THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF MANAGEMENT STUDIES
LEVEL 05 2012/2013
FINAL EXAMINATION 2013
QUANTITATIVE TECHNIQUES FOR MANAGEMENT II – MCU 3209

DATE: 29th June, 2013	**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 four pages.
Use of a non-programmable calculator is allowed.
Normal and Chi-square tables are annexed herewith.
$e^1 = 2.71$

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(1) (a) Explain the properties of the Normal Distribution. (5 Marks)

(b) Entry to the ***University of ABC*** is determined by a national test. In the past years the scores on this test are found to be Normally distributed with a mean of 50 and a standard deviation of 10. In each year, only the top 30% of students based on the test get admission to the ***University of ABC.***

(i) What percent of the students scored higher than 75 in the past years? (5 Marks)

(ii) What percentage of the students scored higher than 40 and less than 60 in the past years? (5 Marks)

(iii) Amith wants to be admitted to this university. He took the test in this year and thinks that he could score 59. Will Amith be able to get admission to ***University of ABC,*** if the scores of this year follow the same pattern as in the past? (5 Marks)

(2) (a) A production process operates with 2% of nonconforming output. In the quality control process of the production, every hour a sample of 50 units of product is tested, and if 2% or more nonconforming outs puts are found in the sample production process is stopped for adjustment.

(i) Find the probability that the production process is being stopped unnecessarily for adjustments. (6 Marks)

(ii) Comment on the quality control process using part (i). Give your suggestions to improve the quality control process if necessary. (4 Marks)

(b) A chemical reaction is run which is the usual yield is 70%. A new process has been introduced that should improve the yield. A promoter of the new procedure claims that more than 90% of the time it produces a better yield than the old process. The new process is being tested 60 times. Assuming the claims of the promoter is true;

(i) Find the probability that number of trials which exceed the yield 70% is more than 45 in the tested sample. (5 Marks)

(ii) Find the probability that number of trials which exceed the yield 70% is less than 35 in the tested sample. (5 Marks)

(Key: Use Normal Approximation to Binomial Distribution.)

(3) (a) Write short notes on following approximations.

(i) Poisson approximation to the Binomial distribution. (3 Marks)

(ii) Normal approximation to the Poisson distribution. (3 Marks)

(b) A particular nuclear plant releases a detectable amount of radioactive gasses three times in a month on average.

(i) Find the probability that there will be at most four such emissions during a month. (4 Marks)

(ii) Find the probability that minimum of 8 emissions during a period in three months time. (5 Marks)

(iii) Find the probability that one to three emissions during a period of two weeks. (5 Marks)

(4) (a) Briefly explain the following.

(i) Point Estimation. (3 Marks)

(ii) Interval Estimation. (3 Marks)

(b) The manager of a lemonade bottling plant is interested about the performance of a production line which has recently installed. The manger has selected 20 one hour periods at random and has recorded the number of crates completed in each hour by this production line. The table below gives the results. Assume the number of crates completed in each hour by this production line follows a Normal distribution.

77	80	86	84	86	77	77	78	86	76
79	79	83	77	82	75	78	77	75	84

(i) Estimate the number of crates completed in each hour by this line. (4 Marks)

(ii) Estimate the standard error of the estimate given in part(i) above. (3 Marks)

(iii) Suppose the mean number of crates completed in an hour by another old production line is 80. The manager claims that the "mean number of crates completed in an hour by the new and the old lines are same". Construct a 95% confidence interval for the mean number of crates completed in an hour by the new line. Comment on the manager's claim. (7 Marks)

(5) Write short notes on following topics. (5 Marks each)

(i) Random sampling methodologies

(ii) Non random sampling methodologies

(iii) Components of a time series

(iv) Chi-square test

(6) An investigation is conducted to study gasoline millage in auto mobiles when use exclusively for urban driving. Ten properly tuned and serviced automobiles manufactured during the same year are used in the study. Each automobile is driven for 1000 kilometers and the average number of kilometers per liter (km/l) is obtained (Y) and the weight of the car in metric tons (X) are recorded. Following table gives the results.

Car Number	1	2	3	4	5	6	7	8	9	10
Y(km/l)	17.9	16.5	16.4	16.8	18.8	15.5	17.5	16.4	15.9	18.3
X(T)	1.35	1.9	1.7	1.8	1.3	2.05	1.6	1.8	1.85	1.4

$\sum X = 16.75$ $\sum X^2 = 28.6375$ $\sum Y = 170$ $\sum Y^2 = 2900.46$ $\sum XY = 282.405$

(i) Plot a scatter diagram and interpret. (5 Marks)

(ii) Fit a suitable regression model to above data and interpret the results. (5 Marks)

(iii) Find the coefficient of determination of the fitted model and interpret the results. (5 Marks)

(iv) Estimate the average number of kilometers travel per liter (km/l) by a car weighted 2.5 tons. (5 Marks)

(7) (a) Briefly explain the following terms

(i) One tail tests (5 Marks)

(ii) Significance level (5 Marks)

(b) During the first three months of 2012, a technician was timed for the repair of an electronic instrument on 12 separate occasions. In the same period, a trainee technician was timed for the repair of a similar instrument on 14 occasions. These times, in minutes, are given in the table below.

Technician	314	296	300	324	255	242	374	250	307	215	317	334		
Trainee	279	351	282	280	258	267	312	357	322	249	228	315	311	341

Assume that these observations may be regarded as independent random samples from normal populations with equal standard deviation of 40 minutes.

(i) Conduct a suitable test to justify the claim " The time taken to repair the instrument is the same by the technician and the trainee". Use 5% level of significance. (6 Marks)

(ii) Subsequently it was known that the times for the trainee and the technician were incorrectly recorded and that each of the values above is 30 minutes less than the actual. What if any difference does this make to the result of the above part (i). (4 Marks)

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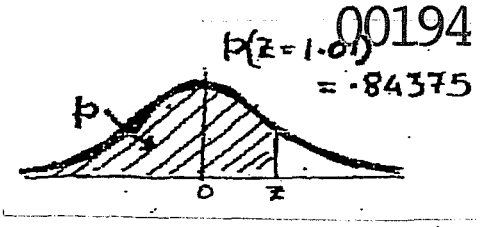
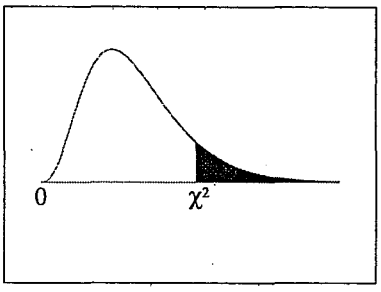


STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997

Chi-Square Distribution Table



The shaded area is equal to α for $\chi^2 = \chi^2_\alpha$.

df	$\chi^2_{.995}$	$\chi^2_{.990}$	$\chi^2_{.975}$	$\chi^2_{.950}$	$\chi^2_{.900}$	$\chi^2_{.100}$	$\chi^2_{.050}$	$\chi^2_{.025}$	$\chi^2_{.010}$	$\chi^2_{.005}$
1	0.000	0.000	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169