(MAA 161)

STATISTIC FOR SCIENCE STUDENTS

SEMESTER 2

ASSIGNMENT 2

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Q1. THE MASTERS AT AUGUSTA

A) i) For the scores of each given round and the final total scores, investigate if the scores of the US players is the same as the scores of players from outside the US

For the scores of Round 2

$H_0 : \mu_{us} = \mu_{xus}$(claim)

$H_1 : \mu_{us} \neq \mu_{xus}$

	Mean US	Mean x US
R2	70.25	71
	S US	S x US
	2.649686	2.144761

n US= 24 n XUS= 30

Test for equal variance:

$F = \frac{Sus^2}{Sx^2} = \frac{2.65^2}{2.14^2} = 1.53$

critical value:

$F_{0.05,23,29} \approx F_{0.05,12,29} = 2.104$

$F_{0.025,23,29} \approx F_{0.025,12,29} = 2.430$

$F_{0.005,23,29} \approx F_{0.005,12,29} = 3.211$

Since test statistic not fall in 5%, 2.5% and 0.5% rejection region, do not reject the null hypothesis at 10%, 5% and 1% significance level. Thus, there is strong evidence that the variance of the scores of US players is the same as the variance of the scores of players from outside the US.

The pooled variance is given by:

$S^2_p = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2} = \frac{(23)2.65^2+(29)2.14^2}{24+30-2} = 5.6601$

Test statistic:

$Z = \frac{(x_1-x_2)-(\mu_1-\mu_2)}{\sqrt{(\frac{s_p^2}{n_1}+\frac{s_p^2}{n_2})}} = \frac{(70.25-71)}{\sqrt{(\frac{5.6601}{24}+\frac{5.6601}{30})}} = -1.15$

$\alpha = 0.01$ critical value $= \pm 2.58$

$\alpha = 0.05$ critical value $= \pm 1.96$

$\alpha = 0.10$ critical value $= \pm 1.65$

Since test statistic not fall in rejection region, do not reject the null hypothesis and conclude that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of European players.

p-value:

$\frac{1}{2}$p-value= P(Z< -1.15) $\approx$ P($Z > 1.15$)=1-0.8749 = 0.1251

p-value= 0.2502

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US.

For the scores of Round 4

$H_0 : \mu_{us} = \mu_{xus}$ (claim)

$H_1 : \mu_{us} \neq \mu_{xus}$

	Mean US	Mean x US
R4	72.25	72.93333
	s US	s x US
	2.165064	2.943165

n US= 24 n XUS= 30

Test for equal variance:

$$F = \frac{Sx^2}{Sus^2} = \frac{2.94^2}{2.17^2} = 1.86$$

critical value:

$F_{0.05,29,23} \approx F_{0.05,24,23} = 2.005$

$F_{0.025,29,23} \approx F_{0.025,24,23} = 2.299$

$F_{0.005,29,23} \approx F_{0.005,24,23} = 3.021$

Since test statistic not fall in 10% , 5% and 1% rejection region, do not reject the null hypothesis. Thus, there is strong evidence that the variance of the scores of US players is the same as the variance of the scores of players from outside the US.

The pooled variance is given by:

$$S^2_p = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2} = \frac{(29)2.94^2+(23)2.17^2}{24+30-2} = 6.903$$

Test statistic:

$$Z = \frac{(x_1-x_2)-(\mu_1-\mu_2)}{\sqrt{(\frac{s_p^2}{n_1}+\frac{s_p^2}{n_2})}} = \frac{(72.93-72.25)}{\sqrt{(\frac{6.903}{30}+\frac{6.903}{24})}} = 0.945$$

$\alpha = 0.01$ critical value =± 2.58
$\alpha = 0.05$ critical value =± 1.96
$\alpha = 0.10$ critical value =± 1.65

Since test statistic not fall in rejection region, do not reject the null hypothesis and conclude that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US.

p-value:
$\frac{1}{2}$p-value= P($Z > 0.945$) $\approx$ P(Z> 0.95)=1-0.8289 = 0.1711

p-value= 0.3422

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US.

Final total scores

$H_0 : \mu_{us} = \mu_{xus}$(claim)
$H_1 : \mu_{us} \neq \mu_{xus}$

	Mean US	Mean x Us
total	288.2083	289
	s Us	s x US
	4.609584	4.487018

n US= 24 n XUS= 30

Test for equal variance:
$F = \frac{Sx^2}{Sus^2} = \frac{4.49^2}{4.61^2} = 0.95$

critical value:

$F_{0.05,29,23} \approx F_{0.05,24,23} = 2.005$

$F_{0.025,29,23} \approx F_{0.025,24,23} = 2.299$

$F_{0.005,29,23} \approx F_{0.005,24,23} = 3.021$

Since test statistic not fall in 5%, 2.5% and 0.5% rejection region, do not reject the null hypothesis at 10%, 5% and 1% significance level. Thus, there is strong evidence that the variance of the scores of US players is the same as the variance of the scores of players from outside the US.

The pooled variance is given by:
$S^2_p = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2} = \frac{(29)4.49^2+(23)4.61^2}{30+24-2} = 20.64$

Test statistic:

$Z = \frac{(x_1 - x_2) - (\mu_1 - \mu_2)}{\sqrt{(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2})}} = \frac{(289 - 288.21)}{\sqrt{(\frac{20.64}{30} + \frac{20.64}{24})}} = 0.635$

$\alpha = 0.01$ critical value =± 2.58
$\alpha = 0.05$ critical value =± 1.96
$\alpha = 0.10$ critical value =± 1.65

Since test statistic not fall in rejection region, do not reject the null hypothesis and conclude that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US.

p-value:
$\frac{1}{2}$p-value= P($Z > 0.635$) $\approx$ P($Z > 0.64$)=1-0.7389 = 0.2611

p-value= 0.5222

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US.

A) ii) For the scores of each given round and the final total scores, investigate if the scores of the US players is the same as the scores of the European players.

For the scores of Round 2

$H_0 : \mu_{us} = \mu_E$(claim)
$H_1 : \mu_{us} \neq \mu_E$

	Mean US	Mean European
R2	70.25	71.375
	S US	S European
	2.649685516	1.932453104

n US= 24 nE= 16

Test for equal variance:

$F = \frac{Sus^2}{Se^2} = \frac{2.65^2}{1.93^2} = 1.88$

critical value:

$F_{0.05,23,15} \approx F_{0.05,12,15} = 2.475$

$F_{0.025,23,15} \approx F_{0.025,12,15} = 2.963$

$F_{0.005,23,15} \approx F_{0.005,12,15} = 4.250$

Since test statistic not fall in 5%, 2.5% and 0.5% rejection region, do not reject the null hypothesis at 10%, 5% and 1% significance level. Thus, there is strong evidence that the variance of the scores of US players is the same as the variance of the scores of the European players.

The pooled variance is given by:

$S^2{}_p=\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}=\frac{(23)2.65^2+(15)1.93^2}{24+16-2}=5.721$

Test statistic:

$T=\frac{(x_1-x_2)-(\mu_1-\mu_2)}{\sqrt{S_P^2(\frac{1}{n_1}+\frac{1}{n_2})}}=\frac{(70.25-71.38)}{\sqrt{5.721(\frac{1}{24}+\frac{1}{16})}}= -1.464$

$\alpha = 0.05$ critical value : $t_{0.025,38}=\pm 2.024$

$\alpha = 0.10$ critical value : $t_{0.05,38}=\pm 1.686$

$\alpha = 0.01$ critical value : $t_{0.005,38}=\pm 2.429$

Since test statistic not fall in rejection region, do not reject the null hypothesis and conclude that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of European players.

p-value:

$\frac{1}{2}$p-value= $P(t_{38}< -1.464) \approx P(t_{30}> 1.5)$=1-0.9280 = 0.072

p-value= 0.144

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of European players.

For the scores of Round 4

$H_0 : \mu_{us}= \mu_E$(claim)

$H_1 : \mu_{us} \neq \mu_E$

	Mean US	Mean European
R4	72.25	73.125
	s US	s European
	2.165063509	3.655047879

n US= 24 nE= 16

Test for equal variance:

$F = \frac{Se^2}{Sus^2}=\frac{3.66^2}{2.17^2}= 2.85$

critical value:

$F_{0.05,15,23} \approx F_{0.05,12,23} = 2.204$

$F_{0.025,15,23} \approx F_{0.025,12,23} = 2.570$

$F_{0.005,15,23} \approx F_{0.005,12,23} = 3.475$

Since test statistic fall in 5% rejection region, reject the null hypothesis at 10% significance level. Thus, there is weak evidence that the variance of the scores of the US players is the different from the variance of the scores of European players.

Test statistic:

$$T = \frac{(x_1 - x_2) - (\mu_1 - \mu_2)}{\sqrt{(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2})}} = \frac{(73.13 - 72.25)}{\sqrt{(\frac{3.66^2}{16} + \frac{2.17^2}{24})}} = 0.887$$

$$Df = \frac{(\frac{s^2}{n} + \frac{s^2}{n})^2}{\frac{(\frac{s^2}{n})^2}{n-1} + \frac{(\frac{s^2}{n})^2}{n-1}} = \frac{(\frac{3.66^2}{16} + \frac{2.17^2}{24})^2}{\frac{(\frac{3.66^2}{16})^2}{15} + \frac{(\frac{2.17^2}{24})^2}{23}} = 22.06 \sim 22 \quad \alpha = 0.05 \text{ critical value : } t_{0.025,22} = \pm 2.074$$

Since test statistic not fall in rejection region, do not reject the null hypothesis and conclude that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of European players.

p-value:

$\frac{1}{2}$p-value= $P(t_{22} > 0.887) \approx P(t_{20} > 0.9) = 1 - 0.8106 = 0.1894$

p-value= 0.3788

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of European players.

Final total scores

	Mean US	Mean European
total	288.2083333	289.5
	s Us	s European
	4.609583917	3.905124838

n US= 24 nE= 16

Test for equal variance:

$$F = \frac{Sus^2}{Se^2} = \frac{4.61^2}{3.91^2} = 1.39$$

critical value:

$F_{0.05,23,15} = 2.475$

$F_{0.025,23,15}$=2.963

$F_{0.005,23,15}$=4.250

Since test statistic not fall in 5%, 2.5% and 0.5% rejection region, do not reject the null hypothesis at 10%, 5% and 1% significance level. Thus, there is strong evidence that the variance of the scores of US players is the same as the variance of the scores of the European players.

The pooled variance is given by:

$S^2_p = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2} = \frac{(23)4.61^2+(15)3.91^2}{24+16-2}$=18.89

Test statistic:

$T = \frac{(x_1-x_2)-(\mu_1-\mu_2)}{\sqrt{s_p^2(\frac{1}{n_1}+\frac{1}{n_2})}} = \frac{(288.21-289.5)}{\sqrt{18.89(\frac{1}{16}+\frac{1}{24})}}$ = -0.919

$\alpha = 0.05$ critical value : $t_{0.025,38} = \pm 2.024$

$\alpha = 0.10$ critical value : $t_{0.05,38} = \pm 1.686$

$\alpha = 0.01$ critical value : $t_{0.005,38} = \pm 2.429$

Since test statistic not fall in rejection region, do not reject the null hypothesis and conclude that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of European players.

p-value:

$\frac{1}{2}$ p-value= $P(t_{38} < -0.919) \approx P(t_{30} > 0.9)$=1-0.8124 = 0.1876

p-value= 0.3752

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of European players.

A) iii) For the scores of each given round and the final total scores, investigate if the scores of the US players is the same as the scores of players from outside the US and also outside the European countries (other parts of the world).

For the scores of Round 2

$H_0 : \mu_{us} = \mu_O$ (claim)

$H_1 : \mu_{us} \neq \mu_O$

	Mean US	Mean O
R2	70.25	70.57143
	S US	S O
	2.649686	2.290174

nUs =24 n0=14

Test for equal variance:

$F = \frac{Sus^2}{So^2} = \frac{2.65^2}{2.29^2} = 1.34$

critical value:

$F_{0.05,23,13} \approx F_{0.05,12,13} = 2.604$

$F_{0.025,23,13} \approx F_{0.025,12,13} = 3.153$

$F_{0.005,23,13} \approx F_{0.005,12,13} = 4.643$

Since test statistic not fall in 5%, 2.5% and 0.5% rejection region, do not reject the null hypothesis at 10%, 5% and 1% significance level. Thus, there is strong evidence that the variance of the scores of US players is the same as the variance of the scores of players from the other parts of the world.

The pooled variance is given by:

$S^2_p = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2} = \frac{(23)2.65^2+(13)2.29^2}{24+14-2} = 6.3803$

Test statistic:

$T = \frac{(x_1-x_2)-(\mu_1-\mu_2)}{\sqrt{S_P^2(\frac{1}{n_1}+\frac{1}{n_2})}} = \frac{(70.25-70.57)}{\sqrt{6.3803(\frac{1}{24}+\frac{1}{14})}} = -0.3767$

$\alpha = 0.05$ critical value : $t_{0.025,36} = \pm 2.028$

$\alpha = 0.10$ critical value : $t_{0.05,36} = \pm 1.688$

$\alpha = 0.01$ critical value : $t_{0.005,36} = \pm 2.719$

Since test statistic not fall in rejection region, do not reject the null hypothesis and conclude that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US and also outside the European countries.

p-value:

$\frac{1}{2}$p-value= $P(t_{36} < -0.3767) \approx P(t_{24} > 0.4)$=1-0.6537 = 0.3463

p-value= 0.6926

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US and also outside the European countries.

For the scores of Round 4

$H_0 : \mu_{us} = \mu_O$ (claim)

$H_1 : \mu_{us} \neq \mu_O$

	Mean US	Mean O
R4	72.25	72.71429
	s US	s O
	2.165064	1.789995

nUs =24 n0=14

$F = \frac{Sus^2}{So^2} = \frac{2.17^2}{1.79^2} = 1.47$

critical value:

$F_{0.05,23,13} \approx F_{0.05,12,13} = 2.604$

$F_{0.025,23,13} \approx F_{0.025,12,13} = 3.153$

$F_{0.005,23,13} \approx F_{0.005,12,13} = 4.643$

Since test statistic not fall in 5%, 2.5% and 0.5% rejection region, do not reject the null hypothesis at 10%, 5% and 1% significance level. Thus, there is strong evidence that the variance of the scores of US players is the same as the variance of the scores of players from the other parts of the world.

The pooled variance is given by:

$S^2_p = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2} = \frac{(23)2.17^2+(14)1.79^2}{24+14-2} = 4.255$

Test statistic:

$T = \frac{(x_1-x_2)-(\mu_1-\mu_2)}{\sqrt{S_P^2(\frac{1}{n_1}+\frac{1}{n_2})}} = \frac{(72.25-72.71)}{\sqrt{4.255(\frac{1}{24}+\frac{1}{14})}} = -0.663$

$\alpha = 0.05$ critical value : $t_{0.025,36} = \pm 2.028$

$\alpha = 0.10$ critical value : $t_{0.05,36} = \pm 1.688$

$\alpha = 0.01$ critical value : $t_{0.005,36} = \pm 2.719$

Since test statistic not fall in rejection region, do not reject the null hypothesis and conclude that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US and also outside the European countries.

p-value:

$\frac{1}{2}$ p-value= P($t_{36} < -0.663$) $\approx$ P($t_{30} > 0.7$)=1-0.7553 = 0.2447

p-value= 0.4894

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US and also outside the European countries.

Final total scores

$H_0 : \mu_{us} = \mu_O$ (claim)

$H_1 : \mu_{us} \neq \mu_O$

	Mean US	Mean O
total	288.2083	288.4286
	s Us	s O
	4.609584	5.010194

nUs =24 n0=14

$$F = \frac{So^2}{Sus^2} = \frac{5.01^2}{4.61^2} = 1.181$$

critical value:

$F_{0.05,13,23} \approx F_{0.05,12,23} = 2.204$

$F_{0.025,13,23} \approx F_{0.025,12,23} = 2.570$

$F_{0.005,13,23} \approx F_{0.005,12,23} = 3.475$

Since test statistic not fall in 5%, 2.5% and 0.5% rejection region, do not reject the null hypothesis at 10%, 5% and 1% significance level. Thus, there is strong evidence that the variance of the scores of US players is the same as the variance of the scores of players from the other parts of the world.

The pooled variance is given by:

$$S^2_p = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2} = \frac{(23)5.01^2+(13)4.61^2}{24+14-2} = 23.71$$

Test statistic:

$T=\frac{(x_1-x_2)-(\mu_1-\mu_2)}{\sqrt{S_P^2(\frac{1}{n_1}+\frac{1}{n_2})}}=\frac{(288.43-288.21)}{\sqrt{23.71(\frac{1}{24}+\frac{1}{14})}}$= 0.1343

$\alpha = 0.05$ critical value : $t_{0.025,36}=\pm 2.028$

$\alpha = 0.10$ critical value : $t_{0.05,36}=\pm 1.688$

$\alpha = 0.01$ critical value : $t_{0.005,36}=\pm 2.719$

Since test statistic not fall in rejection region, do not reject the null hypothesis and conclude that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US and also outside the European countries.

p-value:

$\frac{1}{2}$ p-value= P(t_{36}> 0.1343) $\approx$ P(t_{30}> 0.1)=1-0.5395 = 0.4605

p-value= 0.921

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US and also outside the European countries.

A)iv) For the scores of each given round and the final total scores, investigate if the scores of the European players is the same as the scores of players from other parts of the world.

For the scores of Round 2

$H_0 : \mu_E = \mu_O$ (claim)

$H_1 : \mu_E \neq \mu_O$

	Mean European	Mean O
R2	71.375	70.57142857
	S European	S O
	1.932453104	2.29017422

nE= 16 nO=14

Test for equal variance:

$$F = \frac{So^2}{Se^2} = \frac{2.29^2}{1.93^2} = 1.41$$

critical value:

$F_{0.05,13,15} \approx F_{0.05,12,15} = 2.475$

$F_{0.025,13,15} \approx F_{0.025,12,15} = 2.963$

$F_{0.005,13,15} \approx F_{0.005,12,15} = 4.250$

Since test statistic not fall in 5%, 2.5% and 0.5% rejection region, do not reject the null hypothesis at 10%, 5% and 1% significance level. Thus, there is strong evidence that the variance of the scores of European players is the same as the variance of the scores of players from the other parts of the world.

The pooled variance is given by:

$$S^2_p = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2} = \frac{(13)2.29^2+(15)1.93^2}{14+16-2} = 4.43$$

Test statistic:

$$T = \frac{(x_1-x_2)-(\mu_1-\mu_2)}{\sqrt{S_P^2(\frac{1}{n_1}+\frac{1}{n_2})}} = \frac{(70.57-71.38)}{\sqrt{4.43(\frac{1}{14}+\frac{1}{16})}} = -1.05$$

$\alpha = 0.05$ critical value : $t_{0.025,28} = \pm 2.048$

$\alpha = 0.10$ critical value : $t_{0.05,28} = \pm 1.701$

$\alpha = 0.01$ critical value : $t_{0.005,28} = \pm 2.763$

Since test statistic not fall in rejection region, do not reject the null hypothesis and conclude that there is not even weak evidence to reject the claim that the scores of the European players is the same as the scores of players from the other parts of the world.

p-value:

$\frac{1}{2}$p-value= $P(t_{28} < -1.05) \approx P(t_{24} > 1.1)$=1-0.9128 = 0.0872

p-value= 0.1744

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is not even weak evidence to reject the claim that the scores of the European players is the same as the scores of players from the other parts of the world.

For the scores of Round 4

$H_0 : \mu_E = \mu_O$ (claim)
$H_1 : \mu_E \neq \mu_O$

	Mean European	Mean O
R4	73.125	72.71428571
	s European	s O
	3.655047879	1.789994869

nE= 16 nO=14

$F = \frac{Se^2}{So^2} = \frac{3.66^2}{1.79^2} = 4.18$

critical value:

$F_{0.05,15,13} \approx F_{0.05,12,13} = 2.604$

$F_{0.025,15,13} \approx F_{0.025,12,13} = 3.153$

$F_{0.005,15,13} \approx F_{0.005,12,13} = 4.643$

Since test statistic fall in 5%, 2.5% but not in 0.5% rejection region, reject the null hypothesis at 10% and 5% significance level. Thus, there is enough evidence that the variance of the scores of European players is the different from the variance of the scores of players from other parts of the world.

Test statistic:

$T = \frac{(x_1 - x_2) - (\mu_1 - \mu_2)}{\sqrt{(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2})}} = \frac{(73.13 - 72.14)}{\sqrt{(\frac{3.66^2}{16} + \frac{1.79^2}{14})}} = 0.959$

$Df = \frac{(\frac{s^2}{n} + \frac{s^2}{n})^2}{\frac{(\frac{s^2}{n})^2}{n-1} + \frac{(\frac{s^2}{n})^2}{n-1}} = \frac{(\frac{3.66^2}{16} + \frac{1.79^2}{14})^2}{\frac{(\frac{3.66^2}{16})^2}{15} + \frac{(\frac{1.79^{\ \ 2}}{14})^2}{13}} = 23.68 \approx 24$

$\alpha = 0.05$ critical value : $t_{0.025,24} = \pm 2.064$

Since test statistic not fall in rejection region, do not reject the null hypothesis and conclude that there is not enough evidence to reject the claim that the scores of the European players is the same as the scores of players from the other parts of the world.

p-value:

$\frac{1}{2}$ p-value= P(t_{24}> 0.959) $\approx$ P(t_{24}> 0.9)=1-0.8115 = 0.1885

p-value= 0.377

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is not even weak evidence to reject the claim the scores of the European players is the same as the scores of players from the other parts of the world.

Final total scores

$H_0 : \mu_E = \mu_O$ (claim)

$H_1 : \mu_E \neq \mu_O$

	Mean European	Mean O
total	289.5	288.4285714
	s European	s O
	3.905124838	5.010193691

nE= 16 nO=14

$F = \frac{So^2}{Se^2} = \frac{5.01^2}{3.91^2} = 1.64$ critical value: $F_{0.05,13,15} \approx F_{0.05,12,15} = 2.475$

Since test statistic not fall in 10% rejection region, do not reject the null hypothesis. Thus, there is evidence that the scores of the European players is the same as the scores of players from the other parts of the world.

