Assignment - 03

1.

Subject	1	2	3	4	5	6	7
Before	210	235	208	190	172	244	232
After	190	170	210	188	173	228	232.
D .	20	65	-2	2	-1	16	0

$\bar{D} = 14.285714$

$S_D = 24.018841$

a) 99% C.I for the mean difference.

$$\bar{D} \pm t_{n-1,\alpha/2} \cdot \frac{S_D}{\sqrt{n}}.$$

$$= 14.2857 \pm t_{6,0.005} \cdot \frac{24.0188}{\sqrt{7}}$$

$$= 14.2857 \pm 3.707 \times \frac{24.0188}{\sqrt{7}}$$

$$= (-19.3674, 47.9388)$$

b) Step 1.

$H_0 : \mu_D = 0$

$H_1 : \mu_D \neq 0$.

Step 2.

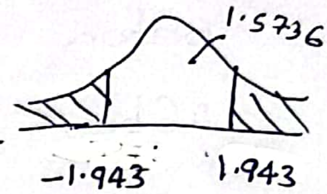
Test statistic $T = \dfrac{\bar{D} - \mu_D}{S_D/\sqrt{n}} = \dfrac{14.2857 - 0}{\frac{24.0188}{\sqrt{7}}}$

$= 1.5736$

Step 3.

Critical value $t_{n-1,\alpha/2} = t_{6,0.05} = 1.943$.

Step 4:



Test value falls in acceptance region. So we donot reject H_0.

Step 5:

We can conclude that the cholesterol has not been changed and the test is carried out with 10% level of significance.

2)

$$n = \frac{Z^2_{\alpha/2}\, p(1-p)}{E^2}.$$

$$= \frac{Z^2_{0.025}(0.5)(0.5)}{(0.03)^2}.$$

$$= \frac{(1.96)^2 \times (0.5)(0.5)}{(0.03)^2}.$$

$$= 1067.11$$

$= 1068$ programs.

3>

pop^n dist^n normal, pop^n variance unknown with equal variances.

Treated sheep.

$\bar{X}_T = 26.5833$

$S_T = 14.3619$

$n_T = 12$

Untreated sheep.

$\bar{X}_U = 39.6667$

$S_U = 13.8586$

$n_U = 12$

Step 1:

$H_0: \mu_T \geq \mu_U \qquad \mu_T - \mu_U \geq 0$

$H_1: \mu_T < \mu_U \qquad \mu_T - \mu_U < 0$ (left tail)

Step 2:

Test statistic

$$T = \frac{\bar{X}_T - \bar{X}_U - (\mu_T - \mu_U)}{S_p\sqrt{1/n_T + 1/n_U}}$$

$$= \frac{26.5833 - 39.6667 - 0}{14.1125\sqrt{1/12 + 1/12}}$$

$$= -\frac{13.0834}{5.7614}$$

$$= -2.2709$$

$$S_p = \sqrt{\frac{(n_T-1)S_T^2 + (n_U-1)S_U^2}{n_T+n_U-2}}$$

$$= \sqrt{\frac{11\times(14.3619)^2 + 11\times(13.8586)^2}{22}}$$

$$= \sqrt{\frac{4381.5746}{22}}$$

$$= \sqrt{199.1625}$$

$$= 14.1125$$

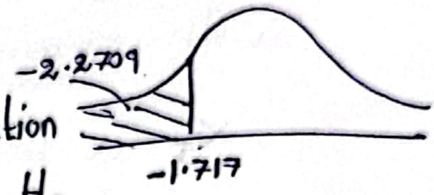
Step 3:

Critical value $t_{n_1+n_2-2,\alpha} = t_{22,0.05}$

$= 1.717$

Step 4.

Test value $= -2.2709 < -1.717$



Test value falls in the rejection region. So we can reject H_0.

Step 5:

So we can conclude that the mean number of tapeworms in the stomachs of the treated lambs is less than the mean for untreated lambs.

b) 95% C.I for $\mu_T - \mu_U$ assess the size of the difference in the two means.

$$\bar{x}_T - \bar{x}_U \pm t_{n_1+n_2-2,\, \alpha/2} \cdot S_p \sqrt{\frac{1}{n_T} + \frac{1}{n_U}}$$

$$= 26.5833 - 39.6667 \pm t_{22,\, 0.025} \times 14.1125 \sqrt{\frac{1}{12} + \frac{1}{12}}$$

$$= -13.0834 \pm 2.074 \times 14.1125 \sqrt{\frac{1}{6}}$$

$$= (-25.0362,\ -1.1342)$$

OR

$$(1.1342,\ 25.0362)$$

4)

$P_c = \frac{94}{125} = 0.75520$

$P_T = \frac{113}{175} = 0.6457$.

