THE OPEN UNIVERSITY OF SRI LANKA
COMMONWEALTH EXECUTIVE MASTER OF BUSINESS/PUBLIC ADMINISTRATION
FINAL EXAMINATION – 2011
MCP 1607 – QUANTITATIVE TECHNIQUES FOR MANAGERS
DURATION: THREE (03) HOURS

DATE : 12TH May 2011 **Time : 9.30 a.m - 12.30 p.m**

INSTURCTIONS TO CANDIDATES

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

Q1) Briefly explain how quantitative techniques could be employed at your work place. Give a brief description of the activities of your work place and the precautions you need to take as a manager when practically employing them.

Q2) a) Find the differential coefficient of the following functions with respect to "x".

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

b) Find the second differential coefficient of $2x^2 + 3$ with respect to "x"

c) Find the turning points of the function
$y = 2x^2 - 27x^2 + 84x + 5$
(You need to find the maximum and minimum points)

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

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

e) Solve the following definite integral

$$\int_1^2 x^2 + 2x + 3_{dx}$$

Q3) a) The distribution of 400 children by gender and height is explained in the table below. Height is classified as "Short", "Average(AVG)", and "Tall".

	HEIGHT			TOTAL
GENDER	SHORT	AVG	TALL	
MALE	25	100	50	175
FEMALE	50	75	100	225
TOTAL	75	175	150	400

One child is selected at random. Calculate the following probabilities.

(i) P(Female)

(ii) P(Tall)

(iii) P(Female ∩ Tall)

(iv) $P(\frac{Tall}{Female})$

(v) $P(\frac{Female}{Tall})$

NOTE : Probability of event "A" is denoted as P(A).

b) In a certain state, 15% of the vehicles have high emission of carbon dioxide, 25% have moderate emission while 60% have low emission of carbon dioxide. It is observed that 10% of the vehicles with high emission, 60% of vehicles with moderate emission and 90% of vehicles with low emission pass the vehicle emission test.

(i) What is the probability that a vehicle that just drives in would pass vehicle emission test.

(ii) Given that a vehicle has passed the vehicle emission test what is the probability that the vehicle has low emission of carbon dioxide.

Q4. a) (i) Evaluate the expression $^{n}C_{r}P^{r}q^{(n-r)}$ where n=8, r=3, p=0.2

(ii) In a team of 5 field investigators the probability that any one investigator could speak tamil is 0.3. What is the probability that three out of the 5 investigators could speak Tamil?

b) (i) Evaluate the expression $e^{-a}\frac{a^{-x}}{x!}$ where $a = 2$ and $x = 3$ and $e = 2.71$

(ii) At a vehicle repair shop, on the average three customers arrive every hour. What is the probability that exactly two customers will arrive the next hour.

c) The time taken to broadcast a Television programme is normally distributed with mean 40 minutes and standard deviation 20 minutes. If the time assigned for the programme is 8.30 a.m to 9.30 a.m what is the probability that the programme could be broadcasted within the assigned time.

Q5. a) State the central limit theorem and explain it's importance in decision making.

b) The manager of a garment factory hopes to estimate the average daily output of his operators. For this purpose he has taken a sample of 64 operators and he observes that the mean and standard deviation of the sample are 240 and 56 respectively.

(i) Develop a 95% confidence interval estimate for the daily output.
(ii) Develop a 80% confidence interval estimate for the daily output.
(iii) By how much, the sample size should be increased to reduce this interval by half.

Q6. It is suggested that money spent on advertising and weekly sales are closely related. In order to investigate into this, data on money spent and weekly sales has being collected for five weeks. In the table below "x" represent money spent in Rs "000"and "y" represent weekly sales in Rs. "000". The table also display the calculated values of the terms $x^2, y^2, and\ xy$ and their total values.

x	y	x^2	y^2	xy
1.2	23.1	1.44	533	27.72
1.7	41.8	2.89	1747	71.06
2.3	47.7	5.29	2275	109.71
3.1	69.0	9.61	4761	213.9
4.0	81.2	16.0	6593	324.8
12.3	**262.8**	**35.23**	**15909**	**747.19**

(i) Calculate the correlation coefficient between money spent and weekly sales.
(ii) Evaluate the line of regression of the form $y = a + bx$
(iii) Predict weekly sales when money spend is 3.5 (Rs. "000")
(iv) What is the residual of the observation where "x" is 2.3.
(v) Evaluate the sum of squares of residuals given by "SSE".
(vi) Calculate the coefficient of determination given as R^2.
(vii) Calculate the standard error of the "b" term in the equation y = a+bx
(viii) Test the hypothesis that "money spent" has an impact on weekly sales.

Q7. Write short notes on
(a) Residual Analysis
(b) Multicolinearity
(c) Auto Correlation
(d) Exponential Smoothing

MATHEMATICAL 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) Sum of squares of residuals (SSE)

$$\text{SSE} = \sum y^2 - a\sum y - b\sum xy$$

(iv) Sum of squares total (SST)

$$\text{SST} = \sum y^2 - n\left(\frac{\sum y}{n}\right)^2$$

(v) $R^2 = \frac{\text{SSR}}{\text{SST}}$ and SST = SSR + SSE

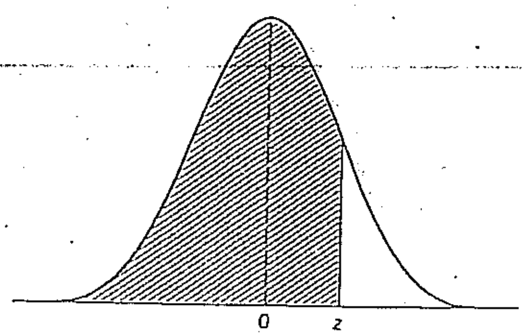
(vi) Standard error of "b" (S_b)