The pooled variance is given by:

$S^2_p = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2} = \frac{(13)5.01^2+(15)3.91^2}{14+16-2} = 19.84$

Test statistic:

$T = \frac{(x_1-x_2)-(\mu_1-\mu_2)}{\sqrt{S_P^2(\frac{1}{n_1}+\frac{1}{n_2})}} = \frac{(288.43-289.5)}{\sqrt{19.84(\frac{1}{14}+\frac{1}{16})}} = -0.656$

$\alpha = 0.05$ critical value : $t_{0.025,28} = \pm 2.048$

$\alpha = 0.10$ critical value : $t_{0.05,28} = \pm 1.701$

$\alpha = 0.01$ critical value : $t_{0.005,28} = \pm 2.763$

Since test statistic not fall in rejection region, do not reject the null hypothesis and conclude that there is not even weak evidence to reject the claim that the scores of the European players is the same as the scores of players from the other parts of the world.

p-value:

$\frac{1}{2}$ p-value= P($t_{28} < -0.656$) $\approx$ P($t_{24} > 0.7$)=1-0.7547 = 0.2453

p-value= 0.4906

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is not even weak evidence, even weak evidence to reject the claim the scores of the European players is the same as the scores of players from the other parts of the world.

A)v) For the scores of each given round and the final total scores, investigate if the scores of the 10 best US players is less than the scores of players from outside the US that finishes in the top 35.

For the scores of Round 2

Parametric test:

$\bar{x}_{us}= \frac{771}{11}$= 70.09 $\bar{x}_o= \frac{1343}{19}$= 70.68

$S^2_{us}= \frac{54133-771^2/11}{10}$= 9.291 $S^2_o = \frac{95001-1343^2/19}{18}$= 4.006

$H_o: \mu_o \leq \mu_{us}$

$H_1: \mu_o > \mu_{us}$ (claim)

Test for equal variance:

F= $\frac{9.291}{4.006}$ =2.319

critical value:

$F_{0.005,10,18}$= 4.030

$F_{0.025,10,18}$= 2.866

$F_{0.05,10,18}$= 2.412

Since the test statistic does not fall in 0.5%, 2.5% and 5% rejection region, Ho is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for US players and players from outside the US are equal.

pooled variance:

$S^2_p= \frac{10(9.291)+18(4.006)}{11+19-2}$= 5.894

Test statistic, $t = \frac{70.68-70.09}{\sqrt{(5.894)(\frac{1}{11}+\frac{1}{19})}} = 0.6414$

$P(t_{28} > 0.6834) < P(t_{28} > 0.6414) < P(t_{28} > 0.5304)$

$0.25 < \text{p-value} < 0.30$

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is not even a weak evidence to support the claim that the scores of Round 2 of the 10 best US players is less than the scores of Round 2 of players from outside the US that finishes in the top 35.

Non-parametric test:

(Mann-Whitney test)

H_o: Scores of Round 2 of the 10 best US players is equal or more than the scores of Round 2 of players from outside the US that finishes in the top 35

H_1: Scores of Round 2 of the 10 best US players is less than the scores of Round 2 of players from outside the US that finishes in the top 35 (claim)

Table 1.0: Scores of the 10 best US players and players from outside the US that finishes in the Top 35 in Round 2

Score	66	67	68	68	68	69	69	69	69	69	69	69	69	70	70
Rank	1	2	4	4	4	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	16	16
Player	US	O	US	US	O	US	US	US	US	O	O	O	O	US	O
Score	70	70	70	71	71	72	72	72	72	73	73	74	74	75	76
Rank	16	16	16	19.5	19.5	22.5	22.5	22.5	22.5	25.5	25.5	27.5	27.5	29	30
Player	O	O	O	O	O	US	O	O	O	O	O	O	O	US	US

R_{us}= 144.5 R_o= 320.5

U_{us}= 144.5 - $\frac{11(12)}{2}$= 78.5 U_o= 320.5 - $\frac{19(20)}{2}$= 130.5

Test statistic = 78.5

n_1=11, n_2= 19, the critical value at 5% significance level is 65 and 1% significance level is 50.

Since the test statistic is greater than 65 and 50, Ho is not rejected at 5% and 1% significance level. There is no sufficient evidence to support the claim that the scores of Round 2 of the 10 best US players is less than the scores of Round 2 of players from outside the US that finishes in the top 35.

For the scores of Round 4

Parametric test:

$\bar{x}_{us} = \frac{780}{11} = 70.91$ $\bar{x}_o = \frac{1357}{19} = 71.42$

$S_{us}^2 = \frac{55328 - 780^2/11}{10} = 1.891$ $S_o^2 = \frac{96999 - 1357^2/19}{18} = 4.480$

$H_o: \mu_o \le \mu_{us}$

$H_1: \mu_o > \mu_{us}$ (claim)

Test for equal variance:

$F = \frac{4.480}{1.891} = 2.369$

critical value:

$F_{0.005,18,10} \approx F_{0.005,12,10} = 5.661$

$F_{0.025,18,10} \approx F_{0.025,12,10} = 3.621$

$F_{0.05,18,10} \approx F_{0.05,12,10} = 2.913$

Since the test statistic does not fall in 0.5%, 2.5% and 5% rejection region, Ho is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for US players and players outside the US are equal.

pooled variance:

$S_p^2 = \frac{18(4.480) + 10(1.891)}{19 + 11 - 2} = 3.555$

Test statistic, $t = \frac{71.42 - 70.91}{\sqrt{(3.555)(\frac{1}{11} + \frac{1}{19})}} = 0.7139$

$P(t_{28} > 0.8546) < P(t_{28} > 0.7139) < P(t_{28} > 06834)$

$0.20 < \text{p-value} < 0.25$

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is not even a weak evidence to support the claim that the scores of Round 4 of the 10 best US players is less than the scores of Round 4 of players from outside the US that finishes in the top 35.

Non-parametric test:

(Mann-Whitney test)

H_o: Scores of Round 4 of the 10 best US players is equal or more than the scores of Round 4 of players from outside the US that finishes in the top 35

H_1: Scores of Round 4 of the 10 best US players is less than the scores of Round 4 of players from outside the US that finishes in the top 35 (claim)

Table 1.1: Scores of the 10 best US players and players from outside the US that finishes in the Top 35 in Round 4

Score	66	68	69	69	70	70	70	70	70	70	70	71	71	71	71
Rank	1	2	3.5	3.5	8	8	8	8	8	8	8	13.5	13.5	13.5	13.5
Player	O	O	US	O	US	US	US	US	O	O	O	US	US	US	O
Score	72	72	72	72	72	72	72	73	73	73	73	73	74	74	74
Rank	19	19	19	19	19	19	19	25	25	25	25	25	29	29	29
Player	US	US	O	O	O	O	O	O	O	O	O	O	US	O	O

R_{us}= 135 R_o= 322

U_{us}= 135 - $\frac{11(12)}{2}$= 69 U_o= 322 - $\frac{19(20)}{2}$= 132

Test statistic = 69

n_1=11, n_2= 19, the critical value at 5% significance level is 65 and 1% significance level is 50.

Since the test statistic is greater than 65 and 50, Ho is not rejected at 5% and 1% significance level. There is no sufficient evidence to support the claim that the scores of Round 4 of the 10 best US players is less than the scores of Round 4 of players from outside the US that finishes in the top 35.

Final total scores

Parametric test:

$\bar{x}_{us}$= $\frac{3128}{11}$= 284.36 $\bar{x}_{\text{o}}$= $\frac{5443}{19}$= 286.47

S_{us}^2= $\frac{889566-3128^2/11}{10}$= 7.427 S_o^2 = $\frac{1559477-5443^2/19}{18}$= 10.961

H_o: $\mu_o \leq \mu_{us}$

H_1: $\mu_o > \mu_{us}$ (claim)

Test for equal variance:

F= $\frac{10.961}{7.427}$ =1.476

critical value:

$F_{0.005,18,10} \approx F_{0.005,12,10}$= 5.661

$F_{0.025,18,10} \approx F_{0.025,12,10}$= 3.621

$F_{0.05,18,10} \approx F_{0.05,12,10}$= 2.913

Since the test statistic does not fall in 0.5%, 2.5% and 5% rejection region, Ho is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for US players and players outside the US are equal.

pooled variance:

$S_p^2 = \frac{18(10.961)+10(7.427)}{19+11-2}$= 9.969

Test statistic, t= $\frac{286.47-284.36}{\sqrt{(9.969)(\frac{1}{19}+\frac{1}{11})}}$= 1.764

P($t_{28} >$ 2.048) < P($t_{28} >$ 1.764) < P($t_{28} >$ 1.701)

0.025 < p-value < 0.05

Since the p-value is smaller than 0.05 but greater than 0.01, Ho is rejected at 5% and 10% significance level. There is sufficient evidence to support the claim that the final total scores of the 10 best US players is less than the final total scores of players from outside the US that finishes in the top 35.

Non-parametric test:

(Mann-Whitney test)

H_o: Final total scores of the 10 best US players is equal or more than the final total scores of players from outside the US that finishes in the top 35.

H_1: Final total scores of the 10 best US players is less than the final total scores of players from outside the US that finishes in the top 35 (claim)

Table 1.2: Final total scores of the 10 best US players and players from outside the US that finishes in the top 35.

Score	278	279	281	281	282	282	283	284	284	285	285	286	286	286	286
Rank	1	2	3.5	3.5	5.5	5.5	7	8.5	8.5	10.5	10.5	14.5	14.5	14.5	14.5
Player	O	US	US	US	O	O	O	US	O	US	O	US	US	US	US
Score	286	286	287	287	287	288	288	289	289	289	289	289	289	290	290
Rank	14.5	14.5	19	19	19	21.5	21.5	25.5	25.5	25.5	25.5	25.5	25.5	29.5	29.5
Player	O	O	O	US	US	O	O	O	O	O	O	O	O	O	O

R_{us}= 124 R_o= 341

U_{us}= 124 - $\frac{11(12)}{2}$= 58 U_o= 341 - $\frac{19(20)}{2}$= 151

Test statistic = 58

n_1=11, n_2= 19, the critical value at 5% significance level is 65 and 1% significance level is 50.

Since the test statistic is smaller than 65 but greater than 50, Ho is rejected at 5% significance level. There is sufficient evidence to support the claim that the final total scores of the 10 best US players is less than the final total scores of players from outside the US that finishes in the top 35**.**

A)v)For the scores of each given round and the final total scores, investigate if the scores of the 10 worst US players is more than the scores of players from outside the US that finishes outside the top 20.

For the scores of Round 2

Parametric test:

$\bar{x}_{us}$= $\frac{705}{10}$= 70.5 $\bar{x}_{\text{o}}$= $\frac{1498}{21}$= 71.33

S_{us}^2= $\frac{49763-705^2/10}{9}$= 6.722 S_o^2 = $\frac{106948-1498^2/21}{20}$= 4.583

H_o**:** $\mu_{us} \leq \mu_o$

H_1**:** $\mu_{us} > \mu_o$ (claim)

Test for equal variance:

F= $\frac{6.722}{4.583}$ =1.467

critical value:

$F_{0.005,9,20} \approx F_{0.005,8,20}$= 4.090

$F_{0.025,9,20} \approx F_{0.025,8,20}$= 2.913

$F_{0.05,9,20} \approx F_{0.05,8,20}$= 2.447

Since the test statistic does not fall in 0.5%, 2.5% and 5% rejection region, Ho is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for US players and players outside the US are equal.

pooled variance:

$S_p^2 = \frac{9(6.722)+20(4.583)}{10+21-2}$= 5.247

Test statistic, t= $\frac{70.5-71.33}{\sqrt{(5.247)(\frac{1}{10}+\frac{1}{21})}}$= -0.946

p-value= P(t_{29} >-0.946) = 1- P(t_{29} >0.946)

1- P(t_{29}> 0.8542) < 1- P(t_{29}> 0.946) < 1- P(t_{29}> 1.055)

0.80 < p-value < 0.85

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is not even a weak evidence to support the claim that the scores of Round 2 of the 10 worst US players is more than the scores of Round 2 of players from outside the US that finishes outside the top 20.

Non-parametric test:

(Mann-Whitney test)

H_o: Scores of Round 2 of the 10 worst US players is equal or less than the scores of Round 2 of players from outside the US that finishes outside the top 20

H_1: Scores of Round 2 of the 10 worst US players is more than the scores of Round 2 of players from outside the US that finishes outside the top 20 (claim)

Table 1.3: Scores of the 10 worst US players and players from outside the US that finishes outside the top 20 in Round 2

Score	66	67	68	68	69	69	70	70	70	70	70	70	71	71	71	71
Rank	1	2	3.5	3.5	5.5	5.5	9.5	9.5	9.5	9.5	9.5	9.5	16	16	16	16
Player	O	US	US	US	O	O	US	US	O	O	O	O	US	US	O	O
Score	71	71	71	72	72	72	72	73	73	73	73	73	74	76	76	
Rank	16	16	16	21.5	21.5	21.5	21.5	26	26	26	26	26	29	30.5	30.5	
Player	O	O	O	US	US	O	O	O	O	O	O	O	O	US	O	

R_{us}= 133.5 R_o= 362.5

U_{us}= 133.5 - $\frac{10(11)}{2}$= 78.5 U_o= 362.5 - $\frac{21(22)}{2}$= 131.5

Test statistic = 78.5

n_1=10, n_2= 21 ≈ n_2=20, the critical value of 5% significance level is 62 and 1% significance level is 47.

Since the test statistic is greater than 62 and 47, Ho is not rejected at 5% and 1% significance level. There is no sufficient evidence to support the claim that the scores of Round 2 of the 10 worst US players is more than the scores of Round 2 of players from outside the US that finishes outside the top 20.

For the scores of Round 4

Parametric test:

$\bar{x}_{us}= \frac{739}{10}= 73.9$ $\bar{x}_{o}= \frac{1546}{21}= 73.62$

$S_{us}^2= \frac{54653-739^2/10}{9}= 4.544$ $S_o^2 = \frac{113980-1546^2/21}{20}= 8.248$

$H_o: \mu_{us} \leq \mu_o$

$H_1: \mu_{us} > \mu_o$ (claim)

Test for equal variance:

$F= \frac{8.248}{4.544} =1.815$

critical value:

$F_{0.005,20,9} \approx F_{0.005,12,9}= 6.227$

$F_{0.025,20,9} \approx F_{0.025,12,9}=3.686$

$F_{0.05,20,9} \approx F_{0.05,12,9}= 3.073$

Since the test statistic does not fall in 0.5%, 2.5% and 5% rejection region, Ho is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for US players and players outside the US are equal.

pooled variance:

$S_p^2= \frac{9(4.544)+20(8.248)}{10+21-2}= 7.098$

Test statistic, $t= \frac{73.9-73.62}{\sqrt{(7.098)(\frac{1}{10}+\frac{1}{21})}}= 0.2735$

P(t_{29}> 0.5302) < P(t_{29}> 0.2735) < P(t_{29}> 0.2557)

0.30 < p-value < 0.40

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is not even a weak evidence to support the claim that the scores of Round 4 of the 10 worst US players is more than the scores of Round 4 of players from outside the US that finishes outside the top 20.

Non-parametric test:

(Mann-Whitney test**)**

H_o: Scores of Round 4 of the 10 worst US players is equal or less than the scores of Round 4 of players from outside the US that finishes outside the top 20

H_1: Scores of Round 4 of the 10 worst US players is more than the scores of Round 4 of players from outside the US that finishes outside the top 20 (claim)

Table 1.4: Scores of the 10 worst US players and players from outside the US that finishes outside the top 20 in Round 4

Score	69	70	70	71	71	72	72	72	72	72	72	72	73	73	73	73
Rank	1	2.5	2.5	4.5	4.5	9	9	9	9	9	9	9	15	15	15	15
Player	O	O	O	US	O	US	US	US	O	O	O	O	US	O	O	O
Score	73	74	74	75	75	75	76	76	76	76	76	76	77	78	81	
Rank	15	18.5	18.5	21	21	21	25.5	25.5	25.5	25.5	25.5	25.5	29	30	31	
Player	O	O	O	US	US	O	US	US	O	O	O	O	US	O	O	

R_{us}= 168.5 R_o= 327.5

U_{us}= 168.5 - $\frac{10(11)}{2}$= 113.5 U_o= 327.5 - $\frac{21(22)}{2}$= 96.5

Test statistic = 96.5

n_1=10, n_2= 21 ≈ n_2=20, the critical value of 5% significance level is 62 and 1% significance level is 47.

Since the test statistic is greater than 62 and 47, Ho is not rejected at 5% and 1% significance level. There is no sufficient evidence to support the claim that the scores of Round 4 of the 10 worst US players is more than the scores of Round 4 of players from outside the US that finishes outside the top 20.

Final total scores:

Parametric test:

$\bar{x}_{us}= \frac{2925}{10}= 292.5$

$\bar{x}_{o}= \frac{6117}{21}= 291.29$

$S_{us}^2= \frac{855649-2925^2/10}{9}= 9.611$

$S_o^2 = \frac{1781971-6117^2/21}{20}= 8.640$

$H_o: \mu_{us} \leq \mu_o$

$H_1: \mu_{us} > \mu_o$ (claim)

Test for equal variance:

$F= \frac{9.611}{8.640} =1.112$

critical value:

$F_{0.005,9,20} \approx F_{0.005,8,20}= 4.090$

$F_{0.025,9,20} \approx F_{0.025,8,20}= 2.913$

$F_{0.05,9,20} \approx F_{0.05,8,20}= 2.447$

Since the test statistic does not fall in 0.5%, 2.5% and 5% rejection region, Ho is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for US players and players outside the US are equal.

pooled variance:

$S_p^2= \frac{9(9.611)+20(8.640)}{10+21-2}= 8.941$

Test statistic, $t= \frac{292.5-291.29}{\sqrt{(8.941)(\frac{1}{10}+\frac{1}{21})}}= 1.057$

$P(t_{29} > 1.311) < P(t_{29} > 1.057) < P(t_{29} > 1.055)$

$0.10 < \text{p-value} < 0.15$

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is not even a weak evidence to support the claim that the final total scores of the 10 worst US players is more than the final total scores of players from outside the US that finishes outside the top 20.

Non-parametric test:

(Mann-Whitney test)

H_o: Final total scores of the 10 worst US players is equal or less than the final total scores of players from outside the US that finishes outside the top 20

H_1: Final total scores of the 10 worst US players is more than the final total scores of players from outside the US that finishes outside the top 20 (claim)

Table 1.5: Final total scores of the 10 worst US players and players from outside the US that finishes outside the top 20.

Score	288	288	289	289	289	289	289	289	289	289	290	290	290	290	291	291
Rank	1.5	1.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	12.5	12.5	12.5	12.5	15.5	15.5
Player	O	O	O	O	US	US	O	O	O	O	US	US	O	O	O	O
Score	292	292	292	292	292	292	293	293	293	295	296	296	297	298	299	
Rank	19.5	19.5	19.5	19.5	19.5	19.5	24	24	24	26	27.5	27.5	29	30	31	
Player	US	O	O	O	O	O	US	US	O	US	US	O	O	US	O	

R_{us}= 189 R_o= 307

U_{us}= 189 - $\frac{10(11)}{2}$= 134 U_o= 307 - $\frac{21(22)}{2}$= 76

Test statistic = 76

n_1=10, n_2= 21 ≈ n_2=20, the critical value of 5% significance level is 62 and 1% significance level is 47.

Since the test statistic is greater than 62 and 47, Ho is not rejected at 5% and 1% significance level. There is no sufficient evidence to support the claim that the final total scores of the 10 worst US players is more than the final total scores of players from outside the US that finishes outside the top 20.

A)vi)For the scores of each given round and the final total scores, investigate if the scores of the 10 best US players is less than the scores of the European players

Round 2

Parametric test:

$\bar{x}_{us}$= $\frac{771}{11}$= 70.09 $\bar{x}_{\text{O}}$= $\frac{1142}{16}$= 71.38

S_{us}^2= $\frac{54133-771^2/11}{10}$= 9.291 S_E^2 = $\frac{81570-1142^2/16}{15}$= 3.983

$H_o: \mu_E \leq \mu_{us}$

$H_1: \mu_E > \mu_{us}$ (claim)

Test for equal variance:

F = $\frac{9.291}{3.983}$= 2.333

critical value:

$F_{0.005,10,15}$= 4.424

$F_{0.025,10,15}$= 3.060

$F_{0.05,10,15}$= 2.544

Since the test statistic does not fall in 0.5%, 2.5% and 5% rejection region, Ho is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of the scores of US players and European players are equal.

pooled variance:

S_p^2= $\frac{10(9.291)+15(3.983)}{11+16-2}$= 6.106

Test statistic, t= $\frac{71.38-70.09}{\sqrt{(6.106)(\frac{1}{11}+\frac{1}{16})}}$= 1.333

P($t_{25} >$ 1.708) < P($t_{25} >$ 1.333) < P($t_{25} >$ 1.316)

0.05 < p-value < 0.10

Since the p-value is smaller than 0.10 but greater than 0.05, Ho is rejected at 10% significance level. There is weak evidence to support the claim that the scores of Round 2 of the 10 best US players is less than the scores of Round 2 of the European players.

Non-parametric test:

(Mann-Whitney test)

H_o: Scores of Round 2 of the 10 best US players is equal or more than the scores of Round 2 of the European players.

H_1: Scores of Round 2 of the 10 best US players is less than the scores of Round 2 of the European players

Table 1.6: Scores of the 10 best US players and European players in Round 2

Score	66	66	68	68	69	69	69	69	70	70	70	70	70	71
Rank	1.5	1.5	3.5	3.5	6.5	6.5	6.5	6.5	5	5	5	5	5	15
Player	US	E	US	US	US	US	US	US	US	E	E	E	E	E
Score	71	71	72	72	72	72	73	73	73	74	74	75	76	
Rank	15	15	18.5	18.5	18.5	18.5	22	22	22	24.5	24.5	26	27	
Player	E	E	US	E	E	E	E	E	E	E	E	US	US	

R_{us}= 111 R_E= 237

U_{us}= 111 - $\frac{11(12)}{2}$= 45 U_E= 237 - $\frac{16(17)}{2}$= 101

Test statistic = 111

n_1=11, n_2= 16, the critical value at 5% significance level is 54 and 1% significance level is 41.

