

THE OPEN UNIVERSITY OF SRI LANKA
COMMONWEALTH EXECUTIVE MASTER OF BUSINESS/PUBLIC
ADMINISTRATION PROGRAMME
OSP9407/MSP9407/MCP1607: QUANTITATIVE TECHNIQUES



FINAL EXAMINATION - 2023
DURATION – THREE (03) HOURS

Date: 12th August 2023

Time: 9.30 am to 12.30 pm

Note to the students:

- Answer only FIVE questions.
- Answers should be focused and methodical.
- This question paper carries 6 Questions and has 6 pages.
- Use of a non-programmable calculator is allowed.

Question 1

- a) A businessman assesses 3 investment opportunities to identify the best investment. The cost and net cash flow for the 3 investments named as Inv1, Inv2 and, Inv3 are stated below. The rate of discount is 5.5%.

Investment	Cash Flow	
	Initial payment (Rs.)	Value at the end of 2 nd Year (Rs.)
Inv1	320,000	358,000
Inv2	280,000	320,500
Inv3	350,000	397,500

- i) Which investment is better? (Show all workings) (6 marks)
- ii) Briefly explain the reason for the above answer. (2 marks)
- iii) What is the second-best investment alternative? Why? (2 marks)
- b) The manager of a company is planning to expect the revenue function of a new product based on a similar product. The fixed cost of producing a new product is 650 and the variable cost per product is equal to $2x - 30$, where the number of products that can be sold is given by x . Moreover, the revenue function has been identified by $x^2 - 3x + 154$. Based on this information, answer the questions given below.

- i) Write a mathematical function for total cost. (2 marks)
- ii) Find the marginal revenue of the company. (2 marks)
- iii) Find the marginal cost of the company. (2 marks)
- iv) Find out the point of production at which the profits can be maximized and the maximum profits. (4 marks)
- [Total 20 Marks]**

Question 2

- a) Following are the attendance of 20 employees of a company in one month (30 days). Answer the questions given below based on the following data set.

19, 14, 28, 16, 12, 23, 29, 17, 18, 17, 21, 23, 15, 18, 22, 15, 17, 16, 20, 25

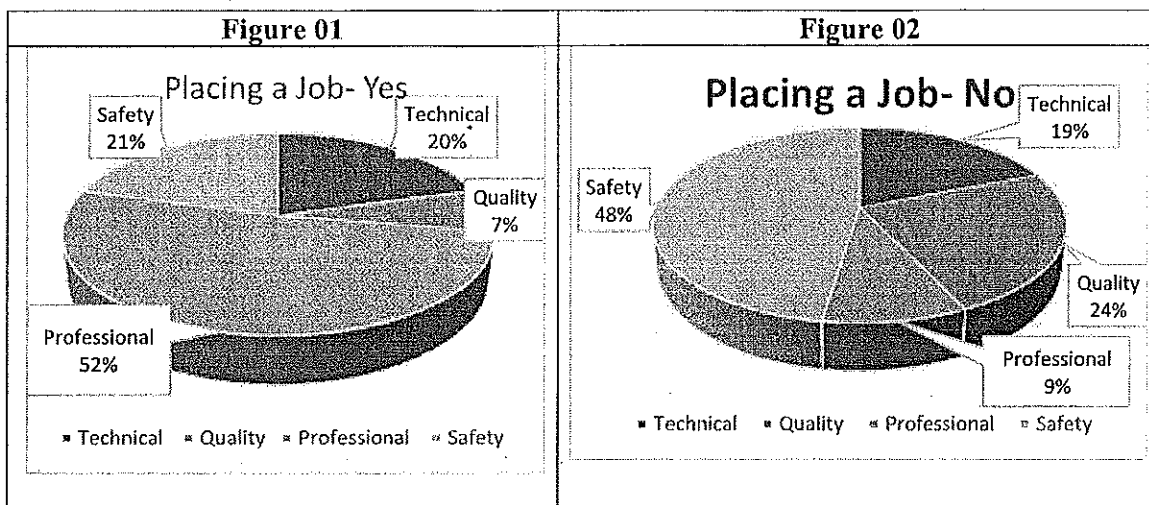
- i) Mean (02 Marks)
- ii) Mode (01 Mark)
- iii) Inter quartile range (IQR) (05 Marks)
- iv) Range (02 Marks)
- v) Interpret the above data set using your statistical knowledge on IQR. (02 Marks)
- b) A market researcher wants to replicate her study using a new sample. This time, she uses a recruitment database to help her narrow down the sample. She selects people living in the region, between ages 16-49 and both men and women. The total sample she used is 6500 in the chosen region. Suppose she needs to study the household expenditures of the people, and she asks you to come up with an idea to study the average household expenditures of them. Discuss the sampling method that you may use to collect data for the said study. Explain the reasons for your selection of sample with the suitable data collection procedures.
- (08 marks)
- [Total 20 Marks]**

