00427

Sri Lanka Institute of Information Technology

B.Sc. Honours Degree in Information Technology

Final Examination
Year 2, Semester 2 (2022)

IT2110 – Probability and Statistics

Duration: 2 Hours

June 2022

Instructions to Candidates:

- You have **10 minute** reading time.
- This paper has **4** questions.
- Answer **all** questions in the booklet given.
- The total marks for the paper is 100 which contributed to 50% of final grade.
- This paper contains **5 pages**, including the cover page and the equation sheet.
- Please show your work for full credit.
- Calculators are allowed.
- Electronic devices capable of storing and retrieving text, including mobile phones are not allowed.

Question 01 — 25 Marks

a) The number of ATM transactions per day were recorded at 30 locations in Western province of Sri Lanka. The data are given below.

25	29	30	31	32	32	35	36	40	43	47	48
48	49	50	51	52	52	55	59	60	61	64	65
68	71	71	76	76	83						

i. Find the five number summary of above data set. **(8 marks)**
ii. Are there any outliers? Justify your answer. **(4 marks)**
iii. Draw the box plot for the above data set. **(4 marks)**
iv. Comment on the distribution of data. **(3 marks)**

b) Give an example for each of the event.
i. Mutually exclusive events **(3 marks)**
ii. Collectively exhaustive events **(3 marks)**

Question 02 — 25 Marks

a) A random sample of 12 undergraduates of a certain university in Sri Lanka typed an average of 68.4 words per minute with a standard deviation of 7.3 words per minute. Construct a 95% confidence interval for the true average number of words typed by all undergraduates of this university and interpret. (Round up the answer to the nearest integer).

(10 marks)

b) A researcher claimed that average content of containers of a particular lubricant is 10 *liters*. He selected a random sample of 35 containers and found that average content of this sample containers is 10.56 *liters* with a standard deviation of 1.246 *liters*. Assuming that contents of containers are normally distributed test the researcher's claim at 5% level of significance and give your conclusions (Round up the test statistic up to 2 decimal places).

(15 marks)

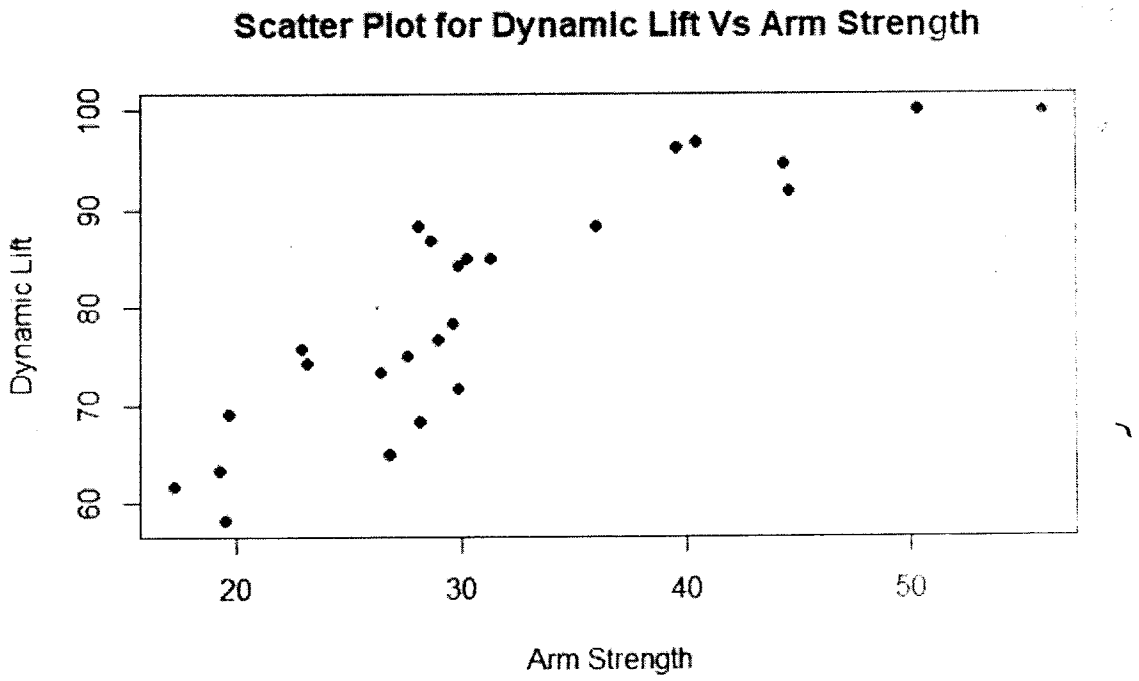
Question 03 — 25 Marks

a) A survey was conducted in two major cities in a country to determine voter sentiment about three political candidates in an upcoming election. Thousand voters were randomly selected from the two cities and following data were recorded. Test whether voter sentiment is independent from the city. Consider 5% level of significance (Round up the test statistic up to 4 decimal places). **(25 marks)**

City	Voter Sentiment			Total
	Favour A	Favour B	Favour C	
City 1	210	221	95	526
City 2	211	176	87	474
Total	421	397	182	1000

Question 04 — 25 Marks

A study was conducted by a team of researchers to determine if certain static arm-strength measures are related with "dynamic lift" characteristics of an individual. Twenty-five individuals were subjected to strength tests and were asked to perform a weight lifting test in which weight was dynamically lifted overhead. Figure below displays the scatter plot for the data (Give all of your answers in four decimal places).



R outputs of the regression model are shown below.

Regression Model

Coefficients

Intercept	Arm Strength
45.805	1.107

Analysis of Variance Table

Response: Dynamic_Lift

	Df	**Sum Sq**	**Mean Sq**	**F value**	***Pr(>F)***
Arm_Strength	*A*	2863.20	*F*	*G*	7.532e-09
Residuals	*B*	*D*	36.7		
Total	*C*	*E*			

a) What can be concluded using the scatterplot? **(2 marks)**

b) Find values marked *A, B, C, D, E, F* and *G* in the ANOVA table (Show your work). **(10 marks)**

c) State the estimated regression equation in the form of $\hat{Y} = \hat{\alpha} + \hat{\beta}X$ and interpret. **(4 marks)**

d) Calculate Pearson's correlation coefficient between arm strength and dynamic lift. **(4 marks)**

e) Test whether population correlation (ρ) between arm strength and dynamic lift is significant at 5% level of significance. **(5 marks)**

End of the Question Paper

Probability and Statistics (IT2110)

Equation Sheet

- Transformation of Normal random variable (X) into Standard normal random variable (Z):

$$Z = \frac{X - \mu}{\sigma}$$

- Chi Squared Test Statistic:

$$X^2 = \sum_{all\ i} \sum_{all\ j} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

- Pearson's Product Moment Correlation Coefficient:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{(n(\sum x^2) - (\sum x)^2) * (n(\sum y^2) - (\sum y)^2)}}$$