THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF MANAGEMENT STUDIES
COMMONWEALTH EXECUTIVE MASTER OF BUSINESS/ PUBLIC ADMINISTRATION
FINAL EXAMINATION – 2022

OSP9407/MSP9407/ MCP1607 - QUANTITATIVE TECHNIQUES

DURATION – THREE (03) HOURS

DATE: 24.09.2022	TIME: 1.30 PM – 4.30 PM

Instructions:

1. **Answer FOUR questions ONLY.**
2. **Use of a non-programmable calculator is allowed.**
3. **All workings pertaining to answers should be properly submitted.**
4. **This question paper contains 5 questions in 6 pages.**

Question 1

1. A company is evaluating 2 investments (Investment A and Investment B). The profit forecast of each investment for 5 years are given in the table below:

Investment	Investment amount (Rs.)	Investment income (Rs.)				
		1st year	2nd year	3rd year	4th year	5th year
A	(800,000)	250,000	250,000	250,000	Nil	250,000
B	(300,000)	100,000	100,000	Nil	100,000	100,000

Identify the **most profitable investment** by calculating the net present values. Use the discount rate of 15%. (11 marks)

2. The **costs** of producing a new product are given below. Based on similar products, you can expect the revenue function of the product.

Fixed cost (Rs.)	6000
Variable cost per product (Rs.)	X- 50
Revenue function	$200X - X^2$

i) Write a mathematical function for the total cost if the number of products that can be sold is X. (2 marks)

ii) Find the marginal revenue of the product. (2 marks)

iii) Find the marginal cost of the product. (2 marks)

3. Daily tourist arrivals at a popular tourist destination for 20 days of this month are given below:

428	292	411	697	692	711	569	429	675	604	633	315	389	365	295	534	697	411	468	326

Describe the tourist arrival of this month based on the following measures: (8 marks)

i) Mean
ii) Median
iii) Mode
iv) Range

(Total 25 marks)

Question 2

1. A company purchases toys to be sold at an exhibition. The toys are purchased for Rs.75 each and are sold for Rs.150 each. Any toy not sold at the exhibition can be disposed for Rs.35 each. The company estimates that four levels of demand are possible, 200, 300, 500 and 1000 toys. The probability for the demand for the different number of toys are as follows.

Demand (number of toys)	Probability
200	0.25
300	0.4
500	0.2
1000	0.15

i) Compute the expected monetary value for purchasing 200, 300, 500 and 1000 toys. (7 marks)

ii) Compute the expected opportunity loss for purchasing 200, 300, 500 and 1000 toys. (7 marks)

iii) Based on the results obtained for (1) and (2), which amount would you choose to purchase, 200, 300, 500 and 1000 toys? (2 marks)

iv) Explain the meaning of expected value of perfect information (EVPI) for this problem and compute the EVPI. (4 marks)

2. A company manufactures 3 products: A, B and C. The resource utilization, resource availability and profit/unit of each product are given below:

Product	Resource Requirement			Profit/ unit (Rs.)
	Raw material (kg)	Time in manufacturing department (hours)	Time in finishing department (hours)	
A	10	7	2	12
B	2	3	4	3
C	1	2	1	1
Availability of resources	**100**	**77**	**80**	

The quantities of A, B, and C that has to be manufactured should be determined so that the total profit has to be maximized. Formulate a linear programming model for the above problem. (Key: Use X1, X2 and X3 as number of units to be manufactured from products A, B, and C respectively). (5 marks)

(Total 25 marks)

Question 3

A scientist wants to know if the highest education level and marital status are related for all people in the country. He collects data on a simple random sample of n = 300 people.

Marital status	Highest education level				Total
	Ordinary level	Advanced level	Degree	Masters or above	
Unmarried	18	36	21	15	90
Married	12	36	45	57	150
Divorced	6	9	9	6	30
Widowed	3	9	9	9	30
Total	39	90	84	87	**300**

1. What is the name of the procedure that can be used to check the association between the performance in final examinations and place lived? (1 mark)
2. What are the hypotheses to be checked in this test? (4 marks)
3. Construct the contingency table and infer at 5% significance level that the highest education level is associated with the marital status? (12 marks)
4. One of these 300 persons was selected randomly. What is the probability that the selected person is married? (2 marks)
5. A randomly selected person was found to be divorced. What is the probability that the person has obtained 'Masters or above' as the highest educational qualification? (2 marks)
6. A randomly selected person was found to be obtained a 'Degree' as the highest educational qualification. What is the probability that the person is unmarried? (2 marks)
7. Find the probability of a randomly selected person with 'Advanced level' qualification as the highest educational qualification, and is a married person. (2 marks)

(Total 25 marks)

Question 4

1. Determine the regression equation based on the output tables given below. (3 marks)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.765	.585	.562	.3864222

a. Predictors: (Constant), Motivation to work from home, Flexibility of work from home

b. Dependent Variable: Employee Productivity

Dependent Variable: Employee Productivity

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.795	.289		3.045	.006
Motivation to work from home	.434	.063	.325	3.456	.001
Flexibility of work from home	.701	.095	.255	1.562	.000

2. The researcher claims that the Employee Productivity increases with the level of Motivation to work from home. Is this statement correct? Justify your answer. (3 marks)
3. Interpret the coefficient of the variable of 'Flexibility of work from home'. (Its strength and how it may affect the Employee Productivity) (3 marks)
4. Estimate the Employee Productivity when the scores for the two dimensions, are Motivation to work from home, and Flexibility of work from home are 4.36 and 3.59 respectively. (2 marks)

5. Use the following table to answer the question given below.

Dimension	Coefficient of correlation with variable E	Sig (p)
A	-0.345	0.000
B	0.895	0.000
C	0.006	0.000
D	-0.643	0.000

Comment on the correlation coefficient values (i.e. the relationship and its strength) given in the above table. (8 marks)

6. Two different areas of a large city are being considered as sites for day-care centers. Of 200 households surveyed in one section, the proportion of which the mother worked full time was 0.52. In another section, 40% of the 150 households surveyed had mothers working at full time jobs. Consider that the data are distributed as Normal and a level of significance of 0.05. Briefly explain the procedure to check any significant difference in the proportions of working mothers in the two areas of the city? (6 marks)

(Total 25 marks)

Question 5

The quarterly sales data of a company are available for past 4 years. An analysis is required to predict the future sales.

Period	Year	Quarter	Sales ('000)	Quarterly Moving Averages	Centered Moving Averages (CMA)	Sales/ CMA
1	2018	1	211			
2		2	274			
3		3	235	236.75	235.625	0.997
4		4	227	234.5	236.375	0.960
5	2019	1	202	238.25	244.75	0.825
6		2	289	*(1)*	*(8)*	*(15)*
7		3	287	*(2)*	*(9)*	*(16)*
8		4	236	*(3)*	*(10)*	*(17)*
9	2020	1	241	*(4)*	*(11)*	*(18)*
10		2	271	*(5)*	*(12)*	*(19)*
11		3	255	*(6)*	*(13)*	*(20)*
12		4	295	*(7)*	*(14)*	*(21)*
13	2021	1	238	267	270.125	0.881
14		2	280	273.25	265.25	1.056
15		3	280	257.25		
16		4	231			

1. Calculate the values for *(1) – (21)*. (7 marks)
2. Find the adjusted seasonal index values. (6 marks)
3. If the trend line equation is, Sales = 237.83+1.8*Period, find the forecasted sales for the four quarters of year 2022. (4 marks)
4. By using examples from real world scenarios, briefly explain the components of time series data.

(8 marks)

(Total 25 marks)