THE OPEN UNIVERSITY OF SRI LNKA
BACHELOR OF MANAGEMENT STUDIES (BMS) DEGREE PROGRAMME
LEVEL 05
ASSIGNMENT TEST - 2015 / 2014/2015
QUANTITATIVE TECHNIQUES FOR MANAGEMENT II – MCU 3209
DURATION: TWO HOURS

DATE: 21.02.2015	TIME: 10.00 A.M. – 12.00 NOON

Answer FOUR (04) questions only.
All questions carry equal marks.
Non-programmable calculators are allowed.

1. A Rental Car company wishes to estimate its average mileage of cars, out of a total of 1200 cars. The company wishes to study a sample of 120.

   a. Identify the sampling frame and the population that would be used by Car Company.

   b. Explain how you can pick a random sample of 120 cars.

   c. Explain how you can pick a stratified sample of 120 cars according to the following categories. (You may show any calculations needed)

   The type of cars and their percentages in the fleet are as follows.
   Super Luxury cars……………….15%
   Luxury cars………………………35%
   Mini cars (4 door)……………….20%
   Mini cars (2 door)……………….30%

2. Assume that a marketer wishes to compare five different package designs. He is interested in knowing which is the most preferred one so that the same can be introduced to the market. A random sample of 200 consumers gives the following results:

Package design	Preference by consumers
A	36
B	52
C	40
D	35
E	37
Total	**200**

Do the consumer preferences for the designs show any significant differences at 5% significant level?

3. a) Briefly describe the following:

   i. Critical region

   ii. Null hypothesis

   iii. Alternative hypothesis

   iv. Test statistic

   v. Type I error

   b) A random sample of 64 graduate students of a university showed a mean age 27 years and standard deviation of 5 years. Establish a 95% confidence interval of the true mean age of all graduate students at the university.

4. a) A factory produces components of which 1% are defective. The components are packed in boxes of 10. If a box is selected at random, find the probability that the box contains exactly one defective.

   b) The number of accidents that occur in an assembly line follows a Poisson distribution, with an average of three accidents per week. Find the probability of having at least two accidents per week.

   c) A survey revealed that 4.5% of young adults reported using alcohol daily for the past 30 days. Using the Normal approximation to the Binomial distribution, find the probability that, in a national poll of 1024 adults, between 35 and 50 inclusive will indicate that they have used alcohol daily for the past 30 days.

5. a) The quantity produced daily at the ABC cement factory is approximately normally distributed with mean 0.82 and standard deviation 0.14. The units are on millions of tons. Find the probability that the total production will between 0.80 and 0.85 million tons.

   b) During the off-hours, people arrive at a tool booth at a mean rate of 0.5 per minute. The arrivals are Poisson distributed. What is the probability that during the next 10 minutes, 3 or more people will arrive?

   c) Large sheets of plate glass made by Acmy Glass Company are inspected for structural defects at each of 5 inspection stations. The probability of successfully identifying a defect at any inspection station is 0.5. Find the probability that a defective part is identified,at two of the inspection station.

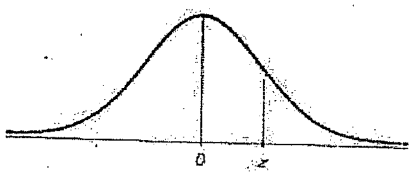


TABLE A-2 Standard Normal (z) Distribution

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	.2517	.2549
0.7	.2580	.2611	.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	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

NOTE: For values of z above 3.09, use 0.4999 for the area.

*Use these common values that result from interpolation:

z score	Area
1.645	0.4500
2.575	0.4950

From Frederick C. Mosteller, Robert E. K. Rourke, Sturdy Statistics, 1973, Addison-Wesley Publishing Co., Reading, MA. Reprinted with permis- f Frederick Mosteller.

