STAT ASSIGNMENT: 2

Q.22 H_0: Height & leadership qualities are independent

H_1: H_0 is false (They are dependent)

$df = (n_r - 1)(n_c - 1) = (3-1)(2-1) = 2$

	(S) Short	(T) Tall	Total
(L) Leader	12	32	44
(F) Follower	22	14	36
(U) Unclassifiable	9	6	15
Total	43	52	95

		O	E	$(O-E)^2/E$
L	S	12	44x43/95 = 19.92	3.15
L	T	32	44x52/95 = 24.08	2.64
F	S	22	36x43/95 = 16.29	2.00
F	T	14	36x52/95 = 19.70	1.66
U	S	9	15x43/95 = 6.79	0.54
U	T	6	15x52/95 = 8.21	0.59

$\chi^2_{stat} = 10.58$

$\chi^2_{crit}(df = 2, \alpha = 0.05) = 5.991$

Since $\chi^2_{stat} > \chi^2_{crit}$ $\boxed{\text{REJECT H0}}$

Q.23. H_0: Marital status and distribution of labor force status is independent

H_1: H_0 is false (They are dependent)

$df = (n_r - 1)(n_c - 1)$
$= (3-1)(3-1) = 4$

	M	W/D	NM	Total
E	679	103	114	896
UE	63	10	20	93
NILF	42	18	25	85
Total	784	131	159	1074

		O	E	$(O-E)^2/E$
E	M	679	$\frac{896 \times 784}{1074} = 654$	0.95
E	W/D	103	$\frac{896 \times 131}{1074} = 109.29$	0.36
E	NM	114	$\frac{896 \times 159}{1074} = 132.65$	2.62
UE	M	63	$\frac{93 \times 784}{1074} = 67.89$	0.35
UE	W/D	10	$\frac{93 \times 131}{1074} = 11.34$	0.016
UE	NM	20	$\frac{93 \times 159}{1074} = 13.77$	2.82
NILF	M	42	$\frac{85 \times 784}{1074} = 62.05$	6.48
NILF	W/D	18	$\frac{85 \times 131}{1074} = 10.37$	5.61
NILF	NM	25	$\frac{85 \times 159}{1074} = 12.58$	12.26

$\chi^2_{stat} = 31.47$

$\chi^2_{crit}(\alpha = 0.05, df = 4) = 9.488$

Since $\chi^2_{stat} > \chi^2_{crit}$

$\boxed{\text{REJECT H0}}$

STAT ASSIGNMENT: 2

Q19. H_0: All candidates are equally popular

H_1: H_0 is False

$\alpha = 0.05$, and $df = 3$

	E	O	O−E	$(O-E)^2$	$(O-E)^2/E$
Higgins	25	41	16	256	10.24
Readon	25	19	−6	36	1.44
White	25	24	−1	1	0.04
Charlton	25	16	−9	81	3.24
					14.96

$\chi^2_{stat} = 14.96$

$\chi^2_{crit(\alpha=0.05, df=3)} = 7.815$

Since $\chi^2_{stat} > \chi^2_{crit}$ $\boxed{\text{REJECT } H_0}$

Q.20. H_0: Age & Photograph preference are independent

H_1: H_0 is false

$df = (n_c - 1)(n_r - 1) = (3-1) \times (3-1) = 4$

$\alpha = 0.05$

	A	B	C	Total
5-6Y	18	22	20	60
7-8Y	2	28	40	70
9-10Y	20	10	40	70
Total	40	60	100	200

R	C	O	E	$(O-E)^2/E$
5-6	A	18	$60 \times 40/200 = 12$	3
5-6	B	22	$60 \times 60/200 = 18$	0.88
5-6	C	20	$60 \times 100/200 = 30$	3.33
7-8	A	2	$70 \times 40/200 = 14$	10.28
7-8	B	28	$70 \times 60/200 = 21$	2.33
7-8	C	40	$70 \times 100/200 = 35$	0.71
9-10	A	20	$70 \times 40/200 = 14$	2.57
9-10	B	10	$70 \times 60/200 = 21$	5.76
9-10	C	40	$70 \times 100/200 = 35$	0.71

$\chi^2_{stat} = 29.57$

$\chi^2_{crit(\alpha=0.05, df=4)} = 9.488$

Since $\chi^2_{stat} > \chi^2_{crit}$

$\boxed{\text{REJECT } H_0}$

Q21 H_0: There is no significant diff. between "support" & "no support" conditions in the frequency with which individuals are likely to conform