Step 1:

$H_0 : P_c \leq P_T$

$H_1 : P_c > P_T$

$\bar{p} = \frac{94+113}{125+175}$

$= \frac{207}{300}$

$= 0.69$

Step 2.

$$\text{Test statistic} = \frac{\hat{P}_c - \hat{P}_T - (P_c - P_T)}{\sqrt{\bar{p}(1-\bar{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$$

$$= \frac{(0.7520 - 0.6457) - 0}{\sqrt{0.69(1-0.69)\left(\frac{1}{125}+\frac{1}{175}\right)}}$$

$$= \frac{0.1063}{0.0542}$$

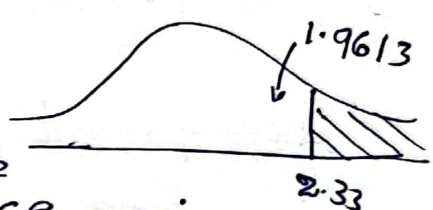
$$= 1.9613$$

Step 3.

Critical value $= Z_{0.01} = +2.33$.

Step 4:

Test value $1.9613 < 2.33$ Critical value



Test value falls on acceptance region.
So we donot reject H_0.

Step 5:

~~Inst~~ We can conclude that the instruction using the computer software is not appear to increase the proportion of students passing the examination in comparison to the pass rate using the the traditional method of instruction.

5) $\mu = 380$

$n = 12$

a) point estimate $\bar{x} = \frac{\sum x_i}{n} = \frac{4680}{12} = 390$.

5. $s = 8.3011$.

95% C.I for the mean no. of properly issued tickets.

$$\bar{x} \pm t_{n-1,\alpha/2} \cdot \frac{s}{\sqrt{n}}$$

$$= 390 \pm t_{11,0.025} \times \frac{8.3011}{\sqrt{12}}$$

$$= 390 \pm 2.201 \times \frac{8.3011}{\sqrt{12}}$$

$$= 390 \pm 5.2743$$

$$= (384.7257, 395.2743)$$

Interpretation:

b) Step 1.

$H_0 : \mu \leq 380.$

$H_1 : \mu > 380$ (Right tail)

Step 2.

Test statistic $T = \dfrac{\bar{x} - \mu}{s / \sqrt{n}}$

$$= \frac{390 - 380}{\frac{8.3011}{\sqrt{12}}}$$

$$= 4.1731$$

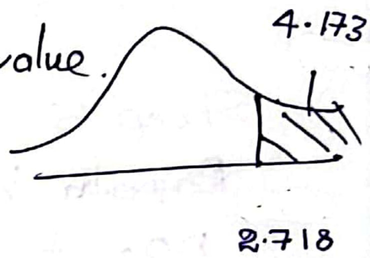
Step 3:

Critical value $t_{n-1, \alpha} = t_{11, 0.01} = 2.718.$

Step 4:

Test value = ~~4.1731~~ > 2.681 = Critical value.

Test value falls in rejection region. We can reject H_0.



Step 5:

We can conclude that the mean number of improperly issued tickets is greater than 380. the test is carried out at 1% significance level.

c) Step 1

$H_0 \ \sigma^2 \leq 35$

$H_1 : \sigma^2 > 35$ (Right tail)

Step 2.

Test statistic $= \dfrac{(n-1)s^2}{\sigma_0^2}$

$$= \frac{(12-1)(8.3011)^2}{35}$$

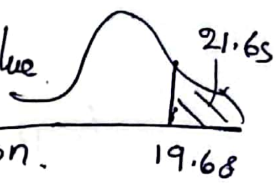
$$= 21.6569$$

Step 3:

Critical value $\chi^2_{\alpha, n-1} = \chi^2_{0.05, 11} = 19.68$

Step 4:

Test value $= 21.6569 \angle 19.68 =$ Critical value



Test value falls in rejection region.

So reject H_0.

Step 5

We can conclude that the variance no. of improperly issued tickets is greater than 35. the test is carried out at 5% significance level.

6)

$n = 36$

$S = 0.6$

Step 1.

$H_0 : \sigma \leq 0.58$

$H_1 : \sigma > 0.58$ (Right sided test)

Step 2:

Test statistic.

$$\chi^2 = \frac{(n-1)s^2}{\sigma_0^2}.$$

$$= \frac{(36-1)(0.6)^2}{(0.58)^2}$$

$$= 37.4554.$$

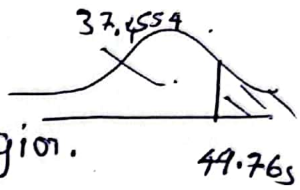
Step 3:

Critical value $= \chi^2_{n-1,\alpha} = \chi^2_{35,0.05}$

$$= \frac{43.77 + 55.76}{2}$$

$$= 49.765.$$

Step 4:



Test value $37.4554 < 49.765$

Test value falls in acceptance region.

$\therefore$ Do not reject H_0.

Step 5.

Pop^n standard deviation is not significantly higher than 0.58. and the test is carried out 5% level of significance.