Since the test statistic is greater than 54 and 41, Ho is not rejected at 5% and 1% significance level. There is no sufficient evidence to support the claim that the scores of Round 2 of the 10 best US players is less than the scores of Round 2 of the European players.

Round 4

Parametric test:

$\bar{x}_{us}$= $\frac{780}{11}$= 70.91 $\bar{x}_{\mathrm{E}}$= $\frac{1170}{16}$= 73.13

S_{us}^2= $\frac{55328-780^2/11}{10}$= 1.891 S_E^2 = $\frac{85770-1170^2/16}{15}$= 14.25

H_o: $\mu_E \leq \mu_{us}$

H_1: $\mu_E > \mu_{us}$ (claim)

Test for equal variance:

F= $\frac{14.25}{1.891}$ =7.536

critical value:

$F_{0.005,15,10} \approx F_{0.005,12,10}$= 5.661

$F_{0.025,15,10} \approx F_{0.025,12,10}$= 3.621

$F_{0.05,15,10} \approx F_{0.05,12,10}$= 2.913

Since the test statistic falls in 0.5%, 2.5% and 5% rejection region, Ho is rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for US players and European players are not equal.

t_{df}, df= $(\frac{14.25}{16} + \frac{1.891}{11})^2 \div [\frac{(14.25/16)^2}{15} + \frac{(1.891/11)^2}{10}]$

= 20.22≈ 20

Test statistic, t= $\frac{73.13-70.91}{\sqrt{(\frac{1.891}{11}+\frac{14.25}{16})}}$= 2.154

p-value= P($t_{20} > 2.154$) = 1-0.9801

p-value= 0.02

Since the p-value is smaller than 0.05 but greater than 0.01, Ho is rejected at 5% and 10% significance level. There is sufficient evidence to support the claim that the scores of Round 4 of the 10 best US players is less than the scores of Round 4 of the European players.

Non-parametric test

(Mann-Whitney test)

H_o: Scores of Round 4 of the 10 best US players is equal or more than the scores of Round 4 of the European players

H_1: Scores of Round 4 of the 10 best US players is less than the scores of Round 4 of the European players (claim)

Table 1.7: Scores of the 10 best US players and European players in Round 4

Score	66	68	69	69	70	70	70	70	70	71	71	71	72	72
Rank	1	2	3.5	3.5	7	7	7	7	7	11	11	11	14.5	14.5
Player	E	E	US	E	US	US	US	US	E	US	US	US	US	US
Score	72	72	73	73	73	74	74	74	75	76	76	78	81	
Rank	14.5	14.5	18	18	18	22	22	22	23	24.5	24.5	26	27	
Player	E	E	E	E	E	US	E	E	E	E	E	E	E	

R_{us}= 115.5 R_E= 265.5

U_{us}= 115.5 - $\frac{11(12)}{2}$= 49.5 U_E= 265.5 - $\frac{16(17)}{2}$= 129.5

Test statistic = 49.5

n_1=11, n_2= 16, the critical value at 5% significance level is 54 and 1% significance level is 41.

Since the test statistic is smaller than 54, Ho is rejected at 5% significance level. There is sufficient evidence to support the claim that the scores of Round 4 of the 10 best US players is less than the scores of Round 4 of the European players.

Final Total score

Parametric test:

$\bar{x}_{us}=\frac{3128}{11}= 284.36$ $\bar{x}_{\mathrm{E}}=\frac{4632}{16}= 289.5$

$S_{us}^2=\frac{889566-3128^2/11}{10}= 7.427$ $S_E^2=\frac{1341208-4632^2/16}{15}= 16.267$

$H_o: \mu_E \leq \mu_{us}$

$H_1: \mu_E > \mu_{us}$ (claim)

Test for equal variance:

$F=\frac{16.267}{7.427}=2.190$

critical value:

$F_{0.005,15,10} \approx F_{0.005,12,10}= 5.661$

$F_{0.025,15,10} \approx F_{0.025,12,10}= 3.621$

$F_{0.05,15,10} \approx F_{0.05,12,10}= 2.913$

Since the test statistic does not fall in 0.5%, 2.5% and 5% rejection region, Ho is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for US players and European players are equal

pooled variance:

$S_p^2=\frac{15(16.267)+10(7.427)}{16+11-2}= 12.731$

Test statistic, $t=\frac{289.5-284.36}{\sqrt{(12.731)(\frac{1}{16}+\frac{1}{11})}}= 3.678$

$P(t_{25} > 3.725) < P(t_{25} > 3.678) < P(t_{25} > 3.450)$

$0.0005 < \text{p-value} < 0.001$

Since the p-value is smaller than 0.01, Ho is rejected at 1%, 5% and 10% significance level. There is strong evidence to support the claim that the final total scores of the 10 best US players is less than the final total scores of the European players.

Non-parametric test:

(Mann-Whitney test)

H_o: Final total scores of the 10 best US players is equal or more than the final total scores of the European players

H_1: Final total scores of the 10 best US players is less than the final total scores of the European players(claim)

Table 1.8: Final total scores of the 10 best US players and European players

Score	279	281	281	282	283	284	285	286	286	286	286	286	287	287
Rank	1	2.5	2.5	4	5	6	7	10	10	10	10	10	14	14
Player	US	US	US	E	E	US	US	US	US	US	US	E	US	US
Score	287	288	288	289	289	290	290	291	291	292	293	296	297	
Rank	14	16.5	16.5	18.5	18.5	20.5	20.5	22.5	22.5	24	25	26	27	
Player	E	E	E	E	E	E	E	E	E	E	E	E	E	

R_{us}= 87 R_E= 291

U_{us}= 87 - $\frac{11(12)}{2}$= 21 U_E= 291 - $\frac{16(17)}{2}$= 155

Test statistic = 21

n_1=11, n_2= 16, the critical value at 5% significance level is 54 and 1% significance level is 41.

Since the test statistic is smaller than 54 and 41, Ho is rejected at 5% and 1% significance level. There is strong evidence to support the claim that the final total scores of the 10 best US players is less than the final total scores of the European players.

A)vi)For the scores of each given round and the final total scores, investigate if the scores of the 10 worst US players is more than the scores of the European players

For the scores of Round 2:

Parametric test:

$\bar{x}_{us}$= $\frac{705}{10}$= 70.5 $\bar{x}_{\mathrm{E}}$ = $\frac{1142}{16}$= 71.38

S^2_{us}= $\frac{49763-705^2/10}{9}$= 6.722 S^2_E = $\frac{81570-1142^2/16}{15}$= 3.983

H_o: $\mu_{us} \leq \mu_E$

H_1: $\mu_{us} > \mu_E$ (claim)

Test for equal variance:

F= $\frac{6.722}{3.983}$ =1.688

critical value:

$F_{0.005,9,15} \approx F_{0.005,8,15}$= 4.674

$F_{0.025,9,15} \approx F_{0.025,8,15}$= 3.199

$F_{0.05,9,15} \approx F_{0.05,8,15}$= 2.641

Since the test statistic does not fall in 0.5%, 2.5% and 5% rejection region, Ho is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for US players and European players are equal.

pooled variance:

S_p^2= $\frac{9(6.722)+15(3.983)}{10+16-2}$= 5.01

Test statistic, t= $\frac{70.5-71.38}{\sqrt{(5.01)(\frac{1}{10}+\frac{1}{16})}}$= -0.975

p-value= P(t_{24}>-0.975) = 1- P(t_{24}>0.975)

1- P($t_{24} >$ 0.8569) < 1- P($t_{24} >$ 0.975) < 1- P($t_{24} >$ 1.059)

0.80 < p-value < 0.85

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is not even a weak evidence to support the claim that the scores of Round 2 of the 10 worst US players is more than the scores of Round 2 of the European players.

Non-parametric test:

(Mann-Whitney test)

H_o: Scores of Round 2 of the 10 worst US players is equal or less than the scores of Round 2 of the European players

H_1: Scores of Round 2 of the 10 worst US players is more than the scores of Round 2 of the European players (claim)

Table 1.9: Scores of the 10 worst US players and European players in Round 2

Score	66	67	68	68	70	70	70	70	70	70	71	71	71
Rank	1	2	3.5	3.5	7.5	7.5	7.5	7.5	7.5	7.5	13	13	13
Player	E	US	US	US	US	US	E	E	E	E	US	US	E
Score	71	71	72	72	72	72	72	73	73	73	74	74	76
Rank	13	13	18	18	18	18	18	22	22	22	24.5	24.5	26
Player	E	E	US	US	E	E	E	E	E	E	E	E	US

R_{us}= 112 R_E= 239

U_{us}= 112 - $\frac{10(11)}{2}$= 57 U_E= 239 - $\frac{16(17)}{2}$= 103.5

Test statistic = 57

n_1=10, n_2= 16, the critical value at 5% significance level is 48 and 1% significance level is 36.

Since the test statistic is greater than 48 and 36, Ho is not rejected at 5% and 1% significance level. There is no sufficient evidence to support the claim that the scores of Round 2 of the 10 worst US players is more than the scores of Round 2 of the European players.

For the scores of Round 4

Parametric test:

$\bar{x}_{us}$= $\frac{739}{10}$= 73.9 $\bar{x}_{\mathrm{E}}$= $\frac{1170}{16}$= 73.13

S_{us}^2= $\frac{54653-739^2/10}{9}$= 4.544 S_E^2 = $\frac{85770-1170^2/16}{15}$= 14.25

H_o: $\mu_{us} \leq \mu_E$

H_1: $\mu_{us} > \mu_E$ (claim)

Test for equal variance:

F= $\frac{14.25}{4.544}$ =3.136

critical value:

$F_{0.005,15,9} \approx F_{0.005,12,9}$= 6.227

$F_{0.025,15,9} \approx F_{0.025,12,9}$=3.686

$F_{0.05,15,9} \approx F_{0.05,12,9}$= 3.073

Since the test statistic falls in 5% rejection region, Ho is rejected at 10% significance level. There is weak evidence that the variances of scores for US players and European players are not equal.

t_{df}, df= $(\frac{14.25}{16}+\frac{4.544}{10})^2 \div [\frac{(14.25/16)^2}{15}+\frac{(4.544/10)^2}{9}]$

= 23.86≈ 24

Test statistic, t= $\frac{73.9-73.13}{\sqrt{(\frac{4.5441}{10}+\frac{14.25}{16})}}$= 0.6639

p-value= P(t_{24}>0.6639) = 1-0.7547

p-value= 0.2453

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is not even weak evidence to support the claim that the scores of Round 4 of the 10 worst US players is more than the scores of Round 4 of the European players.

Non-parametric test:

(Mann-Whitney test)

H_o: Scores of Round 4 of the 10 worst US players is equal or less than the scores of Round 4 of the European players

H_1: Scores of Round 4 of the 10 worst US players is more than the scores of Round 4 of the European players (claim)

Table 2.0: Scores of the 10 worst US players and European players in Round 4

Score	66	68	69	70	71	72	72	72	72	72	73	73	73
Rank	1	2	3	4	5	8	8	8	8	8	12.5	12.5	12.5
Player	E	E	E	E	US	US	US	US	E	E	US	E	E
Score	73	74	74	75	75	75	76	76	76	76	77	78	81
Rank	12.5	15.5	15.5	18	18	18	21.5	21.5	21.5	21.5	24	25	26
Player	E	E	E	US	US	E	US	US	E	E	US	E	E

R_{us}= 144.5 R_E= 206.5

U_{us}= 144.5 - $\frac{10(11)}{2}$= 89.5 U_E= 206.5 - $\frac{16(17)}{2}$= 70.5

Test statistic = 70.5

n_1=10, n_2= 16, the critical value at 5% significance level is 48 and 1% significance level is 36.

Since the test statistic is greater than 48 and 36, Ho is not rejected at 5% and 1% significance level. There is no sufficient evidence to support the claim that the scores of Round 4 of the 10 worst US players is more than the scores of Round 4 of the European players.

Final total scores

Parametric test:

$\bar{x}_{us}=\frac{2925}{10}= 292.5$ $\bar{x}_{\text{E}}=\frac{4632}{16}= 289.5$

$S^2_{us}=\frac{855649-2925^2/10}{9}= 9.611$ $S^2_E=\frac{1341208-4632^2/16}{15}= 16.267$

$H_o\text{:}\ \mu_{us} \leq \mu_E$

$H_1\text{:}\ \mu_{us} > \mu_E$ (claim)

Test for equal variance:

$\text{F}=\frac{16.267}{9.611}=1.693$

critical value:

$F_{0.005,15,9} \approx F_{0.005,12,9}= 6.227$

$F_{0.025,15,9} \approx F_{0.025,12,9}=3.686$

$F_{0.05,15,9} \approx F_{0.05,12,9}= 3.073$

Since the test statistic does not fall in 0.5%, 2.5% and 5% rejection region, Ho is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for US players and European players are equal.

pooled variance:

$S^2_p=\frac{9(9.611)+15(16.267)}{10+16-2}= 13.771$

Test statistic, $t=\frac{292.5-289.5}{\sqrt{(13.771)(\frac{1}{10}+\frac{1}{16})}}= 2.005$

p-value= $P(t_{24} > 2.005) = 1-0.9715$

p-value= 0.0285

Since the p-value is smaller than 0.05 but greater than 0.10, Ho is rejected at 5% and 10% significance level. There is sufficient evidence to support the claim that the final total scores of the 10 worst US players is more than the final total scores of the European players.

Non-parametric test:

(Mann-Whitney test)

H_o: Final total scores of the 10 worst US players is equal or less than the final total scores of the European players

H_1: Final total scores of the 10 worst US players is more than the final total scores of the European players (claim)

Table 2.1: Final total scores of the 10 worst US players and European players.

Score	282	283	286	287	288	288	289	289	289	289	290	290	290
Rank	1	2	3	4	5.5	5.5	8.5	8.5	8.5	8.5	12.5	12.5	12.5
Player	E	E	E	E	E	E	US	US	E	E	US	US	E
Score	290	291	291	292	292	293	293	293	295	296	296	297	298
Rank	12.5	15.5	15.5	17.5	17.5	20	20	20	22	23.5	23.5	25	26
Player	E	E	E	E	US	US	US	E	US	US	E	E	US

R_{us}= 171 R_E= 180

U_{us}= 171 - $\frac{10(11)}{2}$= 116 U_E= 180 - $\frac{16(17)}{2}$= 44

Test statistic = 44

n_1=10, n_2= 16, the critical value at 5% significance level is 48 and 1% significance level is 36.

Since the test statistic is smaller than 48, Ho is rejected at 5% significance level. There is sufficient evidence to support the claim that the final total scores of the 10 worst US players is more than the final total scores of the European players.

A)vii) For the scores of each given round and the final total scores, investigate if the scores of the 10 best US players is less than the scores of players from outside the US and also outside the European countries (other parts of the world)

ROUND 2:

Parametric Test:

$n_{Best\ US}$= 11 $n_{Non\ US\ and\ Euro}$= 14

$\underline{x}_{Best\ US}$= $\frac{771}{11}$= 70.09 $\underline{x}_{Non\ US\ and\ Euro}$= $\frac{988}{14}$= 70.57

$S^2_{Best\ US}$= $\frac{54653-11\ (70.09)^2}{10}$= 9.431 $S^2_{Non\ US\ and\ Euro}$= $\frac{69798-14\ (70.57)^2}{13}$= 5.865

H_o: $\mu_{10 \text{ best US}} \geq \mu_{\text{Non US and Europe}}$

H_1: $\mu_{10 \text{ best US}} < \mu_{\text{Non US and Europe}}$ (claim)

Test for equal variance:

$$F = \frac{9.431}{5.865} = 1.608$$

critical value:

$F_{0.005,10,13}$ = 4.820

$F_{0.025,10,13}$ = 3.250

$F_{0.05,10,13}$ = 2.671

Since the test statistic does not fall in the 0.5%, 2.5% and 5% rejection region, the null hypothesis is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for 10 best US players and players outside the US and also outside the European countries are equal.

The pooled variance is given by:

$$S_p^2 = \frac{10(9.431) + 13\ (5.865)}{11 + 14 - 2} = 7.415$$

Test statistic:

$$t = \frac{(70.09 - 70.57)}{\sqrt{(7.415)\ (\frac{1}{11} + \frac{1}{14})}} = -0.437$$

$t_{0.10,23} = -1.319$, $t_{0.05,23} = -1.714$, $t_{0.01,23} = -2.500$. Since the test statistic does not fall in the rejection region at 10%, 5% and 1% significance level, do not reject the null hypothesis and conclude that there is not enough evidence to support the claim that the scores of 10 best US players is less than the scores of players from outside the US and also outside the European countries.

P-value approach:

$$\text{p-value} = P(t_{23} > 0.437) \approx 1 - P(t_{20} < 0.40) = 1 - 0.6533 = 0.3467$$

Since p-value is greater than α=0.10, α=0.05, and α=0.01 ,do not reject the null hypothesis. Thus, there is not even weak evidence to support the claim that the scores of 10 best US players is less than the scores of players from outside the US and also the outside European countries.

Non-parametric test:

Independent- Mann Whitney Test

H_o: The score of 10 best US players equal or greater than the scores of players from outside the US and also outside the European countries in Round 2

H_1: The score of 10 best US players is less than the scores of players from outside the US and also outside the European countries in Round 2. (claim)

Let US player equal to U and let Non US and European player equal to O

Table 2.2: Score of 10 best US players and players from outside the US and also outside the European countries in Round 2

Score	66	67	68	68	68	69	69	69	69	69	69	69	69
Rank	1	2	4	4	4	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
Player	U	O	U	U	O	U	U	U	U	O	O	O	O

Score	70	70	70	71	71	71	72	73	73	75	76	76
Rank	15	15	15	18	18	18	20	21.5	21.5	23	24.5	24.5
Player	U	U	O	O	O	O	O	O	O	U	U	O

n_{US}: 11 players n_O:14 players

The sum of R_U = 124.5 while the sum of R_o = 200.5. The corresponding statistics are:

U_U: $124.5 - \frac{11(12)}{2} = 58.5$ U_O: $200.5 - \frac{14(15)}{2} = 95.5$

n_1=11, n_2= 14, the critical value at 5% significance level is 46 and 1% significance level is 34.

The test statistic is 58.5. Since the test statistic is greater than the critical values, do not reject the null hypothesis indicating that there is not enough evidence to support the claim that the scores of the 10 best US players is less than the scores of players from outside the US and also outside the European countries.

ROUND 4:

Parametric Test:

$n_{Best\ US}$= 11 $n_{Non\ US\ and\ Euro}$= 14

$\underline{x}_{Best\ US} = \frac{780}{11} = 70.91$ $\underline{x}_{Non\ US\ and\ Euro} = \frac{1018}{14} = 72.71$

$S^2_{Best\ US} = \frac{55328-11\ (70.91)^2}{10} = 1.749$ $S^2_{Non\ US\ and\ Euro} = \frac{74068-14\ (72.71)^2}{13} = 4.123$

H_o: $\mu_{10 \text{ best US}} \geq \mu_{\text{Non US and Europe}}$

H_1: $\mu_{10 \text{ best US}} < \mu_{\text{Non US and Europe}}$ (claim)

Test for equal variance:

$$F = \frac{4.123}{1.749} = 2.357$$

critical value:

$F_{0.005,13,10} \approx F_{0.005,12,10} = 5.661$

$F_{0.025,13,10} \approx F_{0.025,12,10} = 3.621$

$F_{0.05,13,10} \approx F_{0.05,12,10} = 2.913$

Since the test statistic does not fall in the 0.5%, 2.5% and 5% rejection region, the null hypothesis is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for 10 best US players and players outside the US and also outside the European countries are equal.

The pooled variance is given by:

$$S_p^2 = \frac{13\ (4.123) + 10\ (1.749)}{14 + 11 - 2} = 3.091$$

Test statistic:

$$t = \frac{(72.71 - 70.91)}{\sqrt{(3.091)\ (\frac{1}{14} + \frac{1}{11})}} = 2.541$$

$t_{0.10,23} = 1.319$, $t_{0.05,23} = 1.714$, $t_{0.01,23} = 2.500$. Since the test statistic fall in the rejection region at 10% and 5% significance level but not in the 1% significance level, reject the null hypothesis and conclude that there is sufficient evidence to support the claim that the scores of 10 best US players is less than the scores of players from outside the US and also outside the European countries.

P-value approach:

$$\text{p-value} = P(t_{23} > 2.541) \approx 1 - P(t_{20} < 2.5) = 1 - 0.9894 = 0.0106$$

Since p-value is smaller than α=0.10, α=0.05, and α=0.01 ,reject the null hypothesis. Thus, there is strong evidence to support the claim that the scores of 10 best US players is less than the scores of players from outside the US and also the outside European countries.

Non-parametric test:

Independent- Mann Whitney Test

H_o: The score of 10 best US players equal or greater than the scores of players from outside the US and also outside the European countries in Round 4

H_1: The score of 10 best US players is less than the scores of players from outside the US and also outside the European countries in Round 4. (claim)

Let US player equal to U and let Non US and European player equal to O

Table 2.3: Scores of 10 best US players and players from outside the US and also outside the European countries in Round 4

Score	69	70	70	70	70	70	70	71	71	71	71	72	72
Rank	1	4.5	4.5	4.5	4.5	4.5	4.5	9.5	9.5	9.5	9.5	14.5	14.5
Player	U	U	U	U	U	O	O	U	U	U	O	U	U

Score	72	72	72	72	73	73	73	74	74	74	76	76
Rank	14.5	14.5	14.5	14.5	19	19	19	22	22	22	24.5	24.5
Player	O	O	O	O	O	O	O	U	O	O	O	O

n_{US}: 11 players n_O:14 players

The sum of R_U = 98.5 while the sum of R_o = 226.5.

