Session 16 Additional exercise

1) Is there evidence to conclude that the number of people travelling from Banglore to Chennai is different from the number of ppl travelling from Banglore to Hosur in a week.

Pop 1

$n_1 = 1200$

$\bar{x}_1 = 452$

$s_1 = 212$

Pop 2

$n_2 = 800$

$\bar{x}_2 = 523$

$s_2 = 185$

$H_0 = \mu_1 = \mu_2$

$H_a = \mu_1 \neq \mu_2$

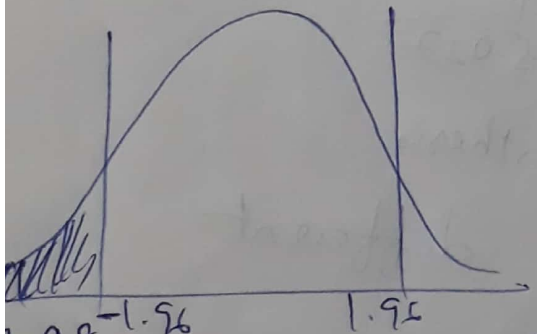
$$\sigma_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} = \sqrt{\frac{(212)^2}{1200} + \frac{(185)^2}{800}}$$

$$= \sqrt{37.45 + 42.78} = \sqrt{80.23} = 8.95$$

$$\text{Observed } z\text{value} = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sigma_{\bar{x}_1 - \bar{x}_2}}$$

$$= \frac{452 - 523}{8.95}$$

$$z = -7.93$$



@ 5%.

∴ we reject H_0.

∴ Number of ppl travelling are different in two routes.

(Q2) Sol

Duracell		Energizer
Pop 1	$H_0 = \mu_1 = \mu_2$	Pop 2
$n_1 = 100$	$H_a = \mu_1 \neq \mu_2$	$n_2 = 100$
$\bar{x}_1 = 308$		$\bar{x}_2 = 254$
$S_1 = 84$		$S_2 = 67$

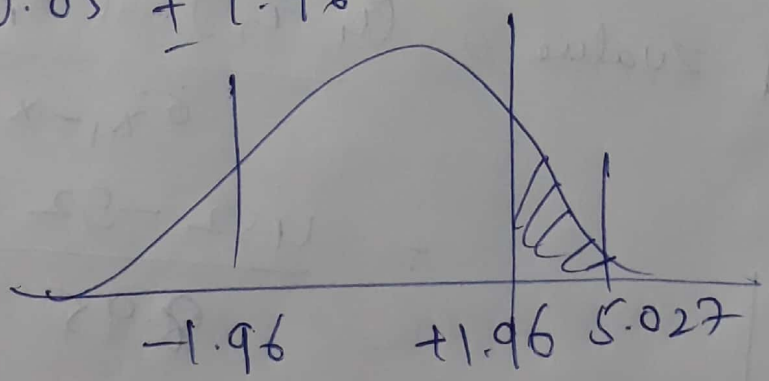
$$\sigma_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}} = \sqrt{\frac{84^2}{100} + \frac{67^2}{100}}$$

$$= \sqrt{70.56 + 44.89} = \sqrt{115.45} = 10.74$$

$$Z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sigma_{\bar{x}_1 - \bar{x}_2}} = \frac{(308 - 254) - 0}{10.74}$$

$$= 5.027$$

$\alpha = 0.05 \pm 1.96$



∴ we reject null hypothesis

∴ People preference is different

Q3 Sol:

Price of Sugar	Price of Syr.
μ_1 = Rs 27.50	μ_2 = Rs 20.00
$n_1 = 14$	$n_2 = 9$
$\bar{x}_1 = 0.317$	$\bar{x}_2 = 0.21$
$s_1 = 0.12$	$s_2 = 0.11$

$$s_p^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$$

$$= \frac{13 \times (0.12)^2 + 8 \times (0.11)^2}{14+9-2}$$

$$= \frac{0.1879 + 0.0968}{21} = \sqrt{0.0135^2}$$

$$= 0.1162$$

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

$$= 0.0135 \sqrt{\frac{1}{14} + \frac{1}{9}} = 0.1162 \sqrt{0.0714 + 0.1111}$$

$$= 0.1162 \sqrt{0.18251}$$

$$= 0.04$$

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sigma_{\bar{x}_1 - \bar{x}_2}}$$

$$= \frac{(0.317 - 0.21) - (27.50 - 20.00)}{0.04}$$

$$= \frac{0.107 - 7.50}{0.04} = \frac{7.393}{0.04}$$

$$= 184.825 > 1.96$$

We reject null hypothesis

(4)

