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THE OPEN UNIVERSITY OF SRI LANKA
COMMONWEALTH EXECUTIVE MASTER OF BUSINESS/PUBLIC ADMINISTRATION
FINAL EXAMINATION – DECEMBER 2014
MCP 1607 – QUANTITATIVE TECHNIQUES
DURATION THREE (03) HOURS

Date: 19th December 2014 **Time – 9.30am – 12.30pm**

Instructions to candidates

a) Answer any five (5) questions.
b) Each question carries equal marks.
c) Write your index number on every page.
d) Use of non programmable calculator are allowed.
e) Necessary statistical tables and mathematical formulae are attached.

Q(01) (a) Find the differential coefficient of the following functions with respect to "x"

(i) $x^3 + 4x^2 + 7x + 1$ (ii) $(x^2 + 7)(x^3 + 2)$

(b) if $y = x^3 + 7x^2 + 2x + 7$ find $\frac{d^2y}{dx^2}$

(c) The total cost of producing "x" units of a certain item is given by Z where

$Z = 7x^2 + 3x + 5$

Find total cost, average cost and marginal cost when 30 units are produced.

(d) The daily sales of a product would increase with the reduction of price. However when the price is too low the sales would drop as the consumer will suspect its quality. The relationship between total sales (T) and price (P) is given by

$T = 3000 + 450\,P - 3P^2$

What should be the price so as to maximize daily sales?

Q(02) (a) A and B are two matrices defined as follows.

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

Evaluate the following

(i) A + B
(ii) A - B
(iii) A x B (vector multiplication)

(b) Using creamer's rule in matrics algebra or inverse matrics method solve the following simultaneous equations.

$2x + y + z = 16$

$x + 2y + 3z = 19$

$x + y + 2z = 13$

Q(03) (a) 600 students were interviewed to assess their computer skills. A breakdown of computer skills by gender is shown in the table below.

Gender	Computer skills			total
	low	average	high	
Male	50	70	80	200
Female	100	125	175	400
Total	150	195	255	800

A student is selected at random. Find the following probabilities.

(i) P (male) (ii) $P(_{skills}^{low})$ (iii) $P\left(\text{male} \cap {}_{skills}^{low}\right)$

(iv) $P\left(\frac{female}{high\ skills}\right)$ (v) $P\left(\frac{high\ skills}{female}\right)$

(b) The financial manager of an organization is concerned about payment of bills by his clients, he has instructed his officers to give telephone calls to clients at least three weeks prior to the due date. However due to pressure of work the officers can contact by phone only 80% of the clients. On the average 60% of the clients who have received telephone calls makes payment while 40% of clients who do not receive telephone calls make payment on time a client is selected at random.

(i) What is the probability that the client has made the payment?
(ii) Given that the client has made the payment what is the probability that he received a telephone call.
(iii) Given that the client has not made the payment what is the probability that he has received a telephone call

Q(04) (a) (i) Evaluate the expression ${}^{n}C_{r}P^{r}q^{(n-r)}$
Where n = 5, r = 3, P = 0.2 and $q = 0.8$

(ii) The probability that a customer entering a retail store makes a purchase is 0.7. What is the probability that exactly four customers out of a group of seven customers that enter the retail store makes purchases.

(b) (i) evaluate the expression $e^{-a}\frac{a^x}{x!}$ where a = 3 and e = 2.71

(ii) A medical officer observes that in his ward there are two deaths per month on the average. What is the probability that there will be three deaths the next month?

(c) The time taken by a swimmer to swim 100 meters in a race is normally distributed with mean 62 seconds and standard deviation 8 seconds.

(i) What is the probability that he will take more than 70 seconds to complete the 100 meters.

(ii) If the Sri Lankan record is 50 seconds what is the probability that he will break the Sri Lankan record.

Q(05) (a) Differentiate between "descriptive statistics" and "inferential statistics"

(b) Give a brief outline on sampling concepts.

(c) With a view to estimate the weight of a loaf of bread.

(i) A sample of 64 loaves of bread was randomly selected and the weight was recorded. It was observed that the mean and standard deviation of the weight of bread in the sample were 430 gr and 40 gr respectively. Develop a 95% confidence interval estimate for the weight of bread.

(ii) What should be the sample size to reduce the width of the confidence interval by half?

Q(06) It is suggested that the number of break downs of a machine is related to its age. Data on age denoted by "x" and number of break downs per year denoted by "y" from six machines is described below. The values of x^2, y^2 and xy are also given below.

	Age (x)	Break downs (y)	x^2	y^2	xy
	9	14	81	196	126
	2	3	4	9	6
	5	4	25	16	20
	7	9	49	81	63
	6	11	36	121	66
	8	8	64	64	64
Total	**37**	**49**	**259**	**487**	**345**

(i) Calculate the correlation coefficient between age and machine break downs.

(ii) Evaluate the line of regression of the form $y = a + bx$

(iii) Estimate the number of break downs per year of a machine with age 10 years.

(iv) What is the residual of the observation, where $x = 5$

(v) Evaluate the sum of squares error given as "SSE"

(vi) Calculate the coefficients of determination (R^2) and interpret the results.

(vii) Calculate the standard error of the "b" coefficient given by SB1.

(viii) Develop a 95% confidence interval estimate for the "b" coefficient.

Q(07) Write short notes on the following

(a) Residual analysis

(b) Multicolinearity

(c) Non-linear regression analysis

(d) Exponential smoothing

MATHEMATICS FORMULAE

i. Correlation Coefficient.

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

ii. Line of regression $y = a+bx$

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

iii. SSE = sum of all (residual)^2 Terms. $= \Sigma y^2 - a\Sigma y - b\Sigma xy$

iv. Coefficient of determination = r^2

v. $Syx = \sqrt{\frac{SSE}{(n-2)}}$

vi. $SB_1 = \frac{Syx}{\sqrt{ssx}}$ where $SSX = \sum(x_i - \bar{x})^2 = \sum x_i^2 - n\bar{x}^2$

vii. Standard error = $\frac{S}{\sqrt{n}}$