Hypothesis Testing

1)

a) $H_0 = 25$, $H_1 : \neq 25$ → True

b) $H_0 : > 10$, $H_1 : = 10$ ⇒ false

c) $H_0 : = 0.1$, $H_1 : = 0.5$ ⇒ false

d) $H_0 : = 30$, $H_1 : \geq 30$ ⇒ false

e) $H_0 = 50$, $H_1 \neq 50$ → True

3) $H_0 = \mu = 34$

$H_1 = \mu \neq 34$

Significance Level = 1 %.

$\mu = 34$, $s = 8$, $n = 50$, $\bar{x} = 32.5$

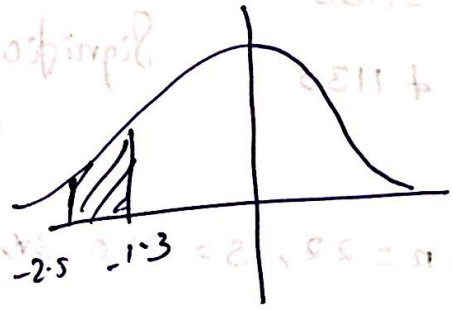
$\alpha = 0.01$

$$z = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{32.5 - 34}{8/\sqrt{50}} = -1.3$$

$P = 1 - (\text{area} - 1.33)$

$P = 1 + 1.33$

$P = 2.33$



Critical Value = ± 2.58

Computed Value of $z = -1.33$ falls in acceptance region

Accept Null hypothesis

2)

$H_0 = \mu = 52$ $\quad H_1 = \mu \neq 52$

$\sigma = 4.50$ $\quad$ Significance lev = 5%

$n = 100$ $\quad$ ie $\alpha = 0.05$

$\bar{x} = 52.80$

$$z = \frac{\mu - \bar{x}}{\sigma/\sqrt{n}} = \frac{52.80 - 52}{4.50/\sqrt{100}} = 1.77$$

$P = 1 - 0.9625$ $\quad$ Critical Value $= \pm 1.96$

$= 3.75$ $\quad$ $z = 1.78$ falls in Acceptance region,

$= 0.0375$

Accept Null hypothesis

The Mean Average Cost of book is 52/-

4) $H_0 = \mu = 1135$

$H_1 = \mu \neq 1135$ $\quad$ Significance level is 5%

$\alpha = 0.05$

$\mu = 1135$, $n = 22$, $S = 240.37$, $\bar{x} = 1031.32$

$$S = \sqrt{\frac{\Sigma (x - \bar{x})^2}{n-1}} = 240.37$$

$$z = \frac{\bar{x} - \mu}{S/\sqrt{n}} = \frac{1031.32 - 1135}{240.37/\sqrt{22}}$$

$= -2.02$

Critical Value of $z = \pm 1.96$

The value of $z = 2.57$ falls in rejection region

Reject Null hypothesis

Average Dental Expenses is not Accurate

5) $H_0 = \mu = 48,432$ ~~48,574~~

$H_1 = \mu \neq 48432$

$\sigma = 2000$

$n = 400$

$\bar{x} = 48,574$

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{48,574 - 48432}{2000/\sqrt{400}}$$

$$= 1.42$$

Critical Value = ± 1.645

Value of $z = 1.42$ falls in Acceptance Region

Accept Null Hypothesis

6) $n = 19$

$H_0 = \mu = 32.28$

$H_1 = \mu \neq 32.28$

$\sigma = 1.29$

$\bar{x} = 31.67$

$\alpha = 0.05$

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{31.67 - 32.28}{1.29/\sqrt{19}} = -2.1$$

Critical Value = ± 1.96

Value of $z = -2.1$ falls in rejection Region

Reject Null hypothesis

The average price is changed.