H_1: H_0 is false

$df = (n_c - 1)(n_r - 1) = (2-1)(2-1) = 1$

since, $df = 1$, requires yate's correction factor while calculating χ^2_{stat}

	S	NS	Total
C	18	40	58
NC	32	10	42
Total	50	50	100

		O	E	$\frac{(O-E-0.5)^2}{E}$
C	S	18	$58 \times 50/100 = 29$	4.56
C	NS	40	$58 \times 50/100 = 29$	3.80
NC	S	32	$42 \times 50/100 = 21$	5.25
NC	NS	10	$42 \times 50/100 = 21$	6.29

$\chi^2_{stat} = 19.91$

$\chi^2_{crit(\alpha=0.05, df=1)} = 3.841$

since $\chi^2_{stat} > \chi^2_{crit}$ $\boxed{\text{REJECT } H_0}$

Q15. $H_0: P_1 - P_2 = 0$

$H_1: P_1 - P_2 \neq 0$

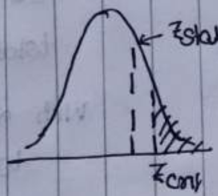
	Pop1	Pop2
	$n_1 = 100$	$n_2 = 100$
	$\bar{x}_1 = 53$	$\bar{x}_2 = 43$
	$\hat{p}_1 = 0.53$	$\hat{p}_2 = 0.43$

population proportion, $p = \frac{\bar{x}_1 + \bar{x}_2}{n_1 + n_2} = \frac{53+43}{200} = 0.48$

$$Z_{stat} = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{p(1-p)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = 1.415$$

With $\alpha = 0.05$, $\alpha/2 = 0.025$,

$Z_{\alpha/2} = 1.96$



$\boxed{\text{ACCEPT } H_0}$

Q16. $H_0: P_1 - P_2 \leq 0.1$

$H_1: P_1 - P_2 > 0.1$

Pop1 With Sweepstake	Pop2 Without Sweepstake
$n_1 = 300$	$n_2 = 700$
$x_1 = 120$	$\bar{x}_2 = 140$
$\hat{p}_1 = 0.40$	$\hat{p}_2 = 0.20$

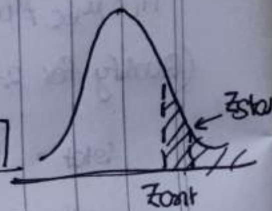
$$Z_{stat} = \frac{\hat{p}_1 - \hat{p}_2 - D}{\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}} = 3.12$$

$D \leftarrow 0.1$

With $\alpha = 0.05$,

$Z_{crit} = Z_\alpha = 1.645$

$\boxed{\text{REJECT } H_0}$



Q17. H_0: Die is unbiased

H_1: Die is biased

Obs:	1	2	3	4	5	6	
Freq:	16	20	25	14	29	28	= 132

In ideal case, expected o/p of each face of die would be $132/6 = 22 = E$

$$\chi^2_{stat} = \sum_{i=1}^{6} \frac{(obs - E)^2}{E} = \frac{(16-22)^2}{22} + \frac{(20-22)^2}{22} + \frac{(25-22)^2}{22} + \frac{(14-22)^2}{22} + \frac{(29-22)^2}{22} + \frac{(28-22)^2}{22}$$

$= 9.0$

Assuming $\alpha = 0.05$, $df = 5$,

$\chi^2_{crit} = 11.0$ Since $\chi^2_{stat} < \chi^2_{crit}$ $\boxed{\text{ACCEPT } H_0}$

Q18. H_0: Gender & voting are independent

H_1: " " " " dependent

	M	W	Total
Voted	2792	3591	6383
Not voted	1486	2131	3617
Total	4278	5722	10000

$df = (2-1) \times (2-1) = 1$

yates correction for df=1

$(O - E - 0.5)^2 / E$

R	C	E	O
V	M	$\frac{6383 \times 4278}{10000}$	2792
V	W	$\frac{6383 \times 5722}{10000}$	3591
NV	M	$\frac{3617 \times 4278}{10000}$	1486
NV	W	$\frac{3617 \times 5722}{10000}$	2131