The corresponding statistics are:

U_U: $98.5 - \frac{11(12)}{2} = 32.5$ U_O: $226.5 - \frac{14(15)}{2} = 121.5$

n_1=11, n_2= 14, the critical value at 5% significance level is 46 and 1% significance level is 34.

The test statistic is 32.5. Since the test statistic is smaller than the critical values at both significance levels, reject the null hypothesis indicating that there is strong evidence to support the claim that the scores of the 10 best US players is less than the scores of players from outside the US and also outside the European countries.

FINAL SCORES

Parametric Test:

$n_{Best\ US}$= 11 $n_{Non\ US\ and\ Euro}$= 14

$\underline{x}_{Best\ US}$= $\frac{3128}{11}$= 284.36 $\underline{x}_{Non\ US\ and\ Euro}$= $\frac{4038}{14}$= 288.43

$S^2_{Best\ US}$= $\frac{889566-11\ (284.36)^2}{10}$= 9.929 $S^2_{Non\ US\ and\ Euro}$= $\frac{1165026-14\ (288.43)^2}{13}$= 26.145

H_o: $\mu_{10\ best\ US} \geq \mu_{Non\ US\ and\ Europe}$

H_1: $\mu_{10\ best\ US} < \mu_{Non\ US\ and\ Europe}$ (claim)

Test for equal variance:

$$F = \frac{26.145}{9.929} = 2.633$$

critical value:

$F_{0.005,13,10} \approx F_{0.005,12,10}$ = 5.661

$F_{0.025,13,10} \approx F_{0.025,12,10}$ = 3.621

$F_{0.05,13,10} \approx F_{0.05,12,10}$= 2.913

Since the test statistic does not fall in the 0.5%, 2.5% and 5% rejection region, the null hypothesis is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for 10 best US players and players outside the US and also outside the European countries are equal.

The pooled variance is given by:

$$S_p^2 = \frac{13\ (26.145) + 10\ (9.929)}{14 + 11 - 2} = 19.095$$

Test statistic:

$$t = \frac{(288.43-284.36)}{\sqrt{(19.095)\ (\frac{1}{14}+\frac{1}{11})}} = 2.312$$

$t_{0.10,23}$ = 1.319, $t_{0.05,23}$ = 1.714, $t_{0.01,23}$= 2.500. Since the test statistic fall in the rejection region at 10% and 5% but not in the 1% significance level, reject the null hypothesis at 10% and 5% significance level and conclude that there is sufficient evidence to support the claim that the scores of 10 best US players is less than the scores of players from outside the US and also outside the European countries.

P-value approach:

$$\text{p-value} = P(t_{23} > 2.312) \approx 1 - P(t_{20} < 2.3) = 1 - 0.9838 = 0.0162$$

Since p-value is smaller than α=0.10 and α=0.05 but greater than α=0.01,reject the null hypothesis at 5% and 10% significance level. Thus, there is enough evidence to support the claim that the scores of 10 best US players is less than the scores of players from outside the US and also the outside European countries.

Non-parametric test:

Independent- Mann Whitney Test

H_o: Scores of 10 best US players equal or greater than the scores of players from outside the US and also outside the European countries in final

H_1: Scores of 10 best US players is less than the scores of players from outside the US and also outside the European countries in final. (claim)

Let US player equal to U and let Non US and European player equal to O

Table 2.4: Final total scores of 10 best US players and players from outside the US and also outside the European countries

Score	278	279	281	281	282	284	284	285	285	286	286	286	286
Rank	1	2	3.5	3.5	5	6.5	6.5	8.5	8.5	12	12	12	12
Player	O	U	U	U	O	U	O	O	U	O	U	U	U

Score	286	287	287	289	289	289	289	292	292	292	292	299
Rank	12	15.5	15.5	18.5	18.5	18.5	18.5	22.5	22.5	22.5	22.5	25
Player	U	U	U	O	O	O	O	O	O	O	O	O

n_{US}: 11 players n_O:14 players

The sum of R_U = 103 while the sum of R_o = 222

The corresponding statistics are:

U_U: $103 - \frac{11(12)}{2} = 37$ U_O: $222 - \frac{14(15)}{2} = 117$

n_1=11, n_2= 14, the critical value at 5% significance level is 46 and 1% significance level is 34.

The test statistic is 37. Since the test statistic is smaller than 46, reject the null hypothesis at 5% significance level indicating that there is enough evidence to support the claim that the scores of the 10 best US players is less than the scores of players from outside the US and also outside the European countries.

A)vii) For the scores of each given round and the final total scores, investigate if the scores of the 10 worst US players is more than the scores of players from outside the US and also outside the European countries (other parts of the world).

(Round 2)

$n_{Worst\ US}$= 10 $\quad$ $n_{Non\ US\ and\ Euro}$= 14

$\underline{x}_{Worst\ US}$= $\frac{705}{10}$= 70.5 $\quad$ $\underline{x}_{Non\ US\ and\ Euro}$= $\frac{988}{14}$= 70.57

$S^2_{Worst\ US}$= $\frac{49763-10\ (70.5)^2}{9}$= 6.722 $\quad$ $S^2_{Non\ US\ and\ Euro}$= $\frac{69798-14\ (70.57)^2}{13}$= 5.865

H_o: $\mu_{10\ worst\ US} \leq \mu_{Non\ US\ and\ Europe}$

H_1: $\mu_{10\ worst\ US} > \mu_{Non\ US\ and\ Europe}$ (claim)

Test for equal variance:

$$F = \frac{6.722}{5.865} = 1.146$$

critical value:

$F_{0.005,9,13} \approx F_{0.005,8,13}$ = 5.076

$F_{0.025,9,13} \approx F_{0.025,8,13}$ = 3.388

$F_{0.05,9,13} \approx F_{0.05,8,13}$= 2.767

Since the test statistic does not fall in the 0.5%, 2.5% and 5% rejection region, the null hypothesis is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for 10 worst US players and players from outside the US and outside European countries are equal.

The pooled variance is given by:

$$S^2_p = \frac{9\ (6.722) + 13\ (5.865)}{10 + 14 - 2} = 6.216$$

Test statistic:

$$t=\frac{(70.5-70.57)}{\sqrt{(6.216)\left(\frac{1}{10}+\frac{1}{14}\right)}}= -0.0678$$

$t_{0.10,22}$ = -1.321, $t_{0.05,22}$ = -1.717, $t_{0.01,22}$= -2.508. Since the test statistic does not fall in the rejection region at 10%,5% and 1% significance level, the null hypothesis not rejected and conclude that there is not even weak evidence to support the claim that the scores of 10 worst US players is more than the scores of players from outside the US and also outside the European countries.

P-value approach:

p-value= $P(t_{22} > 0.0678) \approx 1- P(t_{20} < 0.1)$ = 1-0.5393 = 0.4607

Since p-value is greater than α=0.10 and α=0.05 and α=0.01, the null hypothesis is not rejected. Thus, there is not even weak evidence to support the claim that the scores of 10 worst US players is more than the scores of players from outside the US and also the outside European countries.

Non-parametric test:

Independent- Mann Whitney Test

H_o: The score of 10 worst US players equal or smaller than the scores of players from outside the US and also outside the European countries in Round 2

H_1: The score of 10 worst US players is more than the scores of players from outside the US and also outside the European countries in Round 2 (claim)

Let US players equal to U and let Non US and European players equal to O.

Table 2.5: Scores of 10 worst US players and players from outside the US and also outside the European countries in Round 2

Scores	67	67	68	68	68	69	69	69	69	70	70	70
Rank	1.5	1.5	4	4	4	7.5	7.5	7.5	7.5	11	11	11
Player	O	U	U	U	O	O	O	O	O	U	U	O

Scores	71	71	71	71	71	72	72	72	73	73	76	76
Rank	15	15	15	15	15	19	19	19	21.5	21.5	23.5	23.5
Player	U	U	O	O	O	U	U	O	O	O	O	U

n_{US}: 10 players n_O:14 players

The sum of R_U = 123 while the sum of R_o = 177

The corresponding statistics are:

U_U: 123 - $\frac{10(11)}{2}$ = 68 U_O: 177 - $\frac{14(15)}{2}$ = 72

n_1=10, n_2= 14, the critical value at 5% significance level is 41 and 1% significance level is 30

The test statistic is 68. Since the test statistic is greater than the critical values at both significance levels, the null hypothesis is not rejected indicates that there is not enough evidence to support the claim that the scores of the 10 worst US players is more than the scores of players from outside the US and also outside the European countries.

(ROUND 4)

Parametric Test

$n_{worst\ US}$= 10

$\underline{x}_{Worst\ US}$= $\frac{739}{10}$= 73.9

$S^2_{Worst\ US}$= $\frac{54653-10\ (73.9)^2}{9}$= 4.544

$n_{Non\ US\ and\ Euro}$= 14

$\underline{x}_{Non\ US\ and\ Euro}$= $\frac{1018}{14}$= 72.71

$S^2_{Non\ US\ and\ Euro}$= $\frac{74068-14\ (72.71)^2}{13}$= 4.123

H_o: $\mu_{10\ worst\ US} \leq \mu_{Non\ US\ and\ Europe}$

H_1: $\mu_{10\ worst\ US} > \mu_{Non\ US\ and\ Europe}$ (claim)

Test for equal variance:

$$F = \frac{4.544}{4.123} = 1.102$$

critical value:

$F_{0.005,9,13} \approx F_{0.005,8,13}$ = 5.076

$F_{0.025,9,13} \approx F_{0.025,8,13}$ = 3.388

$F_{0.05,9,13} \approx F_{0.05,8,13}$= 2.767

Since the test statistic does not fall in the 0.5%, 2.5% and 5% rejection region, the null hypothesis is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for 10 worst US players and players from outside the US and outside European countries are equal.

The pooled variance is given by:

$S_p^2 = \frac{9\,(4.544) + 13\,(4.123)}{10 + 14 - 2} = 4.295$

Test statistic:

$t = \frac{(73.9 - 72.71)}{\sqrt{(4.295)\,(\frac{1}{10} + \frac{1}{14})}} = 1.387$

$t_{0.10,22}$ = 1.321, $t_{0.05,22}$ = 1.717, $t_{0.01,22}$= 2.508. Since the test statistic fall in the 10% significance level but not in the 5% and 1% significance levels, the null hypothesis not rejected and conclude that there is not sufficient evidence to support the claim that the scores of 10 worst US players is more than the scores of players from outside the US and also outside the European countries.

P-value approach:

p-value= $P(t_{22} > 1.387) \approx 1 - P(t_{20} < 1.40)$ = 1-0.9116 = 0.0884

Since p-value smaller than α=0.10 but greater than α=0.05 and α=0.01, the null hypothesis is rejected at 10% significance level. Thus, there is weak evidence to support the claim that the scores of 10 worst US players is more than the scores of players from outside the US and also the outside European countries.

Non-parametric test:

Independent- Mann Whitney Test

H_o: The score of 10 worst US players equal or smaller than the scores of players from outside the US and also outside the European countries in Round 4

H_1: The score of 10 worst US players is more than the scores of players from outside the US and also outside the European countries in Round 4 (claim)

Let US players equal to U and let Non US and European players equal to O.

Table 2.6: Scores of 10 worst US players and players from outside the US and also outside the European countries in Round 4

Scores	70	70	71	71	72	72	72	72	72	72	72	73
Rank	1.5	1.5	3.5	3.5	8	8	8	8	8	8	8	13.5
Player	O	O	O	U	U	U	U	O	O	O	O	U

Scores	73	73	73	74	74	75	75	76	76	76	76	77
Rank	13.5	13.5	13.5	16.5	16.5	18.5	18.5	21.5	21.5	21.5	21.5	24
Player	O	O	O	O	O	U	U	U	U	O	O	U

n_{US}: 10 players n_O:14 players

The sum of R_U = 145, while the sum of R_o = 155

The corresponding statistics are:

U_U: 145 - $\frac{10(11)}{2}$= 90 U_O: 155 - $\frac{14(15)}{2}$= 50

n_1=10, n_2= 14, the critical value at 5% significance level is 41 and 1% significance level is 30

The test statistic is 50 . Since the test statistic is greater than the critical values at both significance levels, the null hypothesis is not rejected indicates that there is not enough evidence to support the claim that the scores of the 10 worst US players is more than the scores of players from outside the US and also outside the European countries.

(FINAL SCORES)

Parametric Test:

$n_{Worst\ US}$= 10 $n_{Non\ US\ and\ Euro}$= 14

$\underline{x}_{Worst\ US}$= $\frac{2925}{10}$= 292.5 $\underline{x}_{Non\ US\ and\ Euro}$= $\frac{4038}{14}$= 288.43

$S^2_{Worst\ US}$= $\frac{855649-10\ (292.5)^2}{9}$= 9.611 $S^2_{Non\ US\ and\ Euro}$= $\frac{1165026-14\ (288.43)^2}{13}$= 26.145

H_o: $\mu_{10\ best\ US} \geq \mu_{Non\ US\ and\ Europe}$

H_1: $\mu_{10\ best\ US} < \mu_{Non\ US\ and\ Europe}$ (claim)

Test for equal variance:

$F = \frac{26.145}{9.611}$= 2.720

critical value:

$F_{0.005,13,9} \approx F_{0.005,12,9}$ = 6.227

$F_{0.025,13,9} \approx F_{0.025,12,9}$ = 3.868

$F_{0.05,13,9} \approx F_{0.05,12,9}$= 3.073

Since the test statistic does not fall in the 0.5%, 2.5% and 5% rejection region, the null hypothesis is not rejected at 1%, 5% and 10% significance level. There is strong evidence that the variances of scores for 10 worst US players and players from outside the US and outside European countries are equal.

The pooled variance is given by:

$S_p^2 = \frac{13\ (26.145) + 9\ (9.611)}{14 + 10 - 2} = 19.381$

Test statistic:

$t = \frac{(292.5 - 288.43)}{\sqrt{(19.381)\ (\frac{1}{14} + \frac{1}{10})}} = 2.233$

$t_{0.10,22} = 1.321$, $t_{0.05,22} = 1.717$, $t_{0.01,22} = 2.508$ Since the test statistic fall in the rejection region at 10% and 5% but not in the 1% significance level, reject the null hypothesis at 10% and 5% significance level and conclude that there is sufficient evidence to support the claim that the scores of 10 worst US players is more than the scores of players from outside the US and also outside the European countries.

P-value approach:

$$\text{p-value} = P(t_{22} > 2.233) \approx 1 - P(t_{20} < 2.2) = 1 - 0.9801 = 0.0198$$

Since p-value is smaller than α=0.10 and α=0.05 but greater than α=0.01,reject the null hypothesis at 5% and 10% significance level. Thus, there is enough evidence to support the claim that the scores of 10 worst US players is more than the scores of players from outside the US and also the outside European countries.

Non-parametric test:

Independent- Mann Whitney Test

H_o: The score of 10 worst US players equal or smaller than the scores of players from outside the US and also outside the European countries in final

H_1: The score of 10 worst US players is more than the scores of players from outside the US and also outside the European countries in final (claim)

Let US players equal to U and let Non US and European players equal to O.

Table 2.7: Final total scores of 10 worst US players and players from outside the US and also outside the European countries

Scores	278	282	284	285	286	289	289	289	289	289	289	290
Rank	1	2	3	4	5	8.5	8.5	8.5	8.5	8.5	8.5	12.5
Player	O	O	O	O	O	U	U	O	O	O	O	U
Scores	290	292	292	292	292	292	293	293	295	296	298	299
Rank	12.5	16	16	16	16	16	19.5	19.5	21	22	23	24
Player	U	O	O	O	O	U	U	U	U	U	U	O

n_{US}: 10 players n_O:14 players

The sum of R_U = 163, while the sum of R_o = 137

The corresponding statistics are:

U_U: $163 - \frac{10(11)}{2} = 108$ U_O: $137 - \frac{14(15)}{2} = 32$

n_1=10, n_2= 14, the critical value at 5% significance level is 41 and 1% significance level is 30

The test statistic is 32. Since the test statistic is smaller than 41, reject the null hypothesis at 5% significance level indicating that there is enough evidence to support the claim that the scores of the 10 worst US players is more than the scores of players from outside the US and also outside the European countries.

B)i) Investigate if the scores of all players are the same between the two rounds.

Parametric Test:

$H_o: \mu_2 = \mu_4$(claim)

$H_1: \mu_2 \neq \mu_4$

Table 2.8: Scores of all players in Round 2 and 4

Players	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Round 2	71	68	68	69	72	67	72	75	69	68	66	76	69	70	69	70	69	72
Round 4	73	70	70	72	66	73	74	69	74	70	72	70	71	71	72	72	74	68
Difference,d	-2	-2	-2	-3	6	6	2	6	-5	-2	-6	6	-2	-1	-3	2	-5	6
Players	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Round 2	69	72	71	73	72	67	70	74	69	73	70	68	69	70	71	72	70	72
Round 4	70	71	70	72	72	73	73	69	70	70	71	72	72	72	72	71	73	73
Difference,d	-1	1	1	1	0	6	-3	5	-1	3	-1	-4	-3	-2	-1	1	-3	-1
Players	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Round 2	68	71	71	76	72	73	72	71	66	71	67	70	76	71	71	73	70	73
Round 4	75	74	76	72	72	74	76	76	78	73	75	76	77	75	76	81	76	73
Difference,d	-7	-3	-5	4	0	-1	4	-5	-12	-2	-8	-6	-1	-4	-5	8	6	0

$\underline{d} = \frac{(-2)+(-2)+(-2)+....+(-5)+(-8)+(-6)}{54}$ = -1.963

$S_d = \sqrt{\frac{970-(-1.963)^2/54}{53}}$ = 4.278

Since the sample size is large, Z distribution can be used.

Test statistic:

$Z = \frac{d - \mu}{\sigma / \sqrt{n}} = \frac{(-1.963) - 0}{4.278 / \sqrt{54}}$ = -3.372

At 10% significance level (2 tailed) = -1.6449

At 5% significance level (2 tailed) = -1.9600

At 1% significance level (2 tailed)= -2.5758

Since the test statistic falls in the left rejection region, rejected the null hypothesis at all significance levels and it can be concluded that there is strong evidence to reject the claim that the scores of all players are the same between the two rounds.

p-value approach:

$\frac{1}{2}$p-value = P (Z < -3.372) ≈ P(Z < -3.40) = 1- 0.9997 = 0.0003

p-value = 0.0006

Since the p-value smaller than $\alpha = 0.10, \alpha = 0.05\ and\ \alpha = 0.01$, reject the null hypothesis. Thus, there is strong evidence to reject the claim that the scores of all players are the same between the two rounds.

B)ii) Investigate if the scores of the US players are the same between the two rounds

Parametric test:

$H_o: \mu_2 - \mu_4 = 0$ (claim)

$H_1: \mu_2 - \mu_4 \neq 0$

Table 2.9a: Scores of the US players in Round 2 and 4

US Players	1	2	3	4	5	6	7	8	9	10	11	12
Round 2	68	68	69	75	66	76	69	70	69	69	72	71
Round 4	70	70	72	69	72	70	71	71	74	70	71	70
Difference,d	-2	-2	-3	6	-6	6	-2	-1	-5	-1	1	1
US Players	13	14	15	16	17	18	19	20	21	22	23	24
Round 2	72	67	68	70	72	68	72	71	67	76	71	70
Round 4	72	73	72	72	71	75	72	73	75	77	76	76
Difference,d	0	-6	-4	-2	1	-7	0	-2	-8	-1	-5	-6

$\underline{d}$ = $-\frac{48}{24}$= -2

S_d= $\sqrt{\frac{394-(-48)^2/24}{23}}$= 3.60

Test statistic, t = $\frac{-2}{\frac{3.60}{\sqrt{4}}}$= -2.722

$\frac{1}{2}$p-value= P(t_{23}< -2.722) = P(t_{23}>2.722)

P(t_{23}>2.807) < P(t_{23}>2.722) < P(t_{23}>2.500)

0.005 < $\frac{1}{2}$p-value < 0.01

0.01 < p-value < 0.02

Since the p-value is smaller than 0.05 and 0.10 but greater than 0.01, Ho is rejected at 5% and 10% significance level. There is sufficient evidence to reject the claim that the scores of the US players are the same between round 2 and round 4.

Non-parametric test:

H_o: Scores of the US players are the same between round 2 and round 4 (claim)

H_1: Scores of the US players are different between round 2 and round 4

(Sign-test):

- - - + - + - - - - + + 0 - - - + - 0 - - - - -

Since there are 17 -signs and 5 +signs, the test statistic is 5.

n=22, the critical value at 1% significance level is 4, 5% significance level is 5 and 10% significance level is 6.

Since the test statistic is equal to the critical value at 5% significance level and smaller than the critical value at 10% significance level, Ho is rejected. There is sufficient evidence to reject the claim that the scores of the US players are the same between round 2 and round 4.

(Wilcoxon sign-rank test):

Table 2.9b: Scores of the US players in Round 2 and 4

Round 2	68	68	69	75	66	76	69	70	69	69	72
Round 4	70	70	72	69	72	70	71	71	74	70	71
Difference,D	-2	-2	-3	6	-6	6	-2	-1	-5	-1	1
Rank	9	9	12	18	18	18	9	3.5	14.5	3.5	3.5
Round 2	71	67	68	70	72	68	71	67	76	71	70
Round 4	70	73	72	72	71	75	73	75	77	76	76
Difference,D	1	-6	-4	-2	1	-7	-2	-8	-1	-5	-6
Rank	3.5	18	13	9	3.5	21	9	22	3.5	14.5	18

Sum of +ve ranks is 46.5 and sum of -ve ranks is 206.5.

Test statistic is 46.5.

n=22, the critical value at 1% significance level is 49, 5% significance level is 66 and 10% significance level is 75.

Since the test statistic is smaller than 49, 66 and 75,Ho is rejected at 1%, 5% and 10% significance level. There is strong evidence to reject the claim that the scores of the US players are the same between round 2 and round 4.

