3 Independente Tests to Save Youn Boxing Ring

(a)

Null Hypothesis H_0: Outcome of the match should be independent of the judge.

H_1: Outcome of the match is dependent on the judge

	Judge A	Judge B	Judge C	Total
Player1 Wins	72	50	24	146
Draw	8	5	3	16
Loses	20	8	9	37
Total	100	63	36	199

From the above table, grand total = 199

$$P(\text{Player1 Wins}) = \frac{\text{Total Wins}}{\text{Grand Total}} = \frac{146}{199} = 0.73$$

$$P(\text{Judge A}) = \frac{\text{Total A}}{\text{Grand Total}} = \frac{100}{267} = 0.374$$

Expected frequency of ~~Win~~ player1 & Judge A is = Grand Total * P(win) * P(Judge A)

Similarly

$$\Rightarrow E_{ij} = \frac{T_{4j} \times T_{i4}}{T_{44}}$$

row column

Similarly, we populate the below table with expected frequencies:

	Judge A	Judge B	Judge C
Wins	73.36	46.22	26.41
Draw	8.04	5.065	2.89
Player 1 Loses	18.54	11.71	6.693

$$Q_{obs} = \sum_{r}\sum_{c} \frac{(E_{rc} - O_{rc})^2}{E_{rc}}$$

Observed	Excepted	$\frac{(E-O)^2}{E}$
72	73.36	0.0252
50	46.22	0.309
24	26.41	0.2199
8	8.04	0.00099
5	5.065	0.00083
3	2.89	0.0041
20	18.54	0.1069
8	11.71	1.175
9	6.693	0.7951

$Q_{obs} = 2.63702$

df (Degree of Freedom) $= (3-1) * (3-1) = 4$

P-value $= P_r(\chi^2_4 > Q_{obs}) = 1 - P_r(\chi^2_4 < 2.63702)$

$= 0.620283$

As p-value $(0.620283) > 0.05$, we fail to reject H_0

We Accept H_0.

3) b) Pearson Correlation Coefficient

$$\hat{S}_{X,Y} = \frac{\sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n} (X_i - \bar{X})^2} \sqrt{\sum_{i=1}^{n} (Y_i - \bar{Y})^2}}$$

Let

$X_i \rightarrow$ number of player 1 wins for Judge A for 10 days

$Y_i \rightarrow$ number of player wins for Judge B

$Z_i \rightarrow$ number of player wins for Judge C.

$\bar{X} = \sum_{i=1}^{n} \frac{X_i}{n} = 42.6$ $\quad \bar{Y} = 43$ $\quad \bar{Z} = 40.2$

Correlation between Judges A, B

$$\hat{S}_{A,B} = \frac{\sum_{i=1}^{10} (X_i - 42.6)(Y_i - 43)}{\sqrt{\sum_{i=1}^{10} (X_i - 42.6)^2} \sqrt{\sum_{i=1}^{10} (Y_i - 43)^2}}$$

$= 0.5726 \; (> 0.5)$ - Positive linear Correlation

Correlation between Judges B, C

$$\hat{S}_{Y,Z} = \frac{\sum_{i=1}^{10} (Y_i - 43)(Z_i - 40.2)}{\sqrt{\sum_{i=1}^{10} (Y_i - 43)^2} \sqrt{\sum_{i=1}^{n} (Z_i - 40.2)^2}} = -0.0837$$

$= |-0.0837| \leq 0.5 \Rightarrow$ ~~No~~ No linear Calculation

Correlation between Judges A, C

$$\hat{S}_{X,Z} = \frac{\sum_{i=1}^{10} (X_i - 42.6)(Z_i - 40.2)}{\sqrt{\sum_{i=1}^{10} (X_i - 42.6)^2} \sqrt{\sum_{i=1}^{10} (Z_i - 40.2)^2}} = 0.0913$$

$$\hat{S}_{A,C} \Rightarrow \hat{S}_{X,Z} = 0.0913$$

$$|\hat{S}_{X,Z}| \leq 0.5 \rightarrow \text{No linear Corelation}$$

As the probability of winning each game is same; the results for each Judges should be Corelated.
We observe from the results ~~from~~ of Judge C that it is not linearly Corelated with Judge A & Judge B.
From this we can infer that Judge C is not doing their job.

4 a) Step 1: Define Null hypothesis

$H_0 : \mu \leq \mu_0$

$H_1 : \mu > \mu_0$

Given $X = [21.5, 24.5, 18.5, 17.2, 14.5, 23.2, 22.1, 20.5, 19.4, 18.1, 24.1, 18.5]$

$H_0 : \bar{X} \leq 20$

$H_1 : \bar{X} > 20$

$n = 12$ Since this is One Sample T Test, the degrees of freedom $= n-1 = 12-1 = 11$

$\alpha = 0.05$ to meet 95% Confidence interval

Step ② Calculate ~~Test~~ Test Statistic

$$T = \frac{\bar{X} - \mu_0}{S/\sqrt{n}}$$

$$\bar{X} = \frac{x_1 + x_2 + \cdots x_n}{n} = \frac{21.5 + 24.5 + 18.5 + 17.2 + 14.5 + 23.2 + 22.1 + 20.5 + 19.4 + 18.1 + 24.1 + 18.5}{12}$$

$$= 20.175$$

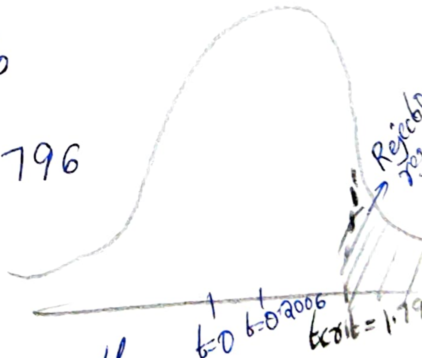
$$S = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{1.768 + 18.74 + 2.78 + 8.82 + 32.14 + 9.18 + 3.72 + 0.108 + 0.59 + 4.28 + 15.44 + 2.78}{11}}$$

$$= 3.0211$$

$$T = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{(20.175 - 20)}{\frac{3.0211}{\sqrt{12}}} = 0.2006$$

Step-3 ~~$t_{(11,0}$~~ If $T > t_{n-1,\alpha}$ reject H_0

$$t_{n-1,\alpha} = t_{11,0.05} = 1.796$$



$T \not> t_{n-1,\alpha}$

$0.2006 \not> 1.796$ we accept H_0

[∴ We accept the null hypothesis]