$\chi^2_{stat} = 6.66$

$\therefore \chi^2_{crit}(0.05, df=1) = 3.841$

Since $\chi^2_{stat} > \chi^2_{crit}$ $\boxed{\text{REJECT } H_0}$

Q10: $\alpha = 0.05$, $n = 25$, $df = 24$,

$\bar{x} = 60$, $s = 4$,

$t_{crit}(0.05, df = 24) = \pm 2.06$

$P(-t_{0.05} < t < t_{0.1}) = 1 - 0.1 - 0.05 = 0.85$

Q11. $H_0: \mu_{BC} = \mu_{BH}$

$H_1: \mu_{BC} \neq \mu_{BH}$

(Qualify for 2-tail test)

	B-C	B-H
n	1200	800
$\bar{x}$	452	523
s	212	185

$$Z_{stat} = \frac{\bar{x}_{BC} - \bar{x}_{BH}}{SE}$$

Where $SE = \sqrt{\frac{s_{BC}^2}{n_{BC}} + \frac{s_{BH}^2}{n_{BH}}} = 8.95$

$$\Rightarrow Z_{stat} = \frac{452 - 523}{8.95} = -7.92$$

With $\alpha = 0.05$, $Z_{\alpha/2} = \pm 1.96$

$\boxed{\text{REJECT HO}}$

Q12. $H_0: \mu_D = \mu_E$

$H_1: \mu_D \neq \mu_E$

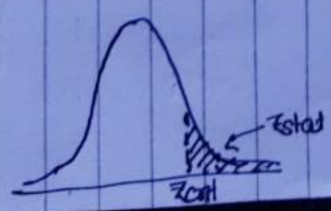
(Qualify for 2-tail test)

	Duracell	Energizer
n	100	100
$\bar{x}$	308	254
s	84	67

$$Z_{stat} = \frac{308 - 254}{\sqrt{\frac{84^2}{100} + \frac{67^2}{100}}} = 5.025$$

With $\alpha = 0.05$, $Z_{\alpha/2} = \pm 1.96$

$\boxed{\text{REJECT HO}}$



Q13. $H_0: \mu_1 - \mu_2 = 0$

$H_1: \mu_1 - \mu_2 \neq 0$

Pop1	Pop2
$\mu_1 = 27.50$	$\mu_2 = 20.00$
$n_1 = 14$	$n_2 = 9$
$\bar{x}_1 = 0.317$	$\bar{x}_2 = 0.21$
$S_1 = 0.12$	$S_2 = 0.11$

$$S_{12} = \sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}} = 0.11629$$

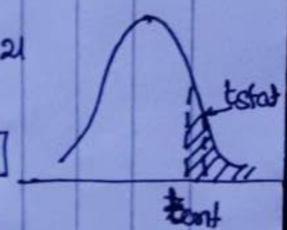
$$SE = \sqrt{\frac{1}{n_1} + \frac{1}{n_2}} \times S_{12} = 0.04968$$

$$t_{stat} = \frac{\bar{x}_1 - \bar{x}_2}{SE} = 2.183$$

With $\alpha = 0.05$, $df = n_1 + n_2 - 2 = 21$

$t_{crit} = 2.08$

$\boxed{\text{REJECT HO}}$



Q14. $H_0: \mu_2 - \mu_1 \leq 0$

$H_1: \mu_2 - \mu_1 > 0$

Pop1	Pop2
$n_1 = 15$	$n_2 = 12$
$\bar{x}_1 = 6598$	$\bar{x}_2 = 6870$
$S_1 = 5844$	$S_2 = 5669$

$$t_{stat} = \frac{(\bar{x}_2 - \bar{x}_1) - (\mu_2 - \mu_1)}{SE}$$

$SE \leftarrow S_{12}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$

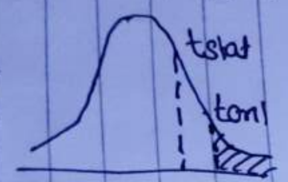
$S_{12} \downarrow \sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}}$

$= 0.91$

With $\alpha = 0.05$, & $df = 25$,

$t_{crit} = 2.05$

$\boxed{\text{ACCEPT HO}}$



Q4: $H_0 : \mu = 1135$
$H_1 : \mu \neq 1135$ } 2-tail test

Given, $n = 22$,
$\bar{x} = 1031.318$
$s = 240.3746$
$SE = s/\sqrt{n} = \frac{240.3746}{\sqrt{22}}$

since $n < 30$ & population σ is unknown, t-test is selected.