8) $n = 16$ $\quad t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$

$\mu = 10$

$\bar{x} = 12$ $\quad \frac{12-10}{1.5/\sqrt{16}}$ $\quad = 5.33$

$s = 1.5$

9) $\alpha = 0.01$ $\quad df = n - 1$

$n = 16$ $\quad df = 15$

$1 - \alpha = 0.99$

$\alpha = 0.01$

$t_{0.99} = -t_{0.01} = -2.602$

10) $n = 25$ $\quad \mu = 60$ $\quad s = 4$

$\alpha = 95\%$ $\quad df = n - 1$

$1 - 0.95 = 0.05$ $\quad = 25 - 1$

$\alpha = 0.05$ $\quad = 24$

~~$t_{0.05} < t < t_{0.10}$~~

$1 - (0.1 + 0.05)$

$= 0.85$

$t_{0.05} < t < t_{0.10}$

$s = 0.985$

1, Population 1 Bangalore to

$n_1 = 1200$
$x_1 = 452$
$s_1 = 212$

Population 2 Bangalore to Hosur

$n_2 = 800$
$x_2 = 523$
$s_2 = 185$

$$\frac{(\bar{x_1} - \bar{x_2}) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} = \frac{(452 - 523) - 0}{\sqrt{\frac{212^2}{1200} + \frac{185^2}{800}}}$$

$$= \frac{-71}{\sqrt{80.234}} = \frac{-71}{8.96} = -7.926$$

Pvalue - $P(x < -7.926) = 0$

H_0 is rejected at Any level

2, Population 1: Dupacel

$n_1 = 100$
$x_1 = 308$
$s_1 = 84$

Population 2: Energized

$n_2 = 100$
$x_2 = 254$
$s_2 = 67$

$H_0 = \mu_1 - \mu_2 \leq 45$

$H_1 = \mu_1 - \mu_2 > 45$

$$t = \frac{(308 - 254) - 45}{\sqrt{\frac{84^2}{100} + \frac{67^2}{100}}} = \frac{9}{\sqrt{11545}} = 0.838$$

$= 0.201$

3) Population 1:

Price of Sugar: Rs 27.50

$n_1 = 14$

$x_1 = 0.317\ \%$

$s_1 = 0.12\ \%$

Population 2:

Price of Sugar = Rs 20.00

$n_2 = 9$

$x_2 = 0.21\ \%$

$s_2 = 0.11\ \%$

$H_0 = \mu_1 - \mu_2 \leq 45$

$H_1 = \mu_1 - \mu_2 > 45$

$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$

$= \frac{0.107}{\sqrt{0.00249}} = 2.154$

$df = (n_1 + n_2 - 2)$

$= (14 + 9 - 2)$

$= 21$

$H_0 \quad \mu_1 - \mu_2 = 0$

$H_1 \quad \mu_1 - \mu_2 = 0$

4) Population

$n_1 = 15$
$x_1 = Rs\ 6598$
$s_1 = 844$

Population 2: After Reduction

$n_2 = 12$
$x_2 = 6870$
$s_2 = 669$

$H_0 = \mu_2 - \mu_1 \leq 0$
$H_1 = \mu_2 - \mu_1 > 0$

$df = (n_1 + n_2) - 2$
$(15+12) - 2$
$df = 25$

$$= \frac{6870 - 6598 - 0}{\sqrt{\frac{(15-1)844^2 + (12-1)669^2}{15+2-2}\left(\frac{1}{15} + \frac{1}{12}\right)}}$$

$$= \frac{272}{\sqrt{89375.25}} = 0.91$$

$t_{.} = t_{0.10} = 1.316$

H_0 is rejected at 10%.

5) Population 1: 1980

$n_1 = 1000$
$x_1 = 53$
$p = 0.53$

Population 2 = 1985

$n_2 = 100$
$x_2 = 43$
$p = 0.53$

$$p = \frac{x_1 + x_2}{n_1 + n_2} = \frac{53+43}{1000+100} = \frac{96}{1100} = 0.0872$$

$$z = \frac{(p_1 - p_2) - 0}{\sqrt{p(1-p)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = \frac{0.1}{\sqrt{0.0793 \times 0.01}} = 0.02816$$

$z_{0.05} = 1.645$

H_0 may not be rejected

6) Population 1: With Sweep stakes

$n_1 = 300$

$x_1 = 120$

$\hat{P}_1 = 0.40$

Population 2: No Sweep stakes

$n_2 = 700$

$x_2 = 140$

$\hat{P}_2 = 0.20$

$H_0 : P_1 - P_2 \leq 0.1$

$H_1 : P_1 - P_2 > 0.10$

$$Z = \frac{(P_1 - P_2) - 0}{\sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}}}$$

$$Z = \frac{(0.40 - 0.20) - 0.10}{\sqrt{\frac{(0.40)(0.60)}{300} + \left(\frac{0.20(0.80)}{700}\right)}}$$

$$= \frac{0.10}{0.03207} = 3.118$$

$Z_t = Z_{0.001} = 3.09$

H_0 is Accepted

7) Unbiased Die turns up $= \frac{132}{6} = 22$ times

Observed	Expected	$(O-E)^2$	$\frac{(O-E)^2}{E}$
16	22	36	1.64
20	22	4	0.18
25	22	9	0.41
14	22	64	2.91
29	22	49	2.23
28	22	36	1.64