B)iii) Investigate if the scores of the European players are the same between the two rounds

PARAMETRIC:

H_o: $\mu_d = 0$ (claim)
H_1: $\mu_d \neq 0$

Table 3.0a: Scores of the European players in Round 2 and 4

PLAYER	COUNTRY	R2	R4	d	d^2
Jon Rahm	Spain	72	66	-6	36
Justin Rose	England	72	74	2	4
Robert MacIntyre	Scotland	70	72	2	4
Tyrrell Hatton	England	74	68	-6	36
Shane Lowry	Ireland	73	72	-1	1
Victor Hovland	Norway	70	73	3	9
Paul Casey	England	74	69	-5	25
Ian Poulter	England	73	70	-3	9
Matthew Fitzpatrick	England	70	73	3	9
Matt Wallace	England	72	73	1	1
Martin Laird	Scotland	71	74	3	9
Henrik Stenson	Sweden	71	76	5	25
Bernd Wiesberger	Austria	66	78	12	144
Tommy Fleetwood	England	70	76	6	36
Jose Maria Olazabal	Spain	71	75	4	16
Francesco Molinari	Italy	73	81	8	64
Total				28	428

$\underline{d} = \frac{28}{16} = 1.75$

$s_d^2 = \frac{428 - \frac{28^2}{16}}{15} = 25.267 \quad s_d = 5.027$

Test statistic:

$T = \frac{d - \mu_d}{\frac{s_d}{\sqrt{n}}} = \frac{1.75}{\frac{5.027}{\sqrt{16}}} = 1.392$

$\alpha = 0.1$ Critical value: $t_{0.05,15} = 1.753$ $\alpha = 0.05$ Critical value: $t_{0.025,15} = 2.131$
$\alpha = 0.01$ Critical value: $t_{0.005,15} = 2.947$

Since test statistic does not fall in rejection region, do not reject the null hypothesis and conclude that there is no enough evidence, even weak evidence to reject the claim that the score of the European players are the same between the two rounds.

p-value:

$\frac{1}{2}$ p-value= $P(t_{16} > 1.392) \approx P(t_{16} > 1.4) = 1-0.9097 = 0.0903$

p-value= 0.1806

Since p-value larger than $\alpha = 0.10$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis implying that there is no enough evidence, even weak evidence to reject the claim that the score of the European players are the same between the two rounds.

NONPARAMETRIC:

H_o: the scores of the European players are the same between the two rounds. (claim)

H_1: the scores of the European players are difference between the two rounds

Sign Test :

Subtract score of European players at round 2 from round 4:

- \+ + - - + - - + + + + + + + +

Since there are 5 – sign and 11 + sign, the test statistic is 5. n=16

From nonparametric statistical table,

$\alpha = 0.1$ Critical value: 4 $\alpha = 0.05$ Critical value: 3

$\alpha = 0.01$ Critical value: 2

Since test statistic is greater than critical value, do not reject the null hypothesis and conclude that there is no enough evidence, even weak evidence to reject the claim that the score of the European players are the same between the two rounds.

Wilcoxon Signed-Rank Test:

Table 3.0b : Scores of the European players in Round 2 and 4

PLAYER	COUNTRY	R2	R4	d	Rank
Jon Rahm	Spain	72	66	-6	13
Justin Rose	England	72	74	2	3.5
Robert MacIntyre	Scotland	70	72	2	3.5
Tyrrell Hatton	England	74	68	-6	13
Shane Lowry	Ireland	73	72	-1	1.5
Victor Hovland	Norway	70	73	3	6.5
Paul Casey	England	74	69	-5	10.5
Ian Poulter	England	73	70	-3	6.5
Matthew Fitzpatrick	England	70	73	3	6.5
Matt Wallace	England	72	73	1	1.5
Martin Laird	Scotland	71	74	3	6.5
Henrik Stenson	Sweden	71	76	5	10.5
Bernd Wiesberger	Austria	66	78	12	16
Tommy Fleetwood	England	70	76	6	13

Jose Maria Olazabal	Spain	71	75	4	9
Francesco Molinari	Italy	73	81	8	15

Sum of + ranks = 44.5
Sum of – ranks = 91.5

Thus, test statistic is 44.5 since it is smaller of the two values.

From the Wilcoxon signed-rank test table,
$\alpha = 0.1$ Critical value: 36 $\alpha = 0.05$ Critical value: 30
$\alpha = 0.01$ Critical value: 19

Since test statistic is greater than critical value, do not reject the null hypothesis and conclude that there is no enough evidence, even weak evidence to reject the claim that the score of the European players are the same between the two rounds.

B)iv) Investigate if the scores of players from other parts of the world (Outside the US and Europe) are the same between the two rounds.

Parametric test:

-2 tailed test with small sample size= t- test

$H_o: \mu_2 - \mu_4 = 0$ (claim)

$H_1: \mu_2 - \mu_4 \neq 0$

Table 3.1a: Scores of players from other parts of the world (Outside the US and Europe) in Round 2 and 4

Players	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Round 2	71	67	69	68	69	69	70	69	71	76	73	72	71	73
Round 4	73	73	74	70	72	70	71	72	72	72	74	76	76	73
Difference,d	-2	-6	-5	-2	-3	-1	-1	-3	-1	4	-1	-4	-5	0
d^2	4	36	25	4	9	1	1	9	1	16	1	16	25	0

$\underline{d}$ =-2.14

$s_d^2 = = \frac{148 - \frac{-30^2}{14}}{13}$ = 16.330 $s_d = 4.04$

critical value:

at 10% significant level- $t_{0.05,13}$ = -1.771

at 5% significant level- $t_{0.025,13}$ = -2.160

at 1% significant level- $t_{0.005,13}$ = -3.012

t= $\frac{\bar{d}-\mu_d}{\frac{s_d}{\sqrt{n}}} = \frac{-2.14}{\frac{4.04}{\sqrt{14}}}$ = -1.982

Since the test statistic falls in 5% rejection region but not in 2.5% and 0.5% rejection region, we reject the null hypothesis at 10% significant level. Hence, there is weak evidence to reject the claim that the scores of other players outside US and europe are the same between two rounds.

p-value approach

$\frac{1}{2}$p-value= P(t_{13}<-1.982)= 2[p(t_{13}<2.0)]= 2(1-0.9666)

p-value= 0.0668

Since p-value smaller than $\alpha = 0.10$, but larger than $\alpha = 0.05$ and $\alpha = 0.01$, we reject the null hypothesis at 10% significant level. Hence, there is weak evidence to reject the claim that the score of other players outside US and europe are the same between 2 rounds.

Non-parametric test

2 dependent sample- Wilcoxon Signed Rank Test

H_o**:** the scores of players outside US and europe are the same between round 2 and round 4. (claim)

H_1**:** the scores of players outside US and europe are different between round 2 and round 4.

Table 3.1b: Scores of players from other parts of the world (Outside the US and Europe) in Round 2 and 4

Round 2	71	67	69	68	69	69	70	69	71	76	73	72	71
Round 4	73	73	74	70	72	70	71	72	72	72	74	76	76
Difference,D	-2	-6	-5	-2	-3	-1	-1	-3	-1	4	-1	-4	-5
Abs	2	6	5	2	3	1	1	3	1	4	1	4	5
Rank	5.5	13	11.5	5.5	7.5	2.5	2.5	7.5	2.5	9.5	2.5	9.5	11.5

sum rank +ve: 9.5 (test statistic)   sum rank -ve: 91.0

critical value at $\alpha = 0.05$,(n=13): 17 $\alpha = 0.01$,(n=13): 10 $\alpha = 0.10$,(n=13): 21

Since the test statistic smaller than critical value, we reject the null hypothesis at 1%, 5% and 10% significance level. Hence, there is strong evidence to reject the claim that the scores of players outside US and europe are the same between round 2 and round 4.

Sign test

Subtract score of players outside US and europe at round 2 from round 4:

- - - - - - - - - - + - - - - 0

Since there are 12 –ve sign and 1 +ve sign, the test statistic is 1 (smallest number). n=13

From nonparametric statistical table,

$\alpha = 0.1$ Critical value: 3 $\alpha = 0.05$ Critical value:2

$\alpha = 0.01$ Critical value: 1

Since test statistic is smaller than critical value at 10% and 5% significant level also equal to the critical value at 1% significant level, we, reject the null hypothesis and conclude that there is strong evidence to reject the claim that the score of players outside US and Europe are the same between the two rounds.

C i) Investigate if the final position of the US players in the top 35 are random among other players in the top 35

H_0 : The final position of the US players in the top 35 are random among other players in the top 35. (Claim)

H_1 : The final positions of the US players in the top 35 are not random among other players in the top 35.

O	US	US	US	O	O	O	US	O	O
US	US	US	US	O	O	US	O	US	US
US	O	US	US	O	O	O	O	O	US
O	US	O	US	O	O	US			

There are 20 runs. There are 18 “US” and 19 “O”.

From statistical table,

n = 18 , n = 19 Critical value : lower = 14

upper = 25

Since the test statistic lies between the two critical limits, do not reject the null hypothesis and conclude that there is not enough evidence to reject the claim that the final position of the US players in the top 35 are random among other players in the top 35.

C ii) Investigate if the final position of the US players outside the top 15 are random among other players outside the top 15

H_0 : The final position of the US players outside the top 15 are random among other players outside the top 15. (Claim)

H_1 : The final position of the US players outside the top 15 are random among other players outside the top 15.

O	US	US	US	O	US	US	O	O	O
O	O	US	O	US	O	US	O	O	US
O	O	O	US	O	O	O	O	US	US
O	US	O	US	O	US	O			

There are 23runs. There are 15 “US” and 22 “O”.

From statistical table,

n = 15 , n = 22 ≈ n = 15 , n = 19

Critical value : lower = 12

upper = 23

Since test statistic fall in the rejection region, reject the null hypothesis and conclude that there is enough evidence to reject the claim that the final position of the US players outside the top 15 are random among other players outside the top 15.

Summarized Table

Question 1 A)

NO	Round 2	Round 4	Final Total Scores
i)	Parametric test: (z test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US in Round 2.	Parametric test: (z test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US in Round 4.	Parametric test: (z test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US in Final.
ii)	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of European players in Round 2.	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of European players in Round 4.	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of European players in Final.
iii)	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US and also outside the European countries in Round2.	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US and also outside the European countries in Round4.	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the scores of the US players is the same as the scores of players from outside the US and also outside the European countries in Final.
iv)	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the scores of the European players is the same as the scores of players from outside the US and also outside the European countries in Round 2.	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the scores of the European players is the same as the scores of players from outside the US and also outside the European countries in Round 4.	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the scores of the European players is the same as the scores of players from outside the US and also outside the European countries in Final.

Question 1 A)

NO	Round 2	Round 4	Final Total Scores
v) Part1	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to support the claim that the scores the 10 best US players is less than the scores of players from outside the US that finishes in the top 35 in Round 2. Non-parametric test: (Mann-Whitney test) -Ho is not rejected at 1% and 5% significance level. -There is no sufficient evidence to support the claim that the scores of the 10 best US players is less than the scores of players from outside the US that finishes in the top 35 in Round 2.	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to support the claim that the scores the 10 best US players is less than the scores of players from outside the US that finishes in the top 35 in Round 4. Non-parametric test: (Mann-Whitney test) -Ho is not rejected at 1% and 5% significance level. -There is no sufficient evidence to support the claim that the scores of the 10 best US players is less than the scores of players from outside the US that finishes in the top 35 in Round 4.	Parametric test: (t test) -Ho is rejected at 5% and 10% significance level. Non-parametric test: (Mann-Whitney test) -Ho is rejected at 5% significance level. -There is sufficient evidence to support the claim that the scores the 10 best US players is less than the scores of players from outside the US that finishes in the top 35 in Final.
v) Part2	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to support the claim that the scores of the 10 worst US players is more than the scores of players from outside the US that finishes outside the top 20 in Round 2. Non-parametric test: (Mann-Whitney test) -Ho is not rejected at 1% and 5% significance level. -There is no sufficient evidence to support the claim that the scores of the 10 worst US players is more than the scores of players from outside the US that finishes outside the top 20 in Round 2.	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to support the claim that the scores of the 10 worst US players is more than the scores of players from outside the US that finishes outside the top 20 in Round4. Non-parametric test: (Mann-Whitney test) -Ho is not rejected at 1% and 5% significance level. -There is no sufficient evidence to support the claim that the scores of the 10 worst US players is more than the scores of players from outside the US that finishes outside the top 20 in Round4.	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to support the claim that the scores of the 10 worst US players is more than the scores of players from outside the US that finishes outside the top 20 in Round4. Non-parametric test: (Mann-Whitney test) -Ho is not rejected at 1% and 5% significance level. -There is no sufficient evidence to support the claim that the scores of the 10 worst US players is more than the scores of players from outside the US that finishes outside the top 20 in Final.

Question 1 A)

NO	Round 2	Round 4	Final Total scores
vi) Part1	Parametric test: (t test) -Ho is rejected at 10% significance level. -There is weak evidence to support the claim that the scores of the 10 best US players is less than the scores of the European players in Round 2. Non-parametric test: (Mann-Whitney test) -Ho is not rejected at 1% and 5% significance level. - There is no sufficient evidence to support the claim that the scores of the 10 best US players is less than the scores of the European players in Round 2.	Parametric test: (t test) -Ho is rejected at 5% and 10% significance level. Non-parametric test: (Mann-Whitney test) -Ho is rejected at 5% significance level. - There is sufficient evidence to support the claim that the scores of the 10 best US players is less than the scores of the European players in Round 4.	Parametric test: (t test) -Ho is rejected at 1%, 5% and 10% significance level. Non-parametric test: (Mann-Whitney test) -Ho is rejected at 1% and 5% significance level. -There is strong evidence to support the claim that the scores of the 10 best US players is less than the scores of the European players in Final.
vi) Part2	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. - There is not even weak evidence to support the claim that the scores of the 10 worst US players is more than the scores of the European players in Round 2. Non-parametric test: (Mann-Whitney test) -Ho is not rejected at 1% and 5% significance level. -There is no sufficient evidence to support the claim that the scores of the 10 worst US players is more than the scores of the European players in Round 2.	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to support the claim that the scores of the 10 worst US players is more than the scores of the European players in Round 4. Non-parametric test: (Mann-Whitney test) -Ho is not rejected at 1% and 5% significance level. -There is no sufficient evidence to support the claim that the scores of the 10 worst US players is more than the scores of the European players in Round 4.	Parametric test: (t test) -Ho is rejected at 5% and 10% significance level. Non-parametric test: (Mann-Whitney test) -Ho is rejected at 5% significance level -There is sufficient evidence to support the claim that the scores of the 10 worst US players is more than the scores of the European players in Final.

Question 1 A)

NO	Round 2	Round 4	Final Total Scores
vii) Part1	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to support the claim that the scores of 10 best US players is less than the scores of players from outside the US and also the outside European countries in Round 2. Non-parametric test: (Mann-Whitney test) -Ho is not rejected at 1% and 5% significance level. -There is not enough evidence to support the claim that the scores of the 10 best US players is less than the scores of players from outside the US and also outside the European countries in Round 2.	Parametric test: (t test) -Ho is rejected at 1%, 5% and 10% significance level. Non-parametric test: (Mann-Whitney test) -Ho is rejected at 1% and 5% significance level. -There is strong evidence to support the claim that the scores of 10 best US players is less than the scores of players from outside the US and also the outside European countries in Round 4.	Parametric test: (t test) -Ho is rejected at 5% and 10% significance level. Non-parametric test: (Mann-Whitney test) -Ho is rejected at 5% significance level -There is enough evidence to support the claim that the scores of 10 best US players is less than the scores of players from outside the US and also the outside European countries in Final.
vii) Part2	Parametric test: (t test) -Ho is not rejected at 1%, 5% and 10% significance level. - There is not even weak evidence to support the claim that the scores of 10 worst US players is more than the scores of players from outside the US and also the outside European countries in Round2. Non-parametric test: (Mann-Whitney test) -Ho is not rejected at 1% and 5% significance level. - There is not enough evidence to support the claim that the scores of the 10 worst US players is more than the scores of players from outside the US and also outside the European countries in Round 2.	Parametric test: (t test) -Ho is rejected at 10% significance level. -There is weak evidence to support the claim that the scores of 10 worst US players is more than the scores of players from outside the US and also the outside European countries in Round4. Non-parametric test: (Mann-Whitney test) -Ho is not rejected at 1% and 5% significance level -There is not enough evidence to support the claim that the scores of the 10 worst US players is more than the scores of players from outside the US and also outside the European countries in Round4.	Parametric test: (t test) -Ho is rejected at 5% and 10% significance level. Non-parametric test: (Mann-Whitney test) -Ho is rejected at 5% significance level - There is enough evidence to support the claim that the scores of 10 worst US players is more than the scores of players from outside the US and also the outside European countries in Final.

Question 1 B)

NO	Result
i)	Parametric test: -Ho is rejected at 1%, 5% and 10% significance level. -There is strong evidence to reject the claim that the scores of all players are the same between Round 2 and Round 4.
ii)	Parametric test: -Ho is rejected at 5% and 10% significance level. Non-parametric test: (Sign-test) -Ho is rejected at 5% and 10% significance level. -There is sufficient evidence to reject the claim that the scores of the US players are the same between round 2 and round 4. (Wilcoxon sign rank test) -Ho is rejected at 1%, 5% and 10% significance level. -There is strong evidence to reject the claim that the scores of the US players are the same between round 2 and round 4.
iii)	Parametric test: -Ho is not rejected at 1%, 5% and 10% significance level. Non-parametric test: (Sign-test) -Ho is not rejected at 1%, 5% and 10% significance level. (Wilcoxon sign rank test) -Ho is rejected at 1%, 5% and 10% significance level. -There is not even weak evidence to reject the claim that the score of the European players are the same between Round 2 and Round 4.
iv)	Parametric test: -Ho is rejected at 10% significance level. - There is weak evidence to reject the claim that the score of other players outside US and Europe are the same between Round 2 and Round 4. Non-parametric test: (Sign-test) -Ho is rejected at 1%, 5% and 10% significance level. (Wilcoxon sign rank test) -Ho is rejected at 1%, 5% and 10% significance level -There is strong evidence to reject the claim that the scores of players outside US and Europe are the same between round 2 and round 4.

Question 1 C)

NO	Result
i)	-Ho is not rejected at 5% significance level. -There is not enough evidence to reject the claim that the final position of the US players in the top 35 are random among other players in the top 35.
ii)	-Ho is rejected at 5% significance level. -There is enough evidence to reject the claim that the final position of the US players outside the top 15 are random among other players outside the top 15.

Q2. LIFE STYLE OF MULTI-RACIAL SOCIETY

B 1)

Gender

H_0: Gender does not affect the marriage of other races.

H_1 : Gender affect the marriage of other races. (Claim)

Table 3.2: Response from different gender on "Among your siblings and close relative, is there anyone marries other races?"

Gender	marry other races			Grand Total
	1 (Yes, 1-2 people)	**2** (Yes, 3 people or above)	**3** (Nobody)	
1 (Male)	20 $\frac{48\times97}{201}$=23.16 $\frac{(20-23.16)^2}{23.16}$=0.43	6 (6.27) 0.01	71 (67.56) 0.18	97
2 (Female)	28 (24.84) 0.4	7 (6.73) 0.01	69 (72.44) 0.16	104
Grand Total	48	13	140	201

Test Statistic:

$$x^2_{(2-1)(3-1)=2} = 0.43 + 0.01 + 0.18 + 0.4 + 0.01 + 0.16 = 1.19$$

$\alpha = 0.1$ Critical value : 4.605 $\alpha = 0.05$ Critical value : 5.991

$\alpha = 0.01$ Critical value : 9.210

Since test statistic does not fall in the rejection region, do not reject the null hypothesis and thus there is not even weak evidence to support the claim that gender affect the marriage of other races

P-value = P (x_2^2>1.19) ≈1 - P (x_2^2<1.2) = 1- 0.4512 =0.5488

Since p-value is greater than $\alpha = 0.1$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis and thus there is not even weak evidence to support the claim that gender affect the marriage of other races.

Discussion:
There are more male choose “nobody” (71 people) than expected value (67.56) while there are less female choose “nobody”(69 people) than expected value (72.44) and there are less male choose “yes, 1-2 people” (20 people) than expected value (23.16) while there are more female choose “yes, 1-2 people”(28 people) than expected value (24.84). Since the differences between observation and expected value are small, therefore the null hypothesis will not be rejected because the test statistic is small. So, gender does not affect the marriage of other races.

Age

H_0: Age does not affect the marriage other races

H_1 : Age affect the marriage of other races. (Claim)

Table 3.3: Response from people with different age on "Among your siblings and close relative, is there anyone marries other races?"

Age	Mix marriage			Grand Total
	1 (Yes, 1-2 people)	**2** (Yes, 3 people or above)	**3** (Nobody)	
1 (16-25)	9 $\frac{48\times58}{201}$=13.85 $\frac{(9-13.85)^2}{13.85}$=1.69	5 (3.75) 0.42	44 (40.39) 0.32	58
2 (26-35)	11 (12.66) 0.22	2 (3.43) 0.59	40 (36.92) 0.26	53
3 (36-45)	8 (7.4) 0.05	1 (2.00) 0.5	22 (21.59) 0.008	31
4 (46-55)	13 (8.36) 2.58	4 (2.26) 1.34	18 (24.38) 1.67	35
5 (56 and above)	7 (5.73) 0.28	1 (1.55) 0.19	16 (16.72) 0.03	24

Grand Total	48	13	140	201

Combine the data since the expected value less than 5

Age	marry other races		Grand Total
	(Yes)	(Nobody)	
1 (16-25)	14 $\frac{61 \times 58}{201}$=17.6 $\frac{(14-17.6)^2}{17.6}$=0.74	44 (40.39) 0.32	58
2 (26-35)	13 (16.08) 0.59	40 (36.92) 0.26	53
3 (36-45)	9 (9.41) 0.02	22 (21.59) 0.008	31
4 (46-55)	17 (10.62) 3.83	18 (24.38) 1.67	35
5 (56 and above)	8 (7.28) 0.07	16 (16.72) 0.03	24
Grand Total	61	140	201

Test Statistic:

$x_4^2 =$ 0.74 + 0.32 + 0.59 + … + 1.67 + 0.07 + 0.03 = 7.54

$\alpha = 0.1$ Critical value : 7.779 $\alpha = 0.05$ Critical value : 9.488

$\alpha = 0.01$ Critical value : 13.28

Since test statistic does not fall in the rejection region, do not reject the null hypothesis and thus there is no even weak evidence to support the claim that age affect the marriage of other races.

