

THE OPEN UNIVERSITY OF SRI LANKA
COMMONWEALTH EXECUTIVE MASTER OF BUSIENSS/PUBLIC
ADMINISTRATION
FINAL EXAMINATION 2010
MCP 1607 – QUANTITATIVE TECHNIQUES FOR MANAGERS
DURATION: THREE (03) HOURS



DATE : 15th May 2010

TIME : 1.30 p.m – 4.30 p.m

INSTRUCTIONS TO CANDIDATES

- a) Answer any five (5) questions only.
- b) Each question carry 20 marks.
- c) Write your index number on every page.
- d) Use of non programmable calculators are allowed.
- e) Graph paper will be provided.
- f) Necessary statistical tables and mathematical formulae annexed.

Q(1) a) Find the differential coefficient of the following functions with respect to "x".

(i) $x^3 + 4x^2 + 5x + 7$ (ii) $(x^2 + 7)(x^3 + 3x + 5)$ (iii) $\frac{x^2}{x^2 + 1}$

b) Find the integral of the following functions with respect to "x".

(i) $x^3 + 4x^2 + 7x + 3$ (ii) $2\sqrt{x} + \frac{1}{\sqrt{x}}$ (iii) $\frac{x^2 + 5x + 6}{x + 2}$

c) Solve the following definite integral

$$\int_2^5 (x^4 + 3x^2 + 7x + 4) dx$$

d) The total sales of an industrial product would drop with the increase in unit price. However it is observed that sales would drop when the price is too low due to customer losing confidence in the product. The relationship between sales and price is given by the equation,

$$Z = 300 + 70p - p^2$$

Where "z" is sales and "p" is price.

- (i) What is the price (p) that would maximize sales.
- (ii) What is the price (p) that would maximize revenue.
- (iii) Briefly explain why these two prices differ.

Q2 (i) A and B are two matrices defined as follows.

$$A = \begin{pmatrix} 6 & 8 & 2 \\ 5 & 9 & 1 \\ 3 & 4 & 7 \end{pmatrix} \quad \text{and} \quad B = \begin{pmatrix} 4 & 3 & 1 \\ 2 & 6 & 1 \\ 1 & 2 & 6 \end{pmatrix}$$

Evaluate the following

- (a) $A - B$
- (b) $A \times B$ (Vector multiplication)

- (ii) Small manufacturer produces handbags, valets, and pencil cases using three process, cutting, stitching, and printing. The number of hours of process time required to complete each product is shown below.

	Cutting	Stitching	Printing
Handbag	1	2	2
Valet	1	1	$\frac{1}{2}$
Pencil cases	0	1	1

Suppose each day, the available plant capacity for cutting, stitching and printing is 25 hrs, 30 hrs and 20 hrs respectively.

- (a) Develop this as a matrix equation.
 - (b) If all the resources are to be utilized to the maximum, find the quantities of each product that have to be manufactured.
- Q3. (i) When an unbiased coin is tossed the probability of getting head is $\frac{1}{2}$. Then by the addition rule of probability we find that the probability of getting head in at least one toss when the coin is tossed twice is $(\frac{1}{2} + \frac{1}{2}) = 1$. The probability being "1" imply that it is certain. But this cannot be so, because we could have both tosses being "TAIL". Briefly explain the inaccuracy of this argument.
- (ii) An ice cream vender sells chocolate, strawberry and vanilla ice cream. He observes that 50% of the time he sells chocolate ice cream, 35% of the time he sells strawberry and 15% of the time he sells vanilla ice cream. Ice cream is sold either in cones or cups. It is observed that 70% of chocolate ice cream, 60% of strawberry

and 40% of vanilla ice cream are sold in cones. If the sale of an ice cream is randomly selected,

- a) What is the probability that the ice cream was sold in a cone.
- b) What is the probability that the ice cream sold is chocolate, given that it was sold in a cone.
- c) What is the probability that the ice cream sold is vanilla given that it was sold in a cone.

Q4. It is believed that the annual cost of maintenance of a machine and its age are closely related. In the table below "x" represents "Age" and "y" represents cost of maintenance measured in Rs."000. Information of five machines is displayed in the table along with the calculated " x^2 ", " y^2 " and " xy " terms.

x	y	x^2	y^2	xy
7	6	49	36	42
4	2	16	4	8
9	5	81	25	45
12	9	144	81	108
8	7	64	49	56
<u>40</u>	<u>29</u>	<u>354</u>	<u>195</u>	<u>259</u>

- (i) Calculate the Correlation Coefficient between age and cost of maintenance.
- (ii) Evaluate the line of regression of the form $y = a + bx$
- (iii) Predict cost of maintenance "y" when age "x" is 15 years.
- (iv) What is the residual of the observation where "x" is 8.
- (v) Evaluate the sum of squares of residuals given as "SSE"
- (vi) Calculate the coefficient of determination and interpret the results.
- (vii) Test the hypothesis that age has an impact on cost of maintenance (hypothesize that $b = 0$)
- (viii) Find the 95% confidence interval for the estimate of slope given by "b".

- Q5. (i) Past experience indicates that 30% of all individuals entering a certain store decide to make a purchase. If a group of five individuals enter the store.
- a) What is the probability that exactly two of them will decide to make a purchase.
- b) What is the probability that less than two of them will decide to make a purchase.
- (ii) A factory manager observes that on the average there are two machine breakdowns every week. What is the probability that there will be no machine breakdowns next week.
- (iii) Assume that the length of a typical televised base ball game including all commercials is normally distributed with mean $2\frac{1}{2}$ hours and standard deviation $\frac{1}{2}$ hour. Consider a televised baseball game that begins at 2.00 pm with the next scheduled broadcast being 5.00 pm. What is the probability that the televised game will cut into the next broadcast scheduled at 5.00 pm.

- Q6. A manufacturer produces two types of ceramic tiles namely type (A) and type (B). They use clay, chemicals and labour hours as resources. While labour is available in plenty they have only 400 kg of clay and 350 gr. of chemicals for their daily production. The unit profit made on type (A) and type (B) tiles is Rs. 30.00 and Rs. 20.00 respectively. While demand for type (B) is unlimited the maximum daily demand for type (A) tiles is 40. A summary of this information along with resource requirements is explained in the table below. The manufacturer hopes to maximize its profit.

Type	Resource Requirement		Maximum Demand (Daily)	Profit per tile (Rs.)
	Clay (Kg) Per tile	Chemicals (grams) per tile		
Type (A)	8	5	40	30
Type (B)	5	7	-	20
Daily Availability of Resource	400	350		

He wishes to know how many tiles of each type should be produced.

- (i) Formulate the linear programming model.
- (ii) Solve the problem using graphical method.
- (iii) With the help of the graph explain why an increase in demand for type (A) would not change the optimal solution.

Q7. A project consist of eight activities A, B,..... H whose precedence and durations are explained in the table below.

ACTIVITY	PRECIDANCE	DURATION (DAYS)
A	PROJECT START	7
B	PROJECT START	6
C	PROJECT START	9
D	A	5
E	A	8
F	C	6
G	E, B AND F	2
H	G AND D	3

- (i) Construct the network diagramme.
- (ii) Time analyse and name the critical path.
- (iii) Can a network have more than one critical path.
- (iv) Find "EST", "EFT", "LST" and "LFT" of activity (B).

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