$\sum \frac{(O-E)^2}{E} = 9.01$

$df = n - 1 = 6 - 1 = 5$

At 5% Significance $\chi^2 = 11.07$

$\chi_0^2 < \chi_e^2$ There is no evidence

nst hypothesis that die is biased

8. Sample Mean = 10,000

	Men	Women	Total
Voted	2792	3591	6383
Not Voted	1486	2131	3617
Observed	4278	5722	10000

$\frac{\Sigma(O-E)^2}{E} = 6.58$

$\chi_2 = 6.58$

from table 10% = 2.71

5% = 3.84

1% = 6.64

$3.84 < \chi_2 < 6.64$

$1\% < P\text{ value} < 5\%$

H_0 is Rejected

∴ Gender & Voting are dependent

9, Higgins Reagdon White Charlton

41 19 24 16

Chi Square = 14.90 with 3 df $\alpha < 0.05$

O	E	O-E	$(O-E)^2$	$(O-E)^2/E$
41	25	16	256	10.24
19	25	-6	36	1.44
24	25	-1	1	0.04
15	25	-9	81	3.24

$\frac{\Sigma(O-E)^2}{E} = 14.96$

df = n-1 = 3

χ_c^2 at 0.05 Level 3 df is 7.32

χ_c^2 is $> \chi_0^2$ 95% > 14.96 > 99%

Candidates are not Equally preferred

	5-6 years	18	22	20
	7-8 y	2	28	40
	9-10 y.	20	810	40

70
70
200

E = Row total x Colums / Grand total

O	E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
11	25	121	10.24
19	25	36	1.44
24	25	1	0.04
16	25	81	3.24

O	E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
18	22	16	3
22	19	9	0.89
20	30	100	0.333
2	14	144	10.29
23	35	49	2.33
40	14	25	0.17
20	21	36	2.571
10	35	121	3.46
40		25	0.71

χ^2 = 29.66

χ^2 13.46 at 0.001

df = 4

χ_0^2 is > χ_c^2

H_0 is Accepted

There is Significant relationship b/co child & photograph

11)

Conform	18	40	58
Not Conform	32	10	42
Total	50	50	100

df-1 = p < 0.05

Su	O	E	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
	18	29	-11	121	4.17
	40	29	11	121	4.17
	32	21	11	121	5.76
	10	21	11	121	5.76

$\chi^2 = 19.86$

$\epsilon = 19.86$.

There is a Significant diff blw Support & no Support Candidates.

12)

	Short	Tall	Total
Leader	12	32	44
Followers	22	14	36
Unclassifiable	9	6	15
Total	43	52	95

10.9 biggest χ^2 at 0.01

O	E	(O-E)	$(O-E)^2$	$\frac{(O-E)^2}{E}$
12	19.92	-7.92	62.72	3.148
32	24.08	7.92	62.72	2.60
22	16.29	5.71	32.6	2
14	19.74	-5.71	32.6	1.654
9	6.79	2.21	4.88	0.7220
6	8.21	-2.21	4.89	0.6

$\Sigma = 10.712$

13)

Employed	679	103	114	93
UnEmployed	63	10	20	85
Not in labor force	42	18	25	1074
	784	131	159	

O	E	(O-E)	$(O-E)^2$	$\frac{(O-E)^2}{E}$
679	654	25	625	0.95
103	109	-6	36	0.33
114	133	-19	361	2.71
63	68	-5	25	0.36
10	11	-1	1	0.10
20	14	6	36	2.57
42	62	-20	400	6.45
18	10	8	64	6.4
25	13	12	144	11.07

$$\chi^2 = 30.95$$

Chi Sq dist with.

$(3-1)(3-1)$

$2 \times 2 = 4$ df

Since $30.96 > 13.28$ Conclude $P < 1\%$ &

reat all confidence Marital status, seems

: be related to Job Status in toon