P-value = P (x_4^2>7.54)≈1- P (x_4^2<7.5)= 1-0.8883 = 0.1117

Since p-value is greater than $\alpha = 0.1$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis and thus there is no even weak evidence to support the claim that age affect the marriage of other races.

Discussion:

There are less adolescents (16-25) and adults (26-35) choose "yes" (14 people and 13 people) than expected value (17.6 and 16.08). While there are more adult (36-45) choose 'nobody" (22 people) than expected (21.59). However, the differences between observation and expected value are small, therefore the null hypothesis will not be rejected because the test statistic is small. So, age does not affect the marriage of other races.

Race

H_0: Race does not affect the marriage of other races

H_1 : Race affect the marriage of other races (Claim)

Combine the data since the expected value less than 5

Table 3.4: Response from people with different race on "Among your siblings and close relative, is there anyone marries other races?"

Race	marry other races		Grand Total
	(Yes)	(Nobody)	
1 (Malay)	42 $\frac{61\times126}{201}$= 38.24 $\frac{(42-38.24)^2}{38.24}$=0.37	84 (87.76) 0.16	126
2 (Chinese)	12 (15.48) 0.78	39 (35.52) 0.34	51
3 (Indian)	6 (5.46) 0.05	12 (12.54) 0.02	18
4 (Others)	1 (1.82) 0.37	5 (4.18) 0.16	6
Grand Total	61	140	201

Test Statistic:

x_3^2 = 0.37 + 0.16 + 0.78 + 0.34 + 0.05 + 0.02 + 0.37 + 0.16 = 2.25

$\alpha = 0.1$ Critical value : 6.251 $\alpha = 0.05$ Critical value : 7.815

$\alpha = 0.01$ Critical value : 11.34

Since test statistic does not fall in the rejection region, do not reject the null hypothesis and thus there is no even weak evidence to support the claim that race affect the marriage of other races

P-value = P (x_3^2>2.25)≈1- P (x_3^2<2.3)= 1-0.4875= 0.5125

Since p-value is greater than $\alpha = 0.1$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis and thus there is no even weak evidence to support the claim that race affect the marriage of other races.

Discussion:

There are less malay (84 people) choose for “nobody” than the expected value (87.76) and less chinese (12 people) choose for “yes” than the expected value (15.48) while more indian (6 people) choose “yes” than expected value (5.46). Because of the small differences between the expected and the observation value, the null hypothesis will not be rejected due to the small value of the test statistic. So, the race does not affect the marriage of other races.

Education level

H_0: Education level does not affect the marriage of other races

H_1 : Education level affect the marriage of other races (Claim)

Combine the data since the expected value less than 5

Table 3.5: Response from people with different education level on "Among your siblings and close relative, is there anyone marries other races?"

Education Level	Marry other races		Grand Total
	(Yes)	(Nobody)	
1 (Primary School)	5 $\frac{15\times61}{201}$= 4.55 $\frac{(5-4.55)^2}{4.55}$= 0.04	10 (10.45) 0.02	15
2 (Secondary School)	25 (21.24) 0.67	45 (48.76) 0.29	70
3 (Diploma/Degree)	29 (32.17) 0.31	77 (73.83) 0.14	106
4 (Masters/PhD)	2 (3.03) 0.35	8 (6.97) 0.15	10
Grand Total	**61**	**140**	**201**

Test Statistic:

x_{3}^{2} = 0.04+ 0.02 + 0.67 + 0.29 + 0.31 + 0.14 + 0.35 +0.15 = 1.97

$\alpha = 0.1$ Critical value : 6.251 $\alpha = 0.05$ Critical value :7.815

$\alpha = 0.01$ Critical value : 11.34

Since test statistic does not fall in the rejection region, do not reject the null hypothesis and thus there is no even weak evidence to support the claim that education level affect the marriage of other races.

P-value = P (x_{3}^{2}> 1.97)≈1- P (x_{3}^{2}<1.9)= 1-0.4066= 0.5934

Since p-value is greater than $\alpha = 0.1$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis and thus there is no even weak evidence to support the claim that education level affect the marriage of other races.

Discussion:
There are more primary and secondary school (5 and 25 people) choose “yes” than the expected value (4.55 and 21.24) while diploma/ degree and masters/Phd” (29 and 2 people) choose less “yes” than the expected value (32.17 and 3.03). Diploma/degree and masters/Phd (77 and 8 people) more choose for “nobody” than the expected value (73.83 and 6.97). Since the differences between observation and expected value are small, therefore the null hypothesis will not be rejected because the test statistic is small. So, education level does not affect the marriage of other races.

Q2 B2

<u>Gender</u>

H_0: Gender does not affect the frequency of prayers in a day.

H_1 : Gender affect the frequency of prayers in a day. (Claim)

Combine the data since the expected value less than 5

Table 3.6: Response from people with different gender on frequency of prayers in a day

Gender	The frequency of prayers in a day			Grand Total
	(None)	(1-4 times)	(5 or more)	
1 (Male)	8 $\frac{15\times97}{201}$= 7.24 $\frac{(8-7.24)^2}{7.24}$=0.08	35 (29.92) 0.86	54 (59.84) 0.57	97
2 (Female)	7 (7.76) 0.07	27 (32.1) 0.81	70 (64.16) 0.53	104
Grand Total	**15**	**62**	**124**	**201**

Test Statistic:

x_2^2 = 0.08 + 0.86 + 0.57 + 0.07 + 0.81 + 0.53 = 2.92

$\alpha = 0.1$ Critical value : 4.605 $\alpha = 0.05$ Critical value : 5.991

$\alpha = 0.01$ Critical value : 9.210

Since test statistic does not fall in the rejection region, do not reject the null hypothesis and thus there is not even weak evidence to support the claim that gender affect the frequency of prayers in a day.

P-value = P (x_2^2> 2.92)≈1- P (x_2^2<3.0)= 1-0.7769= 0.2231

Since p-value is greater than $\alpha = 0.1$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis and thus there is not even weak evidence to support the claim that gender affect the frequency of prayers in a day.

Discussion:
There are more female(70 people) choose “5 or more” than expected value (64.16) while there are less female(27 people) choose “1-4 times” than expected value (32.1) and there are less male(54 people) choose “5 or more” than expected value (23.16) while there are more female choose “yes, 1-2 people”(28 people) than expected value (59.84). Since the differences between observation and expected value are small, therefore the null hypothesis will not be rejected because the test statistic is small. So, gender does not affect the frequency of the prayers in a day.

Age

H_0: Age does not affect the frequency of prayers in a day.

H_1 : Age affect the frequency of prayers in a day. (Claim)

combine the data since the expected value less than 5

Table 3.7: Response from people with different age on frequency of prayers in a day

	the frequency of prayers in a day			
Age	**(None)**	**(1-4 times)**	**(5 or more)**	**Grand Total**
(16-25) (26-35)	13 $\frac{15\times111}{201}$=8.28 $\frac{(13-8.28)^2}{8.28}$=2.69	30 (34.24) 0.53	68 (68.48) 0.003	111
(36-45)	2	23	41	66

(46-55)	(4.93) 1.74	(20.36) 0.34	(40.72) 0.002	
(56 and above)	0 (1.79) 1.79	9 (7.4) 0.35	15 (14.8) 0.003	24
Grand Total	**15**	**62**	**124**	**201**

Test Statistic:

x_{4}^{2} = 2.69 + 0.53 + 0.003 + 1.74 + 0.34 + 0.002 + 1.79 + 0.35 + 0.003 = 7.45

$\alpha = 0.1$ Critical value : 7.779 $\alpha = 0.05$ Critical value : 9.488

$\alpha = 0.01$ Critical value : 13.28

Since test statistic does not fall in the rejection region, do not reject the null hypothesis and thus there is not even weak evidence to support the claim that gender affect the frequency of prayers in a day.

P-value = P (x_{4}^{2}> 7.45)≈1- P (x_{4}^{2}<7.5)= 1-0.8883= 0.1117

Since p-value is greater than $\alpha = 0.1$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis and thus there is not even weak evidence to support the claim that gender affect the frequency of prayers in a day.

Discussion:

The adolescents(16-25) and adults(26-35)(68 people) slightly less choose for “5 or more” than expected value (68.08). Less middle age of adult (36-55)(2 people) choose for “none” than expected value (4.93) and more old people (56 and above) (9 people) choose for “1-4 times” than expected value (7.4). Since the differences between observation and expected value are small, therefore the null hypothesis will not be rejected because the test statistic is small. So, age does not affect the frequency of the prayers in a day.

Race

H_0: Race does not affect the frequency of prayers in a day.

H_1 : Race affect the frequency of prayers in a day. (Claim)

Table 3.8: Response from people with different race on frequency of prayers in a day

Race	the frequency of prayers in a day			Grand Total
	(None)	(1-4 times)	(5 or more)	
(Malay)	0 $\frac{15\times126}{201}$=9.4 $\frac{(0-9..4)^{2}}{9.4}$=9.4	4 (38.87) 31.28	122 (77.73) 25.21	126
(Chinese)	13 (3.8) 22.27	37 (15.73) 28.76	1 (31.46) 29.49	51
(Indian) (Others)	2 (1.79) 0.02	21 (7.4) 24.99	1 (14.8) 12.87	24
Grand Total	**15**	**62**	**124**	**201**

Test Statistic:

x_4^2 = 9.4 + 31.28 + 25.21 + 22.27 + 28.76 + 29.49 + 0.02 + 24.99 +12.87 = 184.3

$\alpha = 0.1$ Critical value : 7.779 $\alpha = 0.05$ Critical value : 9.488

$\alpha = 0.01$ Critical value : 13.28

Since test statistic fall in the rejection region, reject the null hypothesis and thus there is strong evidence to support the claim that race affect the frequency of prayers in a day.

P-value = P (x_4^2> 184.3)≈1- P (x_4^2<25)= 1-0.9999= 0.0001

Since p-value is smaller than$\alpha = 0.1$, $\alpha = 0.05$ and $\alpha = 0.01$, reject the null hypothesis and thus there is strong evidence to support the claim that education level affect the frequency of prayers in a day.

Discussion:
There are no malay choose for "none" while expected value is 9.4, and less chinese (1 people), indian and others (2 people) choose "5 or more" than the expected value(31.46 and 14.8). Since there is a big difference between observation and expected value, the null hypothesis will be rejected because test statistic are also big. So the race affect the frequency of prayers in a day.

<u>Education level</u>

H_0: Education level does not affect the frequency of prayers in a day.

H_1 : Eduction level affect the frequency of prayers in a day. (Claim)

combine the data since expected value less than 5

Table 3.9: Response from people with different education level on frequency of prayers in a day

Education Level	**the frequency of prayers in a day**			**Grand Total**
	(None)	(1-4 times)	(5 or more)	
(Primary School) (Secondary School)	2 $\frac{15\times85}{201}$=6.34 $\frac{(2-6..34)^2}{6.34}$=2.97	35 (26.22) 2.94	48 (52.44) 0.38	85
(Diploma/Degree)	13	27	76	116

(Masters/PhD)	(8.67) 2.16	(35.78) 2.15	(71.56) 0.28	
Grand Total	**15**	**62**	**124**	**201**

Test Statistic:

x_2^2 = 2.97 + 2.94 + 0.38 + 2.16 + 2.15 + 0.28 = 10.88

$\alpha = 0.1$ Critical value : 4.605 $\alpha = 0.05$ Critical value : 5.991

$\alpha = 0.01$ Critical value : 9.210

Since test statistic fall in the rejection region, reject the null hypothesis and thus there is strong evidence to support the claim that education level affects the frequency of prayers in a day.

P-value = P (x_2^2> 10.88)≈1- P (x_2^2<10.0)= 1-0.9933= 0.007

Since p-value is smaller than$\alpha = 0.1$, $\alpha = 0.05$ and $\alpha = 0.01$, reject the null hypothesis and thus there is strong evidence to support the claim that education level affects the frequency of prayers in a day.

Discussion:
Since there is a big difference between observation and expected value because less people from primary and secondary school (2 people) choose for "none" than expected value (6.34) and more people from diploma/degree and masters/PhD (76 people) choose to pray a lot "5 or more" than expected value (71.56), therefore reject the null hypothesis and conclude that the education level affect the frequency of the prayers in a day.

Part C

Investigate if gender, age, race and education level affect the choice of answer or the level of agreement.

Question 1:

Gender

H_o: Gender does not affect the level of agreement on "Current modern lifestyle needs higher expenditure".

H_1 : Gender affects the level of agreement on "Current modern lifestyle needs higher expenditure". (claim)

Table 4.0: Level of agreement from people with different gender on "Current modern lifestyle needs higher expenditure".

Gender	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Male	1 E=$\frac{97\times 2}{201}$= 0.97 χ^2= $\frac{(1-0.97)^2}{0.97}$ = 0.000928	3 (2.90) 0.00345	8 (7.72) 0.0102	38 (41.02) 0.222	47 (44.40) 0.152	97
Female	1 (1.03) 0.000874	3 (3.10) 0.00323	8 (8.28) 0.00947	47 (43.98) 0.207	45 (47.60) 0.142	104
Total	2	6	16	85	92	201

Combine the data since the value for expected is less than 5.

Gender	Level of agreement			Total
	Strongly Disagree, Disagree and Neutral	Agree	Strongly Agree	
Male	12 (11.58) 0.0152	38 (41.02) 0.222	47 (44.40) 0.152	97
Female	12 (12.41) 0.0135	47 (43.98) 0.207	45 (47.60) 0.142	104
Total	24	85	92	201

χ^2_2= 0.0152 + 0.0135 + 0.222 + 0.207 + 0.152 + 0.142

= 0.752

From statistical table, critical values: $\chi^2_{2,0.05}$= 5.991 and $\chi^2_{2,0.10}$ = 4.605. The test statistic does not fall in the 5% and 10% rejection region, and does not reject the null hypothesis. Thus, there is not sufficient evidence to support the claim that gender affects the level of agreement on “Current modern lifestyle needs higher expenditure”.

p-value= P(χ^2_2 > 0.752) ≈P(χ^2_2 > 0.8) = 1-0.3297 = 0.6703

Since the p-value is larger than $\alpha = 0.1$and $\alpha = 0.05$, do not reject the null hypothesis. Thus, there is not sufficient evidence to support the claim that gender affects the level of agreement on “Current modern lifestyle needs higher expenditure”.

Discussion:

From the table, it can be seen that there are less female and male (45 and 38) that choose "Strongly Agree" than the expected values (47.60 and 41.02). While there are more male (12) that choose "Strongly Disagree, Disagree and Neutral" than expected value (11.58). However the differences between observation and expected values are small, therefore the null hypothesis be rejected because the test statistic is too small. Thus, it can be said that gender does not affect the level of agreement for current modern lifestyle needs higher expenditure.

<u>Age</u>

H_o: Age does not affect the level of agreement on "Current modern lifestyle needs higher expenditure".

H_1 : Age affects the level of agreement on "Current modern lifestyle needs higher expenditure". (claim)

Table 4.1: Level of agreement from people with different age on "Current modern lifestyle needs higher expenditure".

Age	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
16-25	0 E=$\frac{58\times2}{201}$= 0.58	2 (1.73)	5 (4.61)	26 (24.53)	25 (26.55)	58
26-35	2 (0.53)	1 (1.58)	5 (4.22)	18 (22.41)	27 (24.26)	53
36-45	0 (0.31)	2 (0.93)	0 (2.47)	14 (13.11)	15 (14.19)	31
46-55	0 (0.35)	1 (1.04)	2 (2.79)	16 (14.80)	16 (16.02)	35
56 and above	0 (0.24)	0 (0.72)	4 (1.91)	11 (10.15)	9 (10.99)	24
Total	2	6	16	85	92	201

Combine the data since the value for expected is less than 5.

Age	Level of agreement			Total
	Strongly disagree, disagree and Neutral	Agree	Strongly Agree	
16-25	7 E=$\frac{58 \times 26}{201}$= 6.93 0.000707	26 (24.53) 0.0881	25 (26.55) 0.0905	58
26-35	8 (6.33) 0.441	18 (22.41) 0.868	27 (24.26) 0.309	53
36-45	2 (3.70) 0.781	14 (13.11) 0.0604	15 (14.19) 0.0462	31
46-55, 56 and above	7 (7.04) 0.000227	27 (24.95) 0.168	25 (27.00) 0.148	59
Total	24	85	92	201

χ_6^2= 0.000707 + 0.0881 + 0.0905 + 0.441 + 0.868 + 0.309 + 0.781 + 0.0604 + 0.0462 + 0.000227 + 0.168+ 0.148

= 3.001

From statistical table, critical values: $\chi_{6,0.05}^2$= 12.59, $\chi_{6,0.10}^2$ = 10.64 and $\chi_{6,0.01}^2$= 16.81 . The test statistic does not fall in the 5%, 10% and 1% rejection region, does not reject the null hypothesis. Thus, there is not sufficient evidence to support the claim that age affects the level of agreement on "Current modern lifestyle needs higher expenditure".

p-value= P(χ_6^2 > 3.001) ≈P(χ_6^2 > 3.0) = 1-0.1912 = 0.8088

Since the p-value is greater than $\alpha = 0.1$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis. Thus, there is not sufficient evidence to support the claim that age affects the level of agreement on "Current modern lifestyle needs higher expenditure"

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "Current modern lifestyle needs higher expenditure" from age (16-25, 26-35, 36-45, 46-55, 56 and above. There are more ages between (26-35) than expected who strongly disagree,disagree and neutral with the statement while there are less ages between (46-55, 56 and above) than expected who strongly disagree, disagree and neutral with the statement. Similarly, there are more ages between (26-35) than expected who strongly agree with the statement while there are less ages between (46-55, 56 and above) than expected who strongly agree with the statement. SInce the behavior of people with age 16-25, 26-35, 36-45, 46-55, 56 to above are same on the extreme levels of agreement (Strongly disagree, disagree, neutral and Strongly agree), hence, age does not affects the level of agreement on "Current modern lifestyle needs higher expenditure".

Race

H_o: Race does not affect the level of agreement on "Current modern lifestyle needs higher expenditure".

H_1: Race affects the level of agreement on "Current modern lifestyle needs higher expenditure". (claim)

Table 4.2: Level of agreement from people with different race on "Current modern lifestyle needs higher expenditure".

Race	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Malay	0 E=$\frac{126\ x\ 2}{201}$=1.25	3 (3.76)	4 (10.02)	54 (53.28)	65 (57.67)	126
Chinese	2 (0.51)	2 (1.52)	8 (4.06)	24 (21.57)	15 (23.34)	51
Indian	0 (0.18)	1 (0.54)	1 (1.43)	4 (7.61)	12 (8.24)	18
Others	0 (0.06)	0 (0.18)	3 (0.48)	3 (2.54)	0 (2.75)	6
Total	2	6	16	85	92	201

Combine the data since the value for expected is less than 5.

Race	Level of agreement				Total
	Strongly disagree and Disagree	Neutral	Agree	Strongly Agree	
Malay	3 (5.01) $\chi^2=\frac{(3-5.01)^2}{5.01}=0.806$	4 (10.03) 3.625	54 (53.28) 0.00973	65 (57.67) 0.932	126
Chinese, Indian, Others	5 (2.99) 1.351	12 (5.97) 6.091	31 (31.72) 0.0163	27 (34.33) 1.565	75
Total	8	16	85	92	201

χ_3^2= 0.806 + 1.352 + 3.625 + 6.091 + 0.00973 + 0.0163 + 0.932 + 1.565

= 14.40

From statistical table, critical values: $\chi^2_{3,0.05}$= 7.815, $\chi^2_{3,0.10}$ = 6.251 and $\chi^2_{3,0.01}$ = 11.34. The test statistic falls in the 5%, 10% and 1% rejection region, the null hypothesis is rejected. Thus, there is sufficient evidence to support the claim that race affects the level of agreement on "Current modern lifestyle needs higher expenditure".

p-value= P(χ_3^2 > 14.40) ≈P(χ_3^2 > 14.5) = 1-0.9755 = 0.0245

Since the p-value is smaller than $\alpha = 0.1$, $\alpha = 0.05$and $\alpha = 0.01$, reject the null hypothesis. Thus, there is sufficient evidence to support the claim that race affects the level of agreement on "Current modern lifestyle needs higher expenditure".

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "Current modern lifestyle needs higher expenditure" from people with different races (Malay, Chinese, Indian and others). There are less Malay than expected who strongly disagree and disagree with the statement while there are more Chinese, Indian and others than expected who strongly disagree and disagree with the statement. On the other hand, there are more Malay than expected who strongly agree with the statement while there are less Chinese, Indian and others than expected who strongly agree with the statement. Since the behavior of Malay and Chinese, Indian and others are opposite on the two extreme levels of agreement (Strongly disagree, disagree and Strongly agree), hence, race affects the level of agreement on "Current modern lifestyle needs higher expenditure"

Education level

H_o: Education level does not affect the level of agreement on "Current modern lifestyle needs higher expenditure".

H_1: Education level affects the level of agreement on "Current modern lifestyle needs higher expenditure". (claim)

Table 4.3: Level of agreement from people with different education level on "Current modern lifestyle needs higher expenditure".

Education level	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Primary school	0 E=$\frac{15\times2}{201}$= 0.15	2 (0.45)	2 (1.20)	5 (6.34)	6 (6.87)	15
Secondary school	0 (0.70)	2 (2.09)	5 (5.57)	31 (29.60)	32 (32.04)	70
Diploma/ Degree	1 (1.05)	2 (3.16)	7 (8.44)	45 (44.83)	51 (48.52)	106
Masters/PhD	1 (0.10)	0 (0.30)	2 (0.80)	4 (4.23)	3 (4.58)	10
Total	2	6	16	85	92	201

Combine the data since the value for expected is less than 5.