(vii) $S_b = \frac{\sqrt{\frac{SSE}{(n-2)}}}{\sqrt{SSX}}$

Where $SSX = \sum x^2 - n\left(\frac{\sum x}{n}\right)^2$

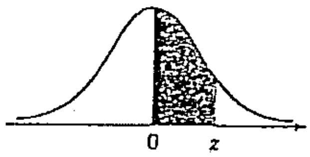
Table A2. Values of z, the standard normal variable, from 0·0 by steps of 0·01 to 3·9, showing the cumulative probability up to z.
(Probability correct to 4 decimal places).

z	0·00	0·01	0·02	0·03	0·04	0·05	0·06	0·07	0·08	0·09
0·0	·5000	·5040	·5080	·5120	·5160	·5199	·5239	·5279	·5319	·5359
·1	·5398	·5438	·5478	·5517	·5557	·5596	·5636	·5675	·5714	·5753
·2	·5793	·5832	·5871	·5910	·5948	·5987	·6026	·6064	·6103	·6141
·3	·6179	·6217	·6255	·6293	·6331	·6368	·6406	·6443	·6480	·6517
·4	·6554	·6591	·6628	·6664	·6700	·6736	·6772	·6808	·6844	·6879
·5	·6915	·6950	·6985	·7019	·7054	·7088	·7123	·7157	·7190	·7224
·6	·7257	·7291	·7324	·7357	·7389	·7422	·7454	·7486	·7517	·7549
·7	·7580	·7611	·7642	·7673	·7704	·7734	·7764	·7794	·7823	·7852
·8	·7881	·7910	·7939	·7967	·7995	·8023	·8051	·8078	·8106	·8133
·9	·8159	·8186	·8212	·8238	·8264	·8289	·8315	·8340	·8365	·8389
1·0	·8413	·8438	·8461	·8485	·8508	·8531	·8554	·8577	·8599	·8621
·1	·8643	·8665	·8686	·8708	·8729	·8749	·8770	·8790	·8810	·8830
·2	·8849	·8869	·8888	·8907	·8925	·8944	·8962	·8980	·8997	·9015
·3	·9032	·9049	·9066	·9082	·9099	·9115	·9131	·9147	·9162	·9177
·4	·9192	·9207	·9222	·9236	·9251	·9265	·9279	·9292	·9306	·9319
·5	·9332	·9345	·9357	·9370	·9382	·9394	·9406	·9418	·9429	·9441
·6	·9452	·9463	·9474	·9484	·9495	·9505	·9515	·9525	·9535	·9545
·7	·9554	·9564	·9573	·9582	·9591	·9599	·9608	·9616	·9625	·9633
·8	·9641	·9649	·9656	·9664	·9671	·9678	·9686	·9693	·9699	·9706
·9	·9713	·9719	·9726	·9732	·9738	·9744	·9750	·9756	·9761	·9767
2·0	·9772	·9778	·9783	·9788	·9793	·9798	·9803	·9808	·9812	·9817
·1	·9821	·9826	·9830	·9834	·9838	·9842	·9846	·9850	·9854	·9857
·2	·9861	·9864	·9868	·9871	·9875	·9878	·9881	·9884	·9887	·9890
·3	·9893	·9896	·9898	·9901	·9904	·9906	·9909	·9911	·9913	·9916
·4	·9918	·9920	·9922	·9925	·9927	·9929	·9931	·9932	·9934	·9936
·5	·9938	·9940	·9941	·9943	·9945	·9946	·9948	·9949	·9951	·9952
·6	·9953	·9955	·9956	·9957	·9959	·9960	·9961	·9962	·9963	·9964
·7	·9965	·9966	·9967	·9968	·9969	·9970	·9971	·9972	·9973	·9974
·8	·9974	·9975	·9976	·9977	·9977	·9978	·9979	·9979	·9980	·9981
·9	·9981	·9982	·9982	·9983	·9984	·9984	·9985	·9985	·9986	·9986
3·0	·9987	·9987	·9987	·9988	·9988	·9989	·9989	·9989	·9990	·9990
·1	·9990	·9991	·9991	·9991	·9992	·9992	·9992	·9992	·9993	·9993
·2	·9993	·9993	·9994	·9994	·9994	·9994	·9994	·9995	·9995	·9995
·3	·9995	·9995	·9995	·9996	·9996	·9996	·9996	·9996	·9996	·9997
·4	·9997	·9997	·9997	·9997	·9997	·9997	·9997	·9997	·9997	·9998
·5	·9998	·9998	·9998	·9998	·9998	·9998	·9998	·9998	·9998	·9998
·6	·9998	·9998	·9999	·9999	·9999	·9999	·9999	·9999	·9999	·9999
·7	·9999	·9999	·9999	·9999	·9999	·9999	·9999	·9999	·9999	·9999
·8	·9999	·9999	·9999	·9999	·9999	·9999	·9999	·9999	·9999	·9999
·9	1·0000									



The curve is $N(0, 1)$, the standard normal variable. The table entry is the shaded area $\Phi(z) = \Pr(Z < z)$. For example, when $z = 1{\cdot}96$ the shaded area is 0·9750. Critical values of the standard normal distribution will be found in the bottom row of Table A3.

Normal Curve Areas



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
.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	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

Source: Abridged from Table I of A. Hald, *Statistical Tables and Formulas* (New York: John Wiley & Sons, Inc.), 1952. Reproduced by permission of A. Hald and the publisher.