THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF MANAGEMENT STUDIES DEGREE PROGRAMME
LEVEL 05 2011/2012
FINAL EXAMINATION 2012
QUANTITATIVE TECHNIQUES FOR MANAGEMENT II – MCU3209

DATE : 19.02.2012	TIME : 1.30 pm – 4.30 pm

INSTRUCTIONS
Duration: Three Hours
ANSWER ANY FIVE (05) QUESTIONS.
All questions carry equal marks.

This question paper has seven questions in five pages.
Use of a non-programmable calculator is allowed.
Normal and Chi-square tables are annexed herewith.
$e^1 = 2.71$

1.

One of the specifications on an electronic component is that its lifetime must exceed 5,000 hours. When the production process is in control the lifetime of the electronic component is normally distributed with mean 7,500 hours and standard deviation 1,000 hours. The manufacturer earns Rs. 1,000/- a unit produced, however defective unit must be replaced at a cost of Rs. 750/- to the manufacturer.

a) Find the fraction of electronic components within the specification when the process is in control.

b) How many electronic components are within the specifications out of 10,000 produced, when the process is in control?

c) Find the total earning of the manufacturer out of 10,000 components produced when the process is in control.

d) Find the mean lifetime of a randomly selected electronic component produced, if the total number of components produced which were within specification are 7,881 out of 10,000 components. Assume that the standard deviation of the lifetime of the electronic component is 1,000 hours.

2.

a) According to the past data, the probability of not raining to a stadium in a certain area on a given day during the month of April is 0.95. A netball tournament is going to be held in this stadium from 15th April 2012 to 18th April 2012.

(i) What is the probability that there will be no rain during the tournament?

(ii) What is the probability that there will be rain during the tournament?

(iii) What is the probability that there will be rain on more than two days during the tournament?

(iv) Find the probability that there will be rain on the second and the third days of the tournament.

b) In the case of snake bites, often, lethal doses are not administered. Suppose 80% of the snake bite cases recover even without treatment. What is the probability that out of 100 cases untreated, more than 85 will survive?

3.

a) Briefly explain the key properties of Poisson Distribution. Under what conditions the Normal Distribution can be used to approximate the Poisson probabilities?

b) Suppose the number of babies born during an 8-hour shift at a maternity wing of a certain hospital follows a Poisson distribution with a mean of 32.

(i) Find the probability that five babies are born during a particular 1-hour period in this maternity wing.

(ii) What is the probability that minimum of three babies are born in a particular 1-hour period in this maternity wing?

(iii) Give another distribution which can be used to approximate to the number of babies born during an 8-hour shift. Clearly sate the distribution and the parameters that you suggest. Hence find the probability that minimum of 20 babies are born during a particular 8- hour session in this maternity wing.

4.

A biologist weights each individual mouse in a random sample consisting of ten mice and records weight to the nearest gram. The mice are then fed on a special diet and after 15 days each mouse is weighted again. The weight to the nearest gram is recorded. Assume that initial weight and the weight after 15 days are normally distributed. The results are as follows.

Initial Weight	50	49	48	52	40	43	51	46	41	42
Weight after 15 days	52	50	50	55	42	45	52	48	42	44

a) Assuming that the researcher has recorded the results in random order in both occasions and the variance of the initial weight and the variance of the weight after 15 days are equal, examine the possibility that there has been a significant increase in mean weight over 15 days. Use 5% level of significance.

b) If the researcher has recorded the results in the same order in both occasions, and the variance of the initial weight and the variance of the weight after 15 days are equal, examine the possibility that there has been a significant increase in mean weight over 15 days. Use 5% level of significance.

c) Suppose you are asked to consult the researcher to conduct this experiment. Out of the methods given in part(i) and part(ii) which method would you suggest for the researcher to implement? Support your answer.

5.

a) A certain manufacturing company produces circular metal disks. The diameter of the disk is used as the dimension of the product. To maintain the quality of the product random samples of 25 disks are chosen in every two hours. If the production process is in control, it is known that diameter of a disk is normally distributed with mean 5cm and standard deviation 0. 02cm. If the mean diameter of disk is not 5cm the production process is considered as out of control. The following table gives some statistics which were calculated from a sample collected on a particular day at 2.00 pm.