Education level	Level of agreement			Total
	Strongly disagree, Disagree and Neutral	Agree	Strongly Agree	
Primary school	4 E=$\frac{15\times24}{201}$= (1.79) 2.729	5 (6.34) 0.283	6 (6.87) 0.110	15
Secondary school	7 (8.36) 0.221	31 (29.60) 0.0662	32 (32.04) 0.00005	70
Diploma/ Degree/Master/ PhD	13 (13.85) 0.0522	49 (44.83) 0.388	54 (48.52) 0.619	116
Total	24	85	92	201

χ^2_4= 2.729 + 0.283 + 0.110 + 0.221 + 0.0662 + 0.00005 + 0.0522 + 0.388 + 0.619

= 4.468

From statistical table, critical values: $\chi^2_{4,0.05}$= 9.488, $\chi^2_{4,0.10}$ = 7.779 and $\chi^2_{4,0.01}$ = 13.28. The test statistic does not fall in the 5%, 10% and 1% rejection region, and does not reject the null hypothesis. Thus, there is not sufficient evidence to support the claim that education level affects the level of agreement on "Current modern lifestyle needs higher expenditure".

p-value= P(χ^2_4 > 4.468) ≈P(χ^2_4 > 4.5) = 1- 0.6575 = 0.3425

Since the p-value is greater than $\alpha = 0.1$, $\alpha = 0.05$and $\alpha = 0.01$, does not reject the null hypothesis. Thus, there is not sufficient evidence to support the claim that education level affects the level of agreement on "Current modern lifestyle needs higher expenditure".

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "Current modern lifestyle needs higher expenditure" from people with different education levels (Primary school, Secondary school, Diploma/Degree and Masters/PhD). There are more people with diploma/degree and masters/ PhD education than expected who strongly disagree, disagree and neutral with the statement while there are less people with secondary school education than expected who strongly disagree, disagree and neutral with the statement. Similarly, there are more people with diploma/degree and masters/ PhD education than expected who strongly agree with the statement while there are less people with secondary school education than expected who strongly agree with the statement. SInce the behavior of people with primary school, diploma/degree and masters/ PhD education are the same on the extreme levels of agreement (Strongly disagree, disagree, neutral and Strongly agree), hence, education level does not affect the level of agreement on "Current modern lifestyle needs higher expenditure''.

Question 2:

Gender

H_o: Gender does not affect the level of agreement on "Modern technology affects current lifestyle".

H_1: Gender affects the level of agreement on "Modern technology affects current lifestyle". (claim)

Table 4.4: Level of agreement from people with different gender on "Modern technology affects current lifestyle".

Gender	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Male	1 E=$\frac{97\times2}{201}$= 0.97 $\chi^2 = \frac{(1-0.97)^2}{0.97}$ = 0.000928	0 (2.90) 0.00345	8 (6.76) 0.223	40 (36.68) 0.301	48 (50.67) 0.141	97
Female	1 (1.03) 0.000874	4 (3.10) 0.00323	6 (7.24) 0.212	36 (39.32) 0.280	57 (54.33) 0.131	104
Total	2	4	14	76	105	201

Combine the data since the expected value is less than 5.

Gender	Level of agreement			Total
	Strongly Disagree, Disagree and Neutral	Agree	Strongly Agree	
Male	9 E = $\frac{97\ x\ 20}{201}$= (9.66) χ^2= $\frac{(9-9.66)^2}{9.66}$= 0.0451	40 (36.68) 0.301	48 (50.67) 0.141	97
Female	11 (10.35) 0.0408	36 (39.32) 0.280	57 (54.33) 0.131	104
Total	20	76	105	201

χ_2^2= 0.0451 + 0.301 + 0.141 + 0.0408 + 0.280 + 0.131

= 0.939

From the statistical table, critical values: $\chi^2_{2,0.05}$= 5.991, $\chi^2_{2,0.10}$ = 4.605 and $\chi^2_{2,0.01}$ = 9.210. The test statistic does not fall in the 5%, 10% and 1% rejection region, and does not reject the null hypothesis. Thus, there is not sufficient evidence to support the claim that gender affects the level of agreement on "Modern technology affects current lifestyle".

p-value= P(χ_2^2 > 0.939) ≈P(χ_2^2 > 0.9) = 1-0.3624 = 0.6376

Since the p-value is greater than $\alpha = 0.1$, $\alpha = 0.05$ and $\alpha = 0.01$, do not reject the null hypothesis. Thus, there is not sufficient evidence to support the claim that gender affects the level of agreement on "Modern technology affects current lifestyle".

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "Modern technology affects current lifestyle" from male and female. There are less male than expected who strongly disagree, disagree and neutral with the statement while there are more female than expected who strongly disagree, disagree and neutral with the statement. Similarly, there are less male than expected who strongly agree with the statement while there are more female than expected who strongly agree with the statement. Since the behavior of male and female are the same on the extreme levels of agreement (Strongly disagree, disagree, neutral and Strongly agree), hence, gender does not affect the level of agreement on "Modern technology affects current lifestyle".

<u>Age</u>

H_o: Age does not affect the level of agreement on "Modern technology affects current lifestyle".

H_1: Age affects the level of agreement on "Modern technology affects current lifestyle". (claim)

Table 4.5: Level of agreement from people with different age on "Modern technology affects current lifestyle".

Age	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
16-25	0 E=$\frac{58\times2}{201}$= 0.58	0 (1.15)	5 (4.04)	24 (21.93)	29 (30.30)	58
26-35	1 (0.53)	0 (1.05)	3 (3.69)	20 (20.04)	29 (27.69)	53
36-45	0 (0.31)	2 (0.62)	2 (2.16)	10 (11.72)	17 (16.19)	31
46-55	1 (0.35)	1 (0.70)	2 (2.44)	15 (13.23)	16 (18.28)	35
56 and above	0 (0.24)	1 (0.48)	2 (1.67)	7 (9.07)	14 (12.54)	24
Total	2	4	14	76	105	201

Combine the data since the expected value is less than 5.

Age	Level of agreement			Total
	Strongly disagree, disagree and Neutral	Agree	Strongly Agree	
16-25	5 E=$\frac{58\times20}{201}$= 5.77 0.103	24 (21.93) 0.195	29 (30.30) 0.0556	58
26-35	4 (5.27) 0.306	20 (20.04) 0.000005	29 (27.69) 0.062	53
36-45	4 (3.08) 0.275	10 (11.72) 0.252	17 (16.19) 0.0405	31
46-55, 56 and above	7 (3.48) 3.560	22 (13.23) 5.814	30 (18.28) 7.514	35
Total	20	76	105	201

χ^2_6= 0.103 + 0.195 + 0.0556 + 0.306 + 0.000005 + 0.062 + 0.275 + 0.252 + 0.0405 + 3.56 + 5.814 + 7.514

= 18.177

From statistical table, critical values: $\chi^2_{6,0.05}$= 12.59, $\chi^2_{6,0.10}$ = 10.64 and $\chi^2_{6,0.01}$= 16.81 . The test statistic falls in the 5%, 10% and 1% rejection region, the null hypothesis is rejected. Thus, there is sufficient evidence to support the claim that age affects the level of agreement on "Modern technology affects current lifestyle".

p-value= P(χ^2_6 > 18.177) ≈P(χ^2_6 > 18.00) = 1-0.9971 = 0.029

Since the p-value is smaller than $\alpha = 0.1$, $\alpha = 0.05$ and $\alpha = 0.01$, the null hypothesis is rejected. Thus, there is not sufficient evidence to support the claim that age affects the level of agreement on "Modern technology affects current lifestyle".

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement “Modern technology affects current lifestyle” from age (16-25, 26-35, 36-45, 46-55, 56 and above. There are less ages between (16-25) than expected who strongly disagree,disagree and neutral with the statement while there are more ages between (36-45) than expected who strongly disagree, disagree and neutral with the statement. Similarly, there are more ages between (16-25) than expected who agree with the statement while there are less ages between (36-45) than expected who agree with the statement. SInce the behavior of people with age 16-25, 26-35, 36-45, 46-55, 56 to above are opposite on the extreme levels of agreement (Strongly disagree, disagree, neutral and agree), hence, age affects the level of agreement on “Modern technology affects current lifestyle”.

<u>Race</u>

H_o: Race does not affect the level of agreement on “Modern technology affects current lifestyle”.

H_1: Race affects the level of agreement on “Modern technology affects current lifestyle”. (claim)

Table 4.6: Level of agreement from people with different race on “Modern technology affects current lifestyle”.

Race	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Malay	0 E = $\frac{126 \, x \, 2}{201}$= 1.25	1 (2.51)	4 (8.78)	45 (47.64)	75 (65.82)	126
Chinese	1 (0.51)	2 (1.01)	5 (3.55)	22 (19.28)	21 (26.64)	51
Indian	0 (0.18)	1 (0.36)	4 (1.25)	6 (6.81)	7 (9.40)	18
Others	0 (0.06)	0 (0.12)	1 (0.42)	3 (2.27)	2 (3.13)	6
Total	2	4	14	76	105	201

Combine the data since the value for expected is less than 5.

Race	Level of agreement			Total
	Strongly disagree , Disagree and neutral	Agree	Strongly Agree	
Malay	6 (12.54) $\chi^2 = \frac{(6-12.54)^2}{12.54} = 3.411$	45 (47.64) 0.146	75 (65.82) 1.280	126
Chinese, Indian, Others	14 (7.46) 5.733	31 (28.36) 0.246	30 (39.18) 2.151	75
Total	20	76	105	201

χ_2^2= 3.411 + 5.733 + 0.146 + 0.246 + 1.280 +2.151

= 12.97

From statistical table, critical values: $\chi^2_{2,0.05}$= 5.991, $\chi^2_{2,0.10}$ = 4.605 and $\chi^2_{2,0.01}$ = 9.210. The test statistic falls in the 5%, 10% and 1% rejection region, the null hypothesis is rejected. Thus, there is sufficient evidence to support the claim that race affects the level of agreement on "Modern technology affects current lifestyle".

p-value= P(χ_2^2 > 12.97) ≈P(χ_2^2 > 10.00) = 1-0.9933 = 0.0067

Since the p-value is smaller than $\alpha = 0.1$, $\alpha = 0.05$and $\alpha = 0.01$, reject the null hypothesis. Thus, there is sufficient evidence to support the claim that race affects the level of agreement on "Modern technology affects current lifestyle".

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "Modern technology affects current lifestyle" from people with different races (Malay, Chinese, Indian and others). There are less Malay than expected who strongly disagree, disagree and neutral with the statement while there are more Chinese, Indian and others than expected who strongly disagree, disagree and neutral with the statement. On the other hand, there are more Malay than expected who strongly agree with the statement while there are less Chinese, Indian and others than expected who strongly agree with the statement. Since the behavior of Malay and Chinese, Indian and others are opposite on the two extreme levels of agreement (Strongly disagree, disagree, neutral and Strongly agree), hence, race affects the level of agreement on "Modern technology affects current lifestyle".

Education level

H_o: Education level does not affect the level of agreement on "Modern technology affects current lifestyles".

H_1: Education level affects the level of agreement on "Modern technology affects current lifestyles". (claim)

Table 4.6: Level of agreement from people with different education level on "Modern technology affects current lifestyle".

Education level	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Primary school	0 E=$\frac{15\times2}{201}$= 0.15	1 (0.30)	2 (1.04)	4 (5.67)	8 (7.84)	15
Secondary school	1 (0.70)	3 (1.40)	5 (4.88)	25 (26.48)	36 (36.57)	70
Diploma/ Degree	0 (1.05)	0 (2.11)	5 (7.38)	45 (40.08)	56 (55.37)	106
Masters/PhD	1 (0.10)	0 (0.20)	2 (0.70)	2 (3.78)	5 (5.22)	10
Total	2	4	14	76	105	201

Combine the data since the value for expected is less than 5.

Education level	Level of agreement			Total
	Strongly disagree, Disagree and Neutral	Agree	Strongly Agree	
Primary school	3 $E=\frac{15\times20}{201}=(1.49)$ $\chi^2=\frac{(3-1.49)^2}{1.49}=1.530$	4 (5.67) 0.492	8 (7.84) 0.00327	15
Secondary school	9 (6.97) 0.591	25 (26.47) 0.08816	36 (36.57) 0.00888	70
Diploma/ Degree/Master/ PhD	8 (11.54) 1.086	47 (43.86) 0.225	61 (60.60) 0.00264	116
Total	20	76	105	201

χ^2_4= 1.530 + 0.492 + 0.00327 + 0.591 + 0.08816 + 0.00888 + 1.086 + 0.225 + 0.00264

= 4.027

From statistical table, critical values: $\chi^2_{4,0.05}$= 9.488, $\chi^2_{4,0.10}$ = 7.779 and $\chi^2_{4,0.01}$ = 13.28. The test statistic does not fall in the 5%, 10% and 1% rejection region, and does not reject the null hypothesis. Thus, there is not sufficient evidence to support the claim that education level affects the level of agreement on "Current modern lifestyle needs higher expenditure".

p-value= P(χ^2_4 > 4.027) ≈P(χ^2_4 > 4.0) = 1- 0.5940 = 0.406

Since the p-value is greater than $\alpha = 0.1$, $\alpha = 0.05$and $\alpha = 0.01$, does not reject the null hypothesis. Thus, there is not sufficient evidence to support the claim that education level affects the level of agreement on "Modern technology affects current lifestyle".

Discussion:
There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "Modern technology affects current lifestyle" from people with different education levels (Primary school, Secondary school, Diploma/Degree and Masters/PhD). There are more people with diploma/degree and masters/ PhD education than expected who agree with the statement while there are less people with secondary school education than expected who agree with the statement. Similarly, there are more people with

diploma/degree and masters/ PhD education than expected who strongly agree with the statement while there are less people with secondary school education than expected who strongly agree with the statement. SInce the behavior of people with primary school, diploma/degree and masters/ PhD education are the same on the extreme levels of agreement (Strongly disagree, disagree, neutral and Strongly agree), hence, education level does not affect the level of agreement on “Modern technology affects current lifestyle”.

Q4:

Gender

H_o: Gender does not affect the level of agreement on “When I am with friends of other races, I don’t feel comfortable when they are talking in their mother tongue”

H_1: Gender affects the level of agreement on “When I am with friends of other races, I don’t feel comfortable when they are talking in their mother tongue” (claim)

Table 4.7: Level of agreement from people with different gender on “When I am with friends of other races, I don’t feel comfortable when they are talking in their mother tongue”

Gender	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Male	18 E= $\frac{97\times37}{201}$=17.86 χ^2= $\frac{(18-17.86)^2}{17.86}$ = 0.001097	24 (22.20) 0.1459	36 (32.33) 0.4166	9 (14.96) 2.3744	10 (9.65) 0.01269	97
Female	19 (19.14) 0.001024	22 (23.80) 0.1361	31 (34.67) 0.3885	22 (16.04) 2.2146	10 (10.35) 0.01184	104
Total	37	46	67	31	20	201

χ^2= 0.001097+0.001024+0.1459+0.1361+0.4166+0.3885+2.3744+2.2146+0.01269+0.01184

= 5.7028

P(χ_4^2 > 5.989) < P(χ_4^2 > 5.7028) < P(χ_4^2 > 4.878)

0.20 < p-value < 0.30

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is not even a weak evidence to support the claim that gender affects the level of agreement on “When I am with friends of other races, I don’t feel comfortable when they are talking in their mother tongue”.

Discussion:

There are five level of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement “When I am with friends of other races, I don’t feel comfortable when they are talking in their mother tongue” from male and female. There are more male than expected who strongly disagree with the statement while there are less female than expected who strongly disagree with the statement. Similarly, there are more male than expected who strongly agree with the statement while there are less female than expected who strongly agree with the statement. Since the behavior of male and female are the same on the two extreme levels of agreement (Strongly disagree and Strongly agree), hence, gender does not affect the level of agreement on “When I am with friends of other races, I don’t feel comfortable when they are talking in their mother tongue”.

<u>Race</u>

H_o: Race does not affect the level of agreement on “When I am with friends of other races, I don’t feel comfortable when they are talking in their mother tongue”

H_1: Race affects the level of agreement on “When I am with friends of other races, I don’t feel comfortable when they are talking in their mother tongue” (claim)

Table 4.8: Level of agreement from people with different race on “When I am with friends of other races, I don’t feel comfortable when they are talking in their mother tongue”

Race	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Malay	16 E=$\frac{126\times37}{201}$=23.19	22 (28.84)	49 (42.00)	22 (19.43)	17 (12.54)	126
Chinese	14 (9.39)	20 (11.67)	10 (17.00)	5 (7.87)	2 (5.07)	51
Indian	5 (3.31)	3 (4.12)	6 (6.00)	3 (2.78)	1 (1.79)	18
Others	2 (1.10)	1 (1.37)	2 (2.00)	1 (0.93)	0 (0.60)	6

Total	37	46	67	31	20	201

Race	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Malay	16 (23.19) $\chi^2=\frac{(16-23.19)^2}{23.19}=2.2$ 292	22 (28.84) 1.6222	49 (42.00) 1.1667	22 (19.43) 0.3399	17 (12.54) 1.5863	126
Chinese, Indian, Others	21 (13.81) 3.7434	24 (17.16) 2.7264	18 (25.00) 1.9600	9 (11.57) 0.5709	3 (7.46) 2.6664	75
Total	37	46	67	31	20	201

χ^2= 2.2292+3.7434+1.6222+2.7264+1.1667+1.9600+0.3399+0.5709+1.5863+2.6664
= 18.6114

P(χ^2_4 > 20.00) < P(χ^2_4 > 18.6114) < P(χ^2_4 > 18.47)

0.0005 < p-value < 0.001

Since the p-value is smaller than 0.01, Ho is rejected at 1%, 5% and 10% significance level. There is strong evidence to support the claim that race affects the level of agreement on "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue".

Discussion:

There are five level of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue" from people with difference race (Malay, Chinese, Indian and others). There are less Malay than expected who strongly disagree with the statement while there are more Chinese, Indian and others than expected who strongly disagree with the statement. On the other hand, there are more Malay than expected who strongly agree with the statement while there are less Chinese, Indian and others than expected who strongly agree with the statement. Since the behavior of Malay and Chinese, Indian and others are opposite on the two extreme levels of agreement (Strongly disagree and Strongly agree), hence, race affects the level of agreement on "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue".

Age

H_o: Age does not affect the level of agreement on "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue"

H_1: Age affects the level of agreement on "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue" (claim)

Table 4.9: Level of agreement from people with different age on "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue"

Age	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
16-25	9 E=$\frac{58\times37}{201}$=10.68	13 (13.27)	22 (19.33)	10 (8.95)	4 (5.77)	58
26-35	9 (9.76)	13 (12.13)	21 (17.67)	5 (8.17)	5 (5.27)	53
36-45	4 (5.71)	6 (7.09)	9 (10.33)	4 (4.78)	8 (3.08)	31
46-55	12 (6.44)	9 (8.01)	8 (11.67)	6 (5.40)	0 (3.48)	35
56 and above	3 (4.42)	5 (5.49)	7 (8.00)	6 (3.70)	3 (2.39)	24
Total	37	46	67	31	20	201

Age	Level of agreement				Total
	Strongly disagree	Disagree	Neutral	Agree, Strongly agree	
16-25	9 (10.68) $\chi^2=\frac{(9-10.68)^2}{10.68}$ = 0.2643	13 (13.27) 0.00549	22 (19.33) 0.3688	14 (14.72) 0.0352	58
26-35	9 (9.76) 0.0592	13 (12.13) 0.0624	21 (17.67) 0.6276	10 (13.45) 0.8849	53
36-45	4 (5.71) 0.5121	6 (7.09) 0.1676	9 (10.33) 0.1712	12 (7.87) 2.1673	31
46-55	12 (6.44) 4.8002	9 (8.01) 0.1224	8 (11.67) 1.1541	6 (8.88) 0.9341	35
56 and above	3 (4.42) 0.4562	5 (5.49) 0.0437	7 (8.00) 0.1250	9 (6.09) 1.3905	24
Total	37	46	67	51	201

χ^2=0.2643+0.0592+0.5121+4.8002+0.4562+0.00549+0.0624+0.1676+0.1224+0.0437+0.3688 + 0.6276+ 0.1712+ 1.1541+0.1250+0.0352+0.8849+2.1673+0.9341+1.3905 = 13.35

$P(\chi^2_{12} > 14.01) < P(\chi^2_{12} > 13.35) < P(\chi^2_{12} > 12.58)$

0.30 < p-value < 0.40

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is not even a weak evidence to support the claim that age affects the level of agreement on "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue".

Discussion:

There are five level of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue" from people with difference range of age (16-

25, 26-35, 36-45, 46-55, 56 and above). There are more people between the ages 26 and 35 than expected who disagree with the statement while there are less people with the ages 56 and above than expected who disagree with the statement. Similarly, there are more people between the ages 26 and 35 than expected who neutral with the statement while there are less people with the ages 56 and above who neutral with the statement. Since the behaviour of the two extreme range of age (26-35, 56 and above) are same on the two levels of agreement (Disagree and Neutral), hence, age does not affects the level of agreement on "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue".