Before reduction

$n_1 = 15$

$\bar{x}_1 = \text{Rs } 6598$

$s_1 = \text{Rs } 844$

After reduction

$n_2 = 12$

$\bar{x}_2 = 6870$

$s_2 = 669$

$H_0 : \mu_1 \leq \mu_2$

$H_1 : \mu_1 > \mu_2$

$$s_p = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}} = \sqrt{\frac{14 \times 844^2 + 11 \times 669^2}{15+12-2}}$$

$$= \sqrt{9972704 + 4923171}$$

$$= \sqrt{\frac{14895875}{25}} = 595835$$

$$t_2 \frac{(\bar{x}_1 - \bar{x}_2) - 0}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = \frac{6598 - 6870}{595835 \sqrt{\frac{1}{15} + \frac{1}{12}}}$$

$$= \frac{-272}{595835 \sqrt{0.066 + 0.0833}}$$

$$= 0.001181 < 2.08$$

$\therefore$ we fail to reject null hypothesis

$\therefore$ No enough evidence to see increase in price.

Q5

1980	1985
$n_1 = 1000$	$n_2 = 100$
$x_1 = 53$	$x_2 = 43$
$P_1 = 0.53$	$P_2 = 0.43$

$$\bar{P} = \frac{1000 \times 0.53 + 100 \times 0.43}{1000 + 100}$$

$$= \frac{530 + 43}{1100} = \frac{573}{1100}$$

$$0.52 = \bar{P}$$
$$0.48 = \bar{q}$$

$$\sigma_{P_1 - P_2} = \sqrt{\frac{\bar{P}\bar{q}}{n_1} + \frac{\bar{P}\bar{q}}{n_2}}$$

$$= \sqrt{\frac{0.52 \times 0.48}{1000} + \frac{0.52 \times 0.48}{100}}$$

$$= \sqrt{0.000249 + 0.00249}$$

$$= 0.052$$

$$Z = \frac{0.53 - 0.43}{0.052} = 1.923 < 1.96.$$

failed to reject null hypothesis.

Q6

With Sweepstakes	No Sweepstakes
$n_1 = 300$	$n_2 = 700$
$x_1 = 120$	$x_2 = 140$
$P_1 = 0.40$	$P_2 = 0.20$

H_0: $P_1 - P_2 \leq 10\%$

H_1: $P_1 - P_2 > 10\%$

$$\bar{P} = \frac{300 \times 0.40 + 700 \times 0.20}{1000} = \frac{120 + 140}{1000} = \frac{260}{1000}$$

$\bar{P} = 0.26$

$\bar{q} = 0.74$

$$\sigma = \sqrt{\frac{0.26 \times 0.74}{300} + \frac{0.26 \times 0.74}{700}}$$

$$= \sqrt{0.000641 + 0.0002748} = 0.03026$$

$$Z = \frac{(0.40 - 0.20) - (0.10)}{0.03026} = \frac{\quad}{3.304672}$$

at 1.1

$\therefore$ we reject null hypothesis.

A die is thrown 132 times with the follow

Q7 soln.

No	obs freq	Exp fre	(obs-exp)^2	$\frac{(fo-fe)^2}{fe}$
1	16	22	36	1.636
2	20	22	4	0.1818
3	25	22	9	0.40909
4	14	22	64	2.9090
5	29	22	49	2.227
6	28	22	36	1.636
	132		198	8.631

$Exp = \frac{132}{6} = 22$

$\chi^2 = \frac{\Sigma(f_o - f_e)^2}{f_e} = 8.631 < 11.07$

Significance 5% 11.07

fail to reject null hypothesis.

Q8 soln.

		Men 1	women 2	
voted	1	2792	3591	6383
Not voted	2	1486	2131	3617
		4278	5722	10000

R	C	fo	fe	$\frac{(fo-fe)^2}{fe}$
1	1	2792	2730.64	1.3784
1	2	3591	3652.35	2.4326
2	1	1486	1547.35	1.030607
2	2	2131	2069.64	1.8187336
				6.6604

Q10:

Age of child	photography A	B	C	
5-6	18	22	20	60
7-8	2	28	40	70
9-10	20	10	40	70
	40	60	100	200

Expected table

			$(O-E)^2/E$	
12	18	30	3	3.333
14	21	35	10.2857	0.714
14	21	35	2.5714	0.714
				4.76

∴ No significant relationship.

Q11

	Support	No. support	
Confirm	18	40	58
No confirm	32	10	42
	50	50	100

Expected table

29	29	110.25	3.801
21	21	110.25	5.25
			9.05

Q12 Obs

Short	tall	
12	32	44
22	14	36
9	6	15
43	52	95

Expected

19.915	24.0421	3.14	2.6
16.294	19.70	1.99	1.65
6.78	8.21	0.719	0.595

$\chi^2 = 10.712$

Q13

Married	Widowed	Never Married	
679	103	114	896
63	10	20	93
42	18	25	85
	131	159	1074
784			

Expected

654.063	109.2	132.64	0.361 2.62
67.81	11.34	13.76	0.159 2.8
62.04	10.36	6.477	5.61 12.2

$\chi^2 = 31.61 > 13.28$ at 4 df