Descriptive Statistics: Disks measured for diameter

Count	Mean	Std.Dev	Minimum	Median	Maximum
25	5.0050	0.0190	4.9988	4.9998	5.0033

(i) Construct a 95% confidence interval for the mean diameter of the discs produced by the process. Round off your answer to four decimal places.

(ii) Interpret your result based on (i).

b) A boy used to play a certain game with a six sided dice. One day he found some problem with the dice and assumed that the dice was not fair. To test his assumption he threw the dice 60 times and the number of occurrences of the scores was recorded. Following table illustrates the results.

Score	1	2	3	4	5	6
Frequency	8	10	6	12	13	11

Test whether the assumption made by the boy is correct at 5% level of significance. Clearly state your conclusion.

6.

a) Briefly explain the components of a time series.

b) The following table provides quarterly sales (in Rs. 1,000) at a bookstore.

Year	Quarter	Sales
2009	1	580
2009	2	426
2009	3	452
2009	4	558
2010	1	610
2010	2	470
2010	3	464
2010	4	616
2011	1	678
2011	2	612
2011	3	564
2011	4	738

(i) Plot the data and comment on the graph.

(ii) Smooth the data using appropriate method and fit trend line for the data.

(iii) Calculate the seasonal effects.

(iv) Calculate the forecasted sales for the first quarter in the year 2012.

7.

Write short notes on **any four (4)** from the following topics.

a) Use of scatter plots in regression analysis

b) Correlation Coefficient

c) Multiple Linier Regression Models

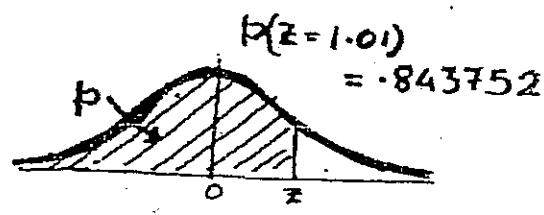
d) Coefficient of Determination

e) Assumptions in regression analysis model

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

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

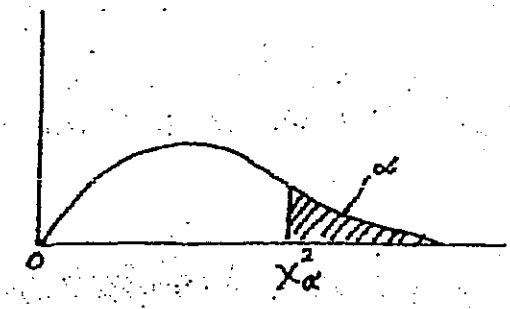
$$a = \frac{\sum y}{n} - b.\frac{\sum x}{n}$$



Standard normal distribution

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.500000	.503989	.507978	.511966	.515953	.519939	.523922	.527903	.531881	.535856
0.1	.539828	.543795	.547758	.551717	.555670	.559618	.563559	.567495	.571424	.575345
0.2	.579260	.583166	.587064	.590954	.594835	.598706	.602568	.606420	.610261	.614092
0.3	.617911	.621720	.625516	.629300	.633072	.636831	.640576	.644309	.648027	.651732
0.4	.655422	.659097	.662757	.666402	.670031	.673645	.677242	.680822	.684386	.687933
0.5	.691462	.694974	.698468	.701944	.705401	.708840	.712260	.715661	.719043	.722405
0.6	.725747	.729069	.732371	.735653	.738914	.742154	.745373	.748571	.751748	.754903
0.7	.758036	.761148	.764238	.767305	.770350	.773373	.776373	.779350	.782305	.785236
0.8	.788145	.791030	.793892	.796731	.799546	.802337	.805105	.807850	.810570	.813267
0.9	.815940	.818589	.821214	.823814	.826391	.828944	.831472	.833977	.836457	.838913
1.0	.841345	.843752	.846136	.848495	.850830	.853141	.855428	.857690	.859929	.862143
1.1	.864334	.866500	.868643	.870762	.872857	.874928	.876976	.879000	.881000	.882977
1.2	.884930	.886861	.888768	.890651	.892512	.894350	.896165	.897958	.899727	.901475
1.3	.903200	.904902	.906582	.908241	.909877	.911492	.913085	.914657	.916207	.917736
1.4	.919243	.920730	.922196	.923641	.925066	.926471	.927855	.929219	.930563	.931888
1.5	.933193	.934478	.935745	.936992	.938220	.939429	.940620	.941792	.942947	.944083
1.6	.945201	.946301	.947384	.948449	.949497	.950529	.951543	.952540	.953521	.954486
1.7	.955435	.956367	.957284	.958185	.959070	.959941	.960796	.961636	.962462	.963273
1.8	.964070	.964852	.965620	.966375	.967116	.967843	.968557	.969258	.969946	.970621
1.9	.971283	.971933	.972571	.973197	.973810	.974412	.975002	.975581	.976148	.976705
2.0	.977250	.977784	.978308	.978822	.979325	.979818	.980301	.980774	.981237	.981691
2.1	.982136	.982571	.982997	.983414	.983823	.984222	.984614	.984997	.985371	.985738
2.2	.986097	.986447	.986791	.987126	.987455	.987776	.988089	.988396	.988696	.988989
2.3	.989276	.989556	.989830	.990097	.990358	.990613	.990863	.991106	.991344	.991576
2.4	.991802	.992024	.992240	.992451	.992656	.992857	.993053	.993244	.993431	.993613
2.5	.993790	.993963	.994132	.994297	.994457	.994614	.994766	.994915	.995060	.995201
2.6	.995339	.995473	.995604	.995731	.995855	.995975	.996093	.996207	.996319	.996427
2.7	.996533	.996636	.996736	.996833	.996928	.997020	.997110	.997197	.997282	.997365
2.8	.997445	.997523	.997599	.997673	.997744	.997814	.997882	.997948	.998012	.998074
2.9	.998134	.998193	.998250	.998305	.998359	.998411	.998462	.998511	.998559	.998605