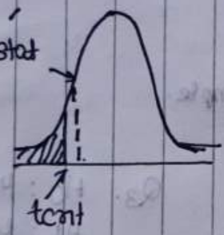
$t_{stat} = \frac{\bar{x} - \mu}{SE} = -2.02$

$df = 22 - 1 = 21$

with $\alpha = 0.05$ & $df = 21$,

$t_{crit} = \pm 2.079$

ACCEPT Ho



Q6. $H_0 : \mu = 32.28$
$H_1 : \mu \neq 32.28$ } 2-tail test

Given: $n = 19$, $\bar{x} = 31.67$, $s = 1.29$

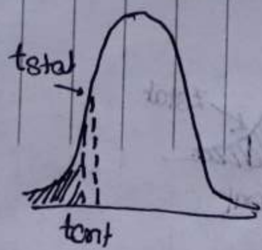
Since $n < 30$ & population σ is unknown, t-test is selected.

$t_{stat} = \frac{\bar{x} - \mu}{SE} = \frac{31.67 - 32.28}{1.29/\sqrt{19}} = -2.06$

With $\alpha = 0.05$, and $df = 19 - 1 = 18$,

$t_{crit} = \pm 2.1009$

ACCEPT H0



Q5: $H_0 : \mu = 48432$
$H_1 : \mu \neq 48432$

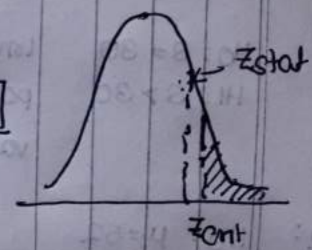
Given, $n = 400$
$\bar{x} = 48574$
$s = 2000$

$Z_{stat} = \frac{\bar{x} - \mu}{s/\sqrt{n}} = 1.42$

For $\alpha = 0.05$, $\alpha/2 = 0.025$

$Z_{crit} = 1.96$

ACCEPT Ho



Q8. $n = 16$, $\mu = 10$, $\bar{x} = 12$, $s = 1.5$

$t_{stat} = \frac{\bar{x} - \mu}{s/\sqrt{n}} = 5.33$

Q9: $\alpha = 0.01$, $n = 16$, $df = 15$

$t_{crit}(0.01, 15) = \pm 2.9467$

ASSIGNMENT : 2

Q1. $H_0 : \mu = 25$
$H_1 : \mu \neq 25$
valid, as it is always about the population under study. Since μ here is the population mean & H_0 is about & always claimed as an equality.

$H_0 : \bar{x} = 50$
$H_1 : \bar{x} \neq 50$
Invalid, as H_0 is always about population under study & not valid for sample.

$H_0 : s = 30$
$H_1 : s > 30$
Invalid, as H_0 is always about population under study & is not a valid statement to be tested for sample.

$H_0 : \sigma > 10$
$H_1 : \sigma = 10$
Invalid statement. H_0 is always expected to have or to be stated with equality sign. Like $=, \leq, \geq$

$H_0 : p = 0.1$
$H_1 : p = 0.5$
Invalid, as both H_0 & H_1 are having different values for claim

Q2 : $H_0 : \mu = 52$
$H_1 : \mu > 52$

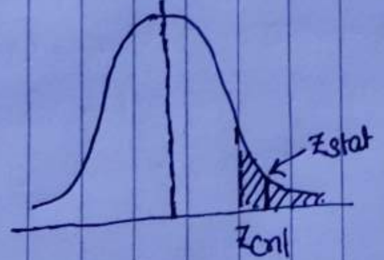
Given $n = 100$
$\bar{x} = 52.80$
$\sigma = 4.50$

Significance level, $\alpha = 0.05$ (95% CI)

$$Z_{stat} = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{52.80 - 52}{4.50/\sqrt{100}} = 1.78$$

For $\alpha = 0.05$,
$Z_{crit} = 1.65$

$\boxed{\text{REJECT H0}}$



Q3. $H_0 : \mu = 34$
$H_1 : \mu < 34$

Given $n = 50$, $\bar{x} = 32.5$, $\sigma = 8$

$$Z_{stat} = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{32.5 - 34}{8/\sqrt{50}} = -1.33$$

For $\alpha = 0.01$,
$Z_{crit} = -2.33$

$\boxed{\text{ACCEPT H0}}$