9, 12, 14, 15, 10, 9)
> t.test(x1, x2)
```

END

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