

THE OPEN UNIVERSITY OF SRI LANKA
 COMMONWEALTH EXECUTIVE MASTER OF BUSINESS/PUBLIC
 ADMINISTRATION
 FINAL EXAMINATION – APRIL 2006
 MCP 1607 – QUANTITATIVE TECHNIQUES FOR MANAGERS
 DURATION : THREE (03) HOURS



Date: 09th April, 2006

Time: 9.30 a.m. 12.30 p.m.

Answer **any five (5)** questions. All questions carry equal marks.
 Graph papers and Normal Distribution Tables will be provided.
 Non programmable calculators will be allowed.

01. “Quantitative techniques are used by Managers at different levels in their day to day work. These techniques have their own limitations, however they have proved to be useful. What is important for managers is to know what the techniques are and what they are used for. They also should develop the skills of interpreting their problems to match the available techniques”. Elaborate this statement with examples in about 200 words.

02. a. Differentiate the following functions with respect to “x”

i. $2x^2+7x+2$ ii. $\frac{x+2}{x+7}$ iii. $x \log (x)$

b. Integrate the following functions with respect to “x”

i. $3x^2+8x+2$ ii. $(x^2+7)(2x+3)$

c. Evaluate the following definite integral.

i. $\int_0^1 2x^2 + 9x + 5 \, dx$

OR

d. If $A = \begin{bmatrix} 2 & 7 & 5 \\ 3 & 4 & 2 \\ 1 & 3 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 4 & 2 \\ 2 & 3 & 1 \\ 1 & 2 & 5 \end{bmatrix}$

Evaluate

i. $A + B$
 ii. $A - B$
 iii. $2xA$

e. Find the inverse of matrix C where

$$C = \begin{bmatrix} 4 & 7 & 6 \\ 3 & 8 & 5 \\ 1 & 3 & 2 \end{bmatrix}$$

03. a. Briefly explain why people resort to sampling instead of studying the full population.
- b. With the view of estimating the number of minutes a candle burns, a sample of 49 candles were lit until they burn off and the number of minutes they burn were recorded. It was observed that the mean and standard deviation of the number of minutes a candle burns was 25 minutes and 14 minutes respectively.
- Develop a 95% confidence interval estimate of the number of minutes a candle burns.
 - Develop a 80% confidence interval estimate of the number of minutes a candle burns.
 - What is the width of the 80% confidence interval?
 - What should the sample size be to reduce width to 4 minutes?
- c. Show that irrespective of sample standard deviation to reduce the width of any confidence interval estimate by half the sample size need to be increased four times.

04. It is suspected that the daily Power Consumption of machines is related to its age. To justify this a sample of five machines were taken and their age and power consumption recorded as shown below.

AGE (Years)	POWER CONSUMPTION(Units)
7	8
4	7
2	2
5	6
1	3

- Calculate the correlation coefficient between age and power consumption.
- Develop the regression equation of the form $y = a + bx$
- What would be the power consumption when the age of the machine is six years?
- Evaluate the coefficient of determination.
- Evaluate the standard error of the estimate (s)

05. A sample of 200 students sitting

- a. the GCE (A/L) examination were interviewed and the results are described in the table below.

GENDER	PROGRAMME OF STUDY			TOTAL
	SCIENCE	ARTS	COMMERCE	
MALE	25	20	30	75
FEMALE	15	70	40	125
TOTAL	40	90	70	200

If a student is randomly selected;

- i. What is the probability that the student selected is a Female?
 - ii. What is the probability that the student selected is studying science?
 - iii. What is the probability that the selected student is studying science given that the student is a female?
 - iv. What is the probability that the student selected is a Female given that she is studying commerce?
- b. An Ice Cream Vendor sells three flavors namely Chocolate, Strawberry and Vanilla. 50% of sales are chocolate 30% are strawberry and 20% are vanilla. In addition ice cream is sold either in cones or cups. The percentage of cone sales for chocolate, strawberry and vanilla are 70%, 60% and 40% respectively.
- i. What is the probability that a randomly selected sale was chocolate given that it was sold on cone?
 - ii. What is the probability that a randomly selected sale was vanilla given that it was sold on cup?

06. The time series shown below describes the export of rice measured in Metric Tons for each quarter from 2001 to 2005. Column (4) of the table is the centered moving average which is already calculated.

Time Series Data

Year	QTR	EXPORT (Metric Tons)	Centered Moving Average	Year	QTR	Export Metric Tons	Centered Moving Average
1	2	3	4	1	2	3	4
2001	1	49	--	2003	3	21	31.0
	2	14	--		4	26	29.12
	3	29	30.87	2004	1	28	30.5
	4	35	31.75		2	39	32.5
2002	1	42	32.2		3	37	32.62
	2	28	30.2		4	26	32.25
	3	17	29.0	2005	1	29	31.87
	4	31	30.5		2	35	34.62
2003	1	38	33.0		3	38	--
	2	44	31.62		4	47	--

- i. Calculate the seasonal index for the four quarters.
 - ii. If it is estimated that the trend value for 2005 third quarter is 32, evaluate the forecast for third quarter of 2005.
 - iii. It is suspected that the time series data, in addition to its seasonal fluctuations has five quarterly cyclic variations. Use auto correlation to verify this hypothesis.
 - iv. What are the limitations of time series analysis?
07. A project consists of 9 activities A,B,C, ... I, whose precedence and durations are explained in the table below.

Precedence Table.

ACTIVITY	PRECEDANCE	DURATION (DAYS)
A	Project start	2
B	Project start	8
C	Project start	3
D	After A	4
E	After A	1
F	After B, E	6
G	After C, F	7
H	After D,G	3
I	After H	6

- i. Construct the network
- ii. Time analyze the network and name the critical path.
- iii. What is the earliest project completion date?
- iv. Calculate EST, LST, EFT and LFT of activity F.
- v. Calculate the free float of activity D.

08. Cooray Anderson Spice Company has a limited amount of three ingredient labelled as A, B and C, used to produce either turmeric or paprika. The marketing department reports that the form can sell as much paprika as it can produce but can sell up to a maximum of only 1700 bottles of Turmeric. Unused ingredients are sold on the open market. The profit gained by reselling these ingredients A, B and C are respectively Rs. 3.00, Rs. 4.00 and Rs. 2.00 for Milliliter. In addition Cooray has signed a contract to supply 600 bottles of Paprika to Wal-Mart Ltd. Details on resource requirements to produce Turmeric and paprika and unit profit is given in the following table. Cooray hopes to maximize profit.

Summary Table

	Resource Requirement (MLS/Bottle)			Maximum Demand (Bottles)	Profit for Bottle (Rs.)
	A	B	C		
Tumeric	4	2	1	1700	42
Paprika	3	2	3	Unlimited	37
Availability (MLS)	8000	9000	7000	----	--

- i. Formulate this as a linear programming problem.
- ii. Solve the problem using graphical method.

Mathematical Formulae

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

In the equation $y = a + bx$

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

$$a = \frac{\sum y}{n} - b \frac{\sum x}{n}$$

$$\left\{ \text{COEFFICIENT OF DETERMINATION} \right\} = \left\{ \text{COEFFICIENT OF CORRELATION} \right\}^2$$

$$\left\{ \text{COEFFICIENT OF DETERMINATION} \right\} = \frac{SSR}{SST}$$

$$SST = SSR + SSE$$

$$SST = \sum y^2 - n (\bar{y})^2 \quad \text{where } \bar{y} = \frac{\sum y}{n}$$

$$\left\{ \text{STANDARD ERROR OF ESTIMATE} \right\} = \sqrt{\frac{SSE}{n-2}}$$

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