Question 3

- a) A study was carried out to identify the type of training program attended and the job placement success of trainees. The researcher has summarized the data obtained from the study in Table 01 and in Figures 01 and 02.
- i) Interpret your findings with Table 01, Figures 01 and 02. (5 Marks)
- ii) State your suggestions to improve the graphs or tables. (5 Marks)

Table 01

Type of Training	Placing a job		Total
	Yes	No	
Technical	6	4	10
Quality	2	5	7
Professional	15	2	17
Safety	6	10	16



- b) A researcher is interested in identifying average IQ knowledge of the O/L students in Sri Lanka. Thus, he collected the data of monthly marks from 600 O/L students in the Colombo district. Identify the following regarding this study?
- i) Variable of interest (2 Marks)
 - ii) Population (1 Mark)
 - iii) Sample (1 Mark)
 - iv) Data / variable type (2 Marks)
- c) Explain the four components of timeseries model with respect to multiplicative and additive models. (4 Marks)
- [Total 20 Marks]**

Question 4

- a) Given below is the output of a regression analysis done for different patients who are suffering from heart disease.

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.989756259							
R Square	0.979617452							
Adjusted R Square	0.979535099							
Standard Error	0.654032173							
Observations	498							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	2	10176.57109	5088.286	11895.24	0			
Residual	495	211.7402511	0.427758					
Total	497	10388.31134						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	14.98465799	0.080136914	186.9882	0	14.82720754	15.14210843	14.82720754	15.14210843
Biking	-0.20013305	0.001365858	-146.525	0	-0.202816647	-0.19744946	-0.202816647	-0.197449457
Smoking	0.178333914	0.003539307	50.38667	5.2E-197	0.171379996	0.185287832	0.171379996	0.185287832

- Determine the regression equation based on the given outputs. (3 marks)
 - The researcher claims that the heart disease increases with the smoking. Is this statement correct? Justify your answer. (2 marks)
 - Interpret the coefficient of the variable of 'Biking'. (Its strength and how it may affect the heart disease) (3 marks)
 - Interpret the R square value. (2 marks)
 - Comment on the significance of the model using ANOVA table (2 marks)
 - If the biking hours are equal to 5 and smoking hours are equal to 2 what will be the value for a heart disease factor? (2 marks)
- vii) Use following table to answer the question given below.

Dimension	Coefficient of correlation
Smoking	0.672
Biking	-0.843

Comment on the correlation coefficient values given in the above table. (6 marks)

[Total 20 Marks]

Question 5

A small-scale entrepreneur purchases bakery items to sell during the weekdays near a school. The bakery items are purchased at Rs.75 each and are sold at Rs.100. Any bakery item not sold by the day can be disposed at a cost of Rs.20 each. The entrepreneur estimates that four levels of demand are possible, 100, 200, 300 and 500 items. The probability for the demand for the different number of bakery items are as follows.

Demand (number of bakery items can be sold)	Probability
100	0.3
200	0.4
300	0.2
500	0.1

- i) Compute the expected monetary value for purchasing 100, 200, 300 and 500 items. (7 marks)
- ii) Compute the expected opportunity loss for purchasing 100, 200, 300 and 500 items. (7 marks)
- iii) Based on the results obtained for (a) and (b), which would you choose to purchase, 100, 200, 300 or 500 items? (2 marks)
- iv) Explain the meaning of expected value of perfect information (EVPI) for this problem and compute the EVPI. (4 marks)

[Total 20 Marks]

Question 6

- a) The performance of a training programme and the type of jobs received from a sample of employees are given below.

Performance of a training program	Type of jobs				Total
	Engineering and technology related	Managerial	IT related	Finance and accountancy	
High	110	55	65	30	260
Medium	75	20	50	35	180
Low	25	85	45	65	220
Total	210	160	160	130	660

- i) What is the name of the procedure that can be used to check the association between the performance of a training programme and the type of jobs received? (2 marks)
- ii) What are the hypotheses to be checked in this test? (4 marks)
- iii) What is the procedure to infer at 5% significance level that the performance of a training programme is associated with the type of jobs received? (6 marks)
- iv) One of these 660 employees was selected randomly. What is the probability that the selected employee is a managerial job holder? (2 marks)
- v) A randomly selected employee was found to be an engineer. What is the probability that the employee has performed low at the training programme? (2 marks)
- b) A bakery produces bread and buns each day. To produce one dozen buns and breads, the following are required.

	Bun	Bread	Available per week
Flour (Pounds)	2	5	1100 pounds
Labor (hours)	2	3	40 (hours)
Unit Profit (Rs.)	7	6	

There are some requirements from the manager as total production should not exceed 750 dozens and number of dozens of buns should not exceed number of dozens of breads by more than 120. Formulate a linear programming model for the above problem. (Use X_1 and X_2 for dozens of buns and bread produced respectively). (4 marks)

[Total 20 Marks]

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