Education level:

H_o: Education level does not affect the level of agreement on "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue"

H_1: Education level affects the level of agreement on "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue" (claim)

Table 5.0: Level of agreement from people with different education level on "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue"

Education level	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Primary school	5 E=$\frac{15\times37}{201}$=2.76	5 (3.43)	4 (5.00)	1 (2.31)	0 (1.49)	15
Secondary school	13 (12.89)	17 (16.02)	21 (23.33)	12 (10.80)	7 (6.79)	70
Diploma/ Degree	18 (19.51)	22 (24.26)	37 (35.33)	18 (16.25)	11 (10.55)	106
Masters/PhD	1 (1.84)	2 (2.29)	5 (3.33)	0 (1.54)	2 (1.00)	10
Total	37	46	67	31	20	201

Education level	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Primary, secondary school	18 (15.65) $\chi^2=\frac{(18-15.65)^2}{15.65}$ = 0.3529	22 (19.45) 0.3343	25 (28.33) 0.3914	13 (13.11) 0.000923	7 (8.46) 0.2520	85
Diploma/ Degree, Masters/ PhD	19 (21.35) 0.2587	24 (26.55) 0.2449	42 (38.67) 0.2868	18 (17.89) 0.000676	13 (11.54) 0.1847	116
Total	37	46	67	31	20	201

χ^2= 0.3529+0.2587+0.3343+0.2449+0.3914+0.2868+0.000923+0.000676+0.2520+0.1847

= 2.3073

p-value= $P(\chi_4^2 > 2.3073) > P(\chi_4^2 > 3.357)$

p-value > 0.50

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is not even weak evidence to support the claim that education level affects the level of agreement on "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue".

Discussion:

There are five level of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "When I am with friends of other races, I don't feel comfortable when they are talking in their mother tongue" from people with difference education level (Primary school, Secondary school, Diploma/Degree and Masters/PhD). There are less people with lower education (Primary and Secondary school) than expected who are neutral with the statement while there are more people with higher education (Diploma/Degree and Masters/PhD) than expected who are neutral with the statement. Similarly, there are less people with lower education (Primary and Secondary school) than expected who strongly agree with the statement while there are more people with higher education (Diploma/Degree and Masters/PhD) than expected who strongly agree with the statement. Since the behavior of the two extreme education levels are same on the two levels of agreement (Neutral and Strongly Agree), hence, education level does not affect the level of agreement on “When I am with friends of other races, I don’t feel comfortable when they are talking in their mother tongue”.

Q6:

Gender

H_o: Gender does not affect the level of agreement on “Occasionally, I like to wear traditional clothes.”

H_1: Gender affects the level of agreement on “Occasionally, I like to wear traditional clothes.” (claim)

Table 5.1: Level of agreement from people with different gender on “Occasionally, I like to wear traditional clothes.”

Gender	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Male	8 E=$\frac{97\times13}{201}$=6.27 χ^2=$\frac{(8-6.27)^2}{6.27}$ = 0.4773	15 (10.62) 1.8064	25 (24.61) 0.00618	31 (31.37) 0.00436	18 (24.13) 1.5573	97
Femele	5 (6.73) 0.4447	7 (11.38) 1.6858	26 (26.39) 0.00576	34 (33.63) 0.00407	32 (25.87) 1.4525	104
Total	13	22	51	65	50	201

χ^2= 0.4773+0.4447+1.8064+1.6858+0.00618+0.00576+0.00436+0.00407+1.5573+1.4525
= 7.444

P(χ^2_4 > 7.779) < P(χ^2_4 > 7.444) < P(χ^2_4 > 5.989)

0.10 < p-value < 0.20

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is not even weak evidence to support the claim that gender affects the level of agreement on “Occasionally, I like to wear traditional clothes.”

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "Occasionally, I like to wear traditional clothes." from male and female. There are more male than expected who strongly disagree with the statement while there are less female than expected who strongly disagree with the statement. Similarly, there are more male than expected who are neutral with the statement while there are less female than expected who are neutral with the statement. Since the behavior of two extreme gender (male and female) are same on the levels of agreement (Strongly disagree and neutral), hence, gender does not affect the level of agreement on "Occasionally, I like to wear traditional clothes."

<u>Race</u>

H_o: Race does not affect the level of agreement on "Occasionally, I like to wear traditional clothes."

H_1: Race affects the level of agreement on "Occasionally, I like to wear traditional clothes." (claim)

Table 5.2: Level of agreement from people with different race on "Occasionally, I like to wear traditional clothes."

Race	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Malay	3 E=$\frac{126\times13}{201}$=8.15	4 (13.79)	32 (31.97)	50 (40.75)	37 (31.34)	126
Chinese	8 (3.30)	16 (5.58)	15 (12.94)	11 (16.49)	1 (12.69)	51
Indian	1 (1.16)	2 (1.97)	2 (4.57)	3 (5.82)	10 (4.48)	18
Others	1 (0.39)	0 (0.66)	2 (1.52)	1 (1.94)	2 (1.49)	6
Total	13	22	51	65	50	201

Race	Level of agreement				Total
	Strongly disagree, disagree	Neutral	Agree	Strongly Agree	
Malay	7 (21.94) $\chi^2=\frac{(7-21.94)^2}{21.94}$ = 10.1734	32 (31.97) 0.0000282	50 (40.75) 2.0997	37 (31.34) 1.0222	126
Chinese	24 (8.88) 25.7449	15 (12.94) 0.3279	11 (16.49) 1.8278	1 (12.69) 10.7688	51
Indian, others	4 (4.18) 0.00775	4 (6.09) 0.7173	4 (7.76) 1.8219	12 (5.97) 6.0906	24
Total	35	51	65	50	201

χ^2= 10.1734+25.7449+0.00775+0.0000282+0.3279+0.7173+2.0997+1.8278+1.8219+1.0222+10.7688+6.0906

= 60.60

p-value= $P(\chi_6^2 > 60.60) < P(\chi_6^2 > 24.10)$

p-value < 0.0005

Since the p-value is smaller than 0.01, Ho is rejected at 1%, 5% and 10% significance level. There is strong evidence to support the claim that race affects the level of agreement on “Occasionally, I like to wear traditional clothes.”

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement “Occasionally, I like to wear traditional clothes.” from people with different races (Malay, Chinese, Indian and others). There are less Malay, Indian and others than expected who strongly disagree with the statement while there are more Chinese than expected who strongly disagree with the statement. On the other hand, there are more Malay, Indian and others than expected who strongly agree with the statement while there are less Chinese than expected who strongly agree with the statement. Since the behavior of Malay, Chinese, Indian and others are opposite on the two extreme levels of agreement (Strongly disagree and Strongly agree), hence, race affects the level of agreement on “Occasionally, I like to wear traditional clothes.”

Age

H_o: Age does not affect the level of agreement on “Occasionally, I like to wear traditional clothes.”

H_1: Age affects the level of agreement on “Occasionally, I like to wear traditional clothes.” (claim)

Table 5.3: Level of agreement from people with different age on “Occasionally, I like to wear traditional clothes.”

Age	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
16-25	5 E= $\frac{58\times13}{201}$ =3.75	8 (6.35)	20 (14.72)	13 (18.76)	12 (14.43)	58
26-35	5 (3.43)	5 (5.80)	15 (13.45)	15 (17.14)	13 (13.18)	53
36-45	0 (2.00)	4 (3.39)	7 (7.87)	12 (10.02)	8 (7.71)	31
46-55	1 (2.26)	3 (3.83)	3 (8.88)	18 (11.32)	10 (8.71)	35
56 and above	2 (1.55)	2 (2.53)	6 (6.09)	7 (7.76)	7 (5.97)	24
Total	13	22	51	65	50	201

Age	Level of agreement				Total
	Strongly disagree, Disagree	Neutral	Agree	Strongly agree	
16-25	13 (10.10) $\chi^2=\frac{(13-10.10)^2}{10.10}$ = 0.8327	20 (14.72) 1.8939	13 (18.76) 1.7685	12 (14.43) 0.4092	58
26-35	10 (9.23) 0.0642	15 (13.45) 0.1786	15 (17.14) 0.2672	13 (13.18) 0.00246	53
36-45	4 (5.40) 0.3630	7 (7.87) 0.0962	12 (10.02) 0.3913	8 (7.71) 0.0109	31
46-55	4 (6.09) 0.7173	3 (8.88) 3.8935	18 (11.32) 3.9419	10 (8.71) 0.1911	35
56 and above	4 (4.18) 0.00775	6 (6.09) 0.00133	7 (7.76) 0.0744	7 (5.97) 0.1777	24
Total	35	51	65	50	201

χ^2= 0.8327+0.0642+0.3630+0.7173+0.00775+1.8939+0.1786+0.0962+3.8935+0.00133+
1.7685+0.2672+0.3913+3.9419+0.0744+0.4092+0.00246+0.0109+0.1911+0.1777
= 15.31

$P(\chi^2_{12} > 15.81) < P(\chi^2_{12} > 15.31) < P(\chi^2_{12} > 14.01)$
$0.20 < \text{p-value} < 0.30$

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is no strong evidence to support the claim that age affects the level of agreement on "Occasionally, I like to wear traditional clothes."

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "Occasionally, I like to wear traditional clothes." from people with different ranges of age (16-25, 26-35, 36-45, 46-55, 56 and above). There are more people between the ages 16 and 25 than expected who strongly disagree and disagree with the statement while there are less people with the ages 56 and above than expected who strongly disagree and disagree with the statement. Similarly, there are more people between the ages 16 and 25 than expected who are neutral with the statement while there are less people with the ages 56 and above than expected who are neutral with the statement. Since the behavior of the two extreme range of age (16-25, 56 and above) are same on the two levels of agreement (Strongly disagree/disagree and Neutral), hence, age does not affect the level of agreement on "Occasionally, I like to wear traditional clothes."

Education level

H_o: Education level does not affect the level of agreement on "Occasionally, I like to wear traditional clothes."

H_1: Education level affects the level of agreement on "Occasionally, I like to wear traditional clothes." (claim)

Table 5.4: Level of agreement from people with different education level on "Occasionally, I like to wear traditional clothes."

Education level	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Primary school	0 E=$\frac{15\times13}{201}$=0.97	3 (1.64)	5 (3.81)	2 (4.85)	5 (3.73)	15
Secondary school	4 (4.53)	5 (7.66)	19 (17.76)	26 (22.64)	16 (17.41)	70
Diploma/ Degree	8 (6.86)	12 (11.60)	25 (26.90)	34 (34.28)	27 (26.37)	106
Masters/ PhD	1 (0.65)	2 (1.09)	2 (2.54)	3 (3.23)	2 (2.49)	10
Total	13	22	51	65	50	201

Education level	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Primary, secondary school	4 (5.50) $\chi^2=\frac{(4-5.50)^2}{5.50}$ = 0.4091	8 (9.30) 0.1817	24 (21.57) 0.2738	28 (27.49) 0.00946	21 (21.14) 0.000927	85
Diploma/ Degree, Masters/ PhD	9 (7.50) 0.3	14 (12.70) 0.1331	27 (29.43) 0.2006	37 (37.51) 0.00693	29 (28.86) 0.000679	116
Total	13	22	51	65	50	201

χ^2= 0.4091+0.3+0.1817+0.1331+0.2738+0.2006+0.00946+0.00693+0.000927+0.000679
= 1.516

$P(\chi^2_4 > 1.649) < P(\chi^2_4 > 1.516) < P(\chi^2_4 > 1.064)$

$0.80 < \text{p-value} < 0.90$

Since the p-value is greater than 0.10, Ho is not rejected at 1%, 5% and 10% significance level. There is no strong evidence to support the claim that education level affects the level of agreement on "Occasionally, I like to wear traditional clothes."

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "Occasionally, I like to wear traditional clothes." from people with different education levels (Primary school, Secondary school, Diploma/Degree and Masters/PhD). There are less people with lower education (primary and secondary school)than expected who strongly disagree with the statement while there are more people with higher education (diploma/degree and masters/PhD) than expected who strongly disagree with the statement. Similarly, there are less people with lower education (primary and secondary school) than expected who strongly agree with the statement while there are more people with higher education (diploma/degree and masters/PhD) than expected who strongly agree with the statement. SInce the behavior of the two extreme education levels are same on the two levels of agreement (Strongly disagree and Strongly agree), hence, education level does not affect the level of agreement on "Occasionally, I like to wear traditional clothes."

Q7: I enjoy looking at and experiencing the festivity celebration of other races

<u>Gender</u>

H_o:Gender does not affects the level of agreement on “I enjoy looking at and experiencing the festivity celebration of other races”

H_1:Gender affect the level of agreement on “enjoy looking and experiencing the festivity celebration of other races” (claim)

Table 5.5: Level of agreement from people with different gender on “I enjoy looking at and experiencing the festivity celebration of other races”

Gender	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Male	1 (1.44)	1 (0.97)	16 (16.40) 0.01	50 (45.85) 0.03	29 (34.67) 0.76	97
Female	2 (1.55)	1 (1.03)	18 (17.59) 0.01	45 (49.15) 0.35	38 (50.19) 2.96	104
Total	3	2	34	95	67	201

-since many cells have less expected value than 5, we combine the cells in the table.

Gender	Level of agreement			Total
	Strongly disagree, disagree and neutral	Agree	Strongly Agree	
Male	18 (18.82) 0.04	50 (45.85) 0.03	29 (32.33) 0.34	97
Female	21 (20.18) 0.03	45 (49.15) 0.35	38 (34.67) 0.32	104
Total	39	95	67	201

degree of freedom (3-1)(2-1)= 2

test statistic:

x_3^2= 0.04+0.03+0.34+0.03+0.35+0.32

=1.11

p-value approach

p value = p(x_2^2> 1.11) = 1- 0.4231 . p- value is 0.5769.

since p value larger than significant level, null hypothesis is not rejected at 1%, 5% and 10% significance level. Hence, there is not even weak evidence to support the claim that gender affects the level of agreement on “enjoy looking and experiencing the festivity celebration of other races”.

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement “I enjoy looking at and experiencing the festivity celebration of other races” from male and female. There are less male than expected who strongly disagree, disagree and neutral with the statement while there are more female than expected who strongly disagree, disagree and neutral with the statement. Similarly, there are less male than expected who strongly agree with the statement while there are more female than expected who strongly agree with the statement. Since the behavior of male and female are same on the two extreme levels of agreement (Strongly disagree, disagree, neutral and Strongly agree), hence, gender does not affect the level of agreement on “I enjoy looking at and experiencing the festivity celebration of other races.”

<u>Age</u>

H_o: different age groups does not affect the level of agreement on “enjoy looking and experiencing the festivity celebration of other races”

H_1different age group affects the level of agreement on “enjoy looking and experiencing the festivity celebration of other races” (claim).

Table 5.6: Level of agreement from people with different age on "I enjoy looking at and experiencing the festivity celebration of other races"

Age	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
16-25	1 (0.87) 0.02	0 (0.58)	6 (9.81) 1.48	29 (28.00) 0.04	22 (18.76) 0.56	58
26-35	1 (0.80) 0.05	1 (0.53) 0.42	9 (8.97) 0.10x10^-3	21 (25.58) 0.28	21 (17.14) 0.87	53
36-45	1 (0.46) 0.63	0 (0.31)	7 (5.24) 0.59	18 (14.96) 0.62	5 (10.02) 2.52	31
46-55	0 (0.52)	1 (0.35) 1.21	6 (5.92) 1.08x10^-3	18 (16.89) 0.07	10 (11.32) 0.15	35
56 and above	0 (0.36)	0 (0.24)	6 (4.06) 0.93	9 (11.58) 0.57	9 (7.76) 0.20	24
Total	3	2	34	95	67	201

- more than 20% cells have expected value less than 5. Hence we need to combine table.

Age	Level of agreement			Total
	Strongly disagree, disagree and neutral	Agree	Strongly agree	
16-25	7 (11.25) 1.61	29 (27.41) 0.09	22 (19.33) 0.37	58
26-35	11 (10.28) 0.05	21 (25.05) 0.65	21 (17.67) 0.63	53
36-45	8 (6.01) 0.66	18 (14.65) 0.77	5 (10.33) 2.75	31
46-55	7 (6.79) 6.49x10^-3	18 (16.54) 0.13	10 (11.67) 0.24	35
56 and above	6 (4.66) 0.39	9 (11.34) 0.48	9 (8.00) 0.13	24
Total	39	95	67	201

Degree of freedom (3-1)(5-1)= 8

critical value: $x^2_{8,0.05}$ = 15.51 at 5% significant level

$x^2_{8,0.10}$= 13.36 at 10% significant level.

$x^2_{8,0.01}$ = 20.09 at 1% significant level

Test statistic:

x^2_3= 1.61+0.09+0.37+0.05+0.65+0.63+0.66+0.77+2.75+6.49x10^-3+0.13+0.24+0.39+0.48+0.13

= 8.956

Critical region approach

Since test statistic does not fall in the rejection region, we accept the null hypothesis. Hence, there is not even weak evidence to support the claim that age affects level of agreement on "enjoy looking and experiencing the festivity celebration of other races".

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "I enjoy looking at and experiencing the festivity celebration of other races" from people with different ranges of age (16-25, 26-35, 36-45, 46-55, 56 and above). There are more people between the ages 26 and 35 and also with the ages 56 and above than expected who strongly disagree, disagree and neutral with the statement while there are more people between the ages 26 and 35 and also with the ages 56 and above than expected who strongly agree with the statement. Since the behavior of the two extreme range of age (26-35, 56 and above) are same on the levels of agreement (Strongly disagree, Disagree, Neutral and Strongly agree), hence, age does not affect the level of agreement on "I enjoy looking at and experiencing the festivity celebration of other races".

Race

H_o: race does not affect the level of agreement on "I enjoy looking at and experiencing the festivity celebration of other races"

H_1:race affects the level of agreement on "I enjoy looking at and experiencing the festivity celebration of other races". (claim)

Table 5.7: Level of agreement from people with different race on "I enjoy looking at and experiencing the festivity celebration of other races"

Race	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Malay	2 (1.88)	1 (1.25)	25 (21.31)	60 (59.55)	38 (42.00)	126
Chinese	1 (0.76)	1 (0.51)	6 (8.63)	28 (24.10)	15 (17.00)	51
Indian	0 (0.27)	0 (0.18)	3 (3.04)	3 (8.51)	12 (6.00)	18
	0	0	0	4	2	6

Others	(0.09)	(0.06)	(1.01)	(2.83)	(2.00)	
Total	3	2	34	95	67	201

-Since many cells have expected value less than 5, we combine the cells in the table.

Race	Level of agreement			Total
	Strongly disagree, disagree and neutral	Agree	Strongly Agree	
Malay	28 (24.45) 0.52	60 (59.55) 3.4x10^-3	38 (42.00) 0.38	126
Chinese,	8 (9.90) 0.36	28 (24.10) 0.63	15 (17.00) 0.24	51
Indian, other	3 (4.66) 0.59	7 (11.34) 1.66	14 (8.00) 4.50	24
Total	39	95	67	201

degree of freedom (3-1)(3-1)= 4

critical value: $x^2_{4,0.05}$ = 9.488 at 5% significance level

$x^2_{4,0.10}$= 7.779 at 10% significance level

$x^2_{4,0.01}$= 13.28 at 1% significance level

Test statistic:

x^2_3= 0.52+3.4x10^-3+0.38+0.36+0.63+0.24+0.59+1.66+4.50

= 8.8834

Critical region approach

since test statistic does not fall in 1%, 5% and 10% rejection region, we accept the null hypothesis. Hence, there is not even weak evidence to support the claim that race affects the level of agreement on “I enjoy looking at and experiencing the festivity celebration of other races”.

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "I enjoy looking at and experiencing the festivity celebration of other races" from people with different races (Malay, Chinese, Indian and others). There are more Malay than expected who strongly disagree, disagree and neutral with the statement while there are less Indian and others than expected who strongly disagree, disagree and neutral with the statement. Similarly, There are more Malay than expected who agree with the statement while there are less Indian and others than expected who agree with the statement. Since the behavior of the two extreme race (Malay and Indian/others) are the same on the levels of agreement (strongly disagree, disagree, neutral and agree), hence, race does not affect the level of agreement on "I enjoy looking at and experiencing the festivity celebration of other races".

Education level

H_o: education level does not affect the level of agreement on "experiencing the festivity celebration of other races".

H_1: education level does affect the level of agreement on "experiencing the festivity celebration of other races". (claim)

Table 5.8: Level of agreement from people with different education level on "I enjoy looking at and experiencing the festivity celebration of other races"

Education level	Level of agreement					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
Primary school	0 (0.22)	0 (0.15)	4 (2.54)	6 (7.09)	5 (5.00)	15
Secondary school	1 (1.04)	0 (0.70)	9 (11.84)	39 (33.08)	21 (23.33)	70
Diploma/ degree	2 (1.58)	2 (1.05)	20 (17.93)	46 (50.10)	36 (35.33)	106
Masters/ PhD	0 (0.15)	0 (0.10)	1 (1.69)	4 (4.73)	5 (3.33)	10
Total	3	2	34	95	67	201

-Since more than 20% cells have expected value less than 5, we combine the cells in the table.

Education level	Level of agreement			Total
	Strongly disagree, disagree and neutral	Agree	Strongly Agree	
Primary school, secondary school	14 (16.49) 0.38	45 (40.17) 0.58	26 (28.33) 0.19	85
Diploma/degree, Masters/PhD	25 (22.51) 0.28	50 (54.83) 0.43	41 (38.67) 0.14	116
Total	39	95	67	201

degree of freedom (3-1)(2-1)= 2

critical value: $x^2_{2,0.05}$ = 5.991 at 5% significant level

$x^2_{2,0.10}$= 4.605 at 10% significant level

test statistic

x^2_3= 0.38+0.58+0.19+0.28+0.43+0.14

= 2.00

Critical region approach

Since test statistic does not fall in the rejection region, we accept the null hypothesis. Hence, there is strong evidence to reject the claim that education level does not affect level of agreement on "enjoy looking and experiencing the festivity celebration of other races".

Discussion:

There are five levels of agreement (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) on the statement "I enjoy looking at and experiencing the festivity celebration of other races" from people with difference education level (Primary school, Secondary school, Diploma/Degree and Masters/PhD). There are less people with lower education (primary and secondary school) than expected who strongly disagree, disagree and neutral with the statement while there are more people with higher education (diploma/degree and masters/ PhD) than expected who strongly disagree, disagree and neutral with the statement. Similarly, there are less people with lower education (primary and secondary school) than expected who strongly agree with the statement while there are more people with higher education (diploma/degree and masters/PhD) than expected who strongly agree with the statement. SInce the behavior of the two extreme education level are same on the levels of agreement (Strongly disagree, Disagree, Neutral and Strongly agree), hence, education level does not affects the level of agreement on "I enjoy looking at and experiencing the festivity celebration of other races."