THE OPEN UNIVERSITY OF SRI LANKA
COMMONWEALTH EXECUTIVE MASTER OF BUSINESS/ PUBLIC ADMINISTRATION
FINAL EXAMINATION 2016
MCP 1607 - QUANTITATIVE TECHNIQUES FOR MANAGERS
DURATION :THREE (03) HOURS

DATE : 26.11.2016 **TIME : 09.30 am to 12.30 pm**

INSTRUCTION TO CANDIDATES.

a) **Answer any five (05) questions only.**
b) **Each question carry 20 marks.**
c) **Write your index number on every page.**
d) **Use of non programmable calculator is allowed.**
e) **Graph paper will be provided.**
e) **Necessary statistical tables and mathematical formulae annexed.**

(Q1) a. Find the differential coefficient of the following functions with respect to "x"

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

iii) $(2x+4)^2$ iv) $\sqrt{x}+\frac{1}{\sqrt{x}}$

b. If $y = x^4+3x+7$ find $\frac{d^2y}{dx^2}$

c. Social studies has revealed that both the young and the elderly spend lot of time watching TV. If the number of hours per month in watching "TV" is denoted by "y" and the age denoted by "x" and their relationship is given by the equation;

$y = x^2 - 24x + 180$

Find at what age will "hours of watching TV" be minimum?

(Q2) a. 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.

i) A - B

ii) A x B (vector multiplication)

b. A small manufacturer produce handbags, valets and pencil cases using three processes, cutting, stitching and printing. The number of hours of process time required to complete one unit of each product is shown below.

	Handbag	**Valet**	**Pencil Cases**
Cutting	1	2	2
Stitching	1	1	½
Printing	0	1	1

Suppose each day, the plant capacity used for cutting, stitching and printing is 25 hrs, 30 hrs and 20 hrs respectively. And the number of handbags, Valets and Pencil Cases produced is x, y and z.

Develop this relationship as a matrix equation.

c. Use Cramer's rule or inverse metrics method to solve the following simultaneous equations.

$$3x + 4y + z = 14$$
$$x + 5y + 3z = 20$$
$$2x + y + 2z = 10$$

(Q3) a. "When an unbiased coin is tossed the probability of getting head is ½ .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 (½ + ½) = 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.

b. An ice cream vender sells chocolate, strawberry and vanilla ice creams. 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 ice cream and 40% of vanilla ice cream are sold in cones. If the sale of an ice cream is randomly selected.

i) What is the probability that the ice cream was sold in a cone.

ii) What is the probability that the ice cream sold is chocolate, given that it was sold in a cone.

iii) What is the probability that the ice cream sold is vanilla, given that it was sold in a cone.

(Q4) a. 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,

i) What is the probability that exactly two of them will decide to make a purchase?

ii) What is the probability that less than two of them will decide to make a purchase?

b. A factory manager observes that on average there are two machine breakdowns every week. What is the probability that there will be no machine breakdowns next week?

c. Assume that the length of time of a typical televised base ball game including all commercials is normally distributed with mean 2 ½ hours and standard deviation ½ 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?

(Q5) 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.

i) Develop a 95% confidence interval estimate of the number of minutes a candle burns.

ii) Develop a 80% confidence interval estimate of the number of minutes a candle burns.

iii) What is the width of the 80% confidence interval?

iv) What should the sample size be to reduce the width to 4 minutes?

c. Test the hypothesis at 5% level of significance that the candle burns for at least 30 minutes.

(Assume that the time the candle burnt is normally distributed)

(Q6) It is believed that the annual cost of maintenance of a machine and its age is 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
40	29	354	195	259

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 maintaining "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 result.

vii) Find the standard error of coefficient "b" given by Sb1

viii) Find the 95% confidence interval for the estimate of slope given by "b".

Mathematical Formula

i) Correlation coefficient

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

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

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

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

iv) Coefficient of determination = r^2

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

vi) $Sb1 = \frac{Syx}{\sqrt{SSX}}$ where $SSX = \varepsilon x^2 - \frac{(\varepsilon x)^2}{n}$

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

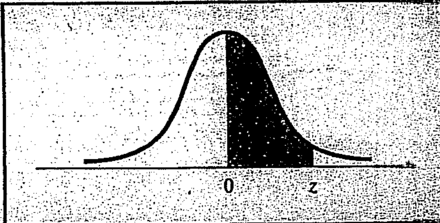

TABLE 2
Area Under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.49865	.49869	.49874	.49878	.49882	.49886	.49889	.49893	.49897	.49900
3.1	.49903	.49906	.49910	.49913	.49916	.49918	.49921	.49924	.49926	.49929
3.2	.49931	.49934	.49936	.49938	.49940	.49942	.49944	.49946	.49948	.49950
3.3	.49952	.49953	.49955	.49957	.49958	.49960	.49961	.49962	.49964	.49965
3.4	.49966	.49968	.49969	.49970	.49971	.49972	.49973	.49974	.49975	.49976
3.5	.49977	.49978	.49978	.49979	.49980	.49981	.49981	.49982	.49983	.49983
3.6	.49984	.49985	.49985	.49986	.49986	.49987	.49987	.49988	.49988	.49989
3.7	.49989	.49990	.49990	.49990	.49991	.49991	.49992	.49992	.49992	.49992
3.8	.49993	.49993	.49993	.49994	.49994	.49994	.49994	.49995	.49995	.49995
3.9	.49995	.49995	.49996	.49996	.49996	.49996	.49996	.49996	.49997	.49997

Entry represents area under the standard normal distribution from the mean to *z*.