Chi-Square Table: Values of χ^2_α



$\chi^2_{.10}$	$\chi^2_{.05}$	$\chi^2_{.025}$	$\chi^2_{.01}$	$\chi^2_{.005}$	df
2.70554	3.84146	5.02389	6.63490	7.87944	1
4.60517	5.99147	7.37776	9.21034	10.5966	2
6.25139	7.81473	9.34840	11.3449	12.8381	3
7.77944	9.48773	11.1433	13.2767	14.8602	4
9.23635	11.0705	12.8325	15.0863	16.7496	5
10.6446	12.5916	14.4494	16.8119	18.5476	6
12.0170	14.0671	16.0128	18.4753	20.2777	7
13.3616	15.5073	17.5346	20.0902	21.9550	8
14.6837	16.9190	19.0228	21.6660	23.5893	9
15.9871	18.3070	20.4831	23.2093	25.1882	10
17.2750	19.6751	21.9200	24.7250	26.7569	11
18.5494	21.0261	23.3367	26.2170	28.2995	12
19.8119	22.3621	24.7356	27.6883	29.8194	13
21.0642	23.6848	26.1190	29.1413	31.3193	14
22.3072	24.9958	27.4884	30.5779	32.8013	15
23.5418	26.2962	28.8454	31.9999	34.2672	16
24.7690	27.5871	30.1910	33.4087	35.7185	17
25.9894	28.8693	31.5264	34.8053	37.1564	18
27.2036	30.1435	32.8523	36.1908	38.5822	19
28.4120	31.4104	34.1696	37.5662	39.9968	20
29.6151	32.6705	35.4789	38.9321	41.4010	21
30.8133	33.9244	36.7807	40.2894	42.7956	22
32.0069	35.1725	38.0757	41.6384	44.1813	23
33.1963	36.4151	39.3641	42.9798	45.5585	24
34.3816	37.6525	40.6465	44.3141	46.9278	25
35.5631	38.8852	41.9232	45.6417	48.2899	26
36.7412	40.1133	43.1944	46.9630	49.6449	27
37.9159	41.3372	44.4607	48.2782	50.9933	28
39.0875	42.5569	45.7222	49.5879	52.3356	29
40.2560	43.7729	46.9792	50.8922	53.6720	30
51.8050	55.7585	59.3417	63.6907	66.7659	40
63.1671	67.5048	71.4202	76.1539	79.4900	50
74.3970	79.0819	83.2976	88.3794	91.9517	60
85.5271	90.5312	95.0231	100.425	104.215	70
96.5782	101.879	106.629	112.329	116.321	80
107.565	113.145	118.136	124.116	128.299	90
118.498	124.342	129.561	135.807	140.169	100