Cumulative Binomial Probabilities

n	k	0.01	0.05	0.10	0.15	0.20	0.25	0.30	1/3	0.35	0.40	0.45	0.49	0.50
2	0	0.9801	0.9025	0.8100	0.7225	0.6400	0.5625	0.4900	0.4444	0.4225	0.3600	0.3025	0.2601	0.2500
	1	0.0198	0.0950	0.1800	0.2550	0.3200	0.3750	0.4200	0.4444	0.4550	0.4800	0.4950	0.4998	0.5000
	2	0.0001	0.0025	0.0100	0.0225	0.0400	0.0625	0.0900	0.1111	0.1225	0.1600	0.2025	0.2401	0.2500
3	0	0.9703	0.8574	0.7290	0.6141	0.5120	0.4219	0.3430	0.2963	0.2746	0.2160	0.1664	0.1326	0.1250
	1	0.0294	0.1354	0.2430	0.3251	0.3840	0.4219	0.4410	0.4444	0.4436	0.4320	0.4084	0.3823	0.3750
	2	0.0003	0.0071	0.0270	0.0574	0.0960	0.1406	0.1890	0.2222	0.2389	0.2880	0.3341	0.3674	0.3750
	3		0.0001	0.0010	0.0034	0.0080	0.0156	0.0270	0.0370	0.0429	0.0640	0.0911	0.1177	0.1250
4	0	0.9606	0.8145	0.6561	0.5220	0.4096	0.3164	0.2401	0.1975	0.1785	0.1296	0.0915	0.0677	0.0625
	1	0.0388	0.1715	0.2916	0.3685	0.4096	0.4219	0.4116	0.3951	0.3845	0.3456	0.2995	0.2600	0.2500
	2	0.0006	0.0135	0.0486	0.0975	0.1536	0.2109	0.2646	0.2963	0.3105	0.3456	0.3675	0.3747	0.3750
	3		0.0005	0.0036	0.0115	0.0256	0.0469	0.0756	0.0988	0.1115	0.1536	0.2005	0.2400	0.2500
	4			0.0001	0.0005	0.0016	0.0039	0.0081	0.0123	0.0150	0.0256	0.0410	0.0577	0.0625
5	0	0.9510	0.7738	0.5905	0.4437	0.3277	0.2373	0.1681	0.1317	0.1160	0.0778	0.0503	0.0345	0.0313
	1	0.0480	0.2036	0.3281	0.3915	0.4096	0.3955	0.3602	0.3292	0.3124	0.2592	0.2059	0.1657	0.1563
	2	0.0010	0.0214	0.0729	0.1382	0.2048	0.2637	0.3087	0.3292	0.3364	0.3456	0.3369	0.3185	0.3125
	3		0.0011	0.0081	0.0244	0.0512	0.0879	0.1323	0.1646	0.1812	0.2304	0.2757	0.3060	0.3125
	4			0.0004	0.0022	0.0064	0.0147	0.0284	0.0412	0.0488	0.0768	0.1128	0.1470	0.1563
	5				0.0001	0.0003	0.0010	0.0024	0.0041	0.0053	0.0102	0.0185	0.0282	0.0313
6	0	0.9415	0.7351	0.5315	0.3772	0.2622	0.1780	0.1177	0.0878	0.0754	0.0467	0.0277	0.0176	0.0156
	1	0.0571	0.2321	0.3543	0.3993	0.3932	0.3560	0.3025	0.2634	0.2437	0.1866	0.1359	0.1014	0.0938
	2	0.0014	0.0306	0.0984	0.1762	0.2458	0.2966	0.3241	0.3292	0.3280	0.3110	0.2780	0.2437	0.2344
	3		0.0021	0.0146	0.0415	0.0819	0.1318	0.1852	0.2195	0.2355	0.2765	0.3032	0.3121	0.3125
	4		0.0001	0.0012	0.0055	0.0154	0.0330	0.0595	0.0823	0.0951	0.1382	0.1861	0.2249	0.2344
	5			0.0001	0.0004	0.0015	0.0044	0.0102	0.0165	0.0205	0.0369	0.0609	0.0864	0.0938
	6					0.0001	0.0002	0.0007	0.0014	0.0018	0.0041	0.0083	0.0138	0.0156
7	0	0.9321	0.6983	0.4783	0.3206	0.2097	0.1335	0.0824	0.0585	0.0490	0.0280	0.0152	0.0090	0.0078
	1	0.0659	0.2573	0.3720	0.3960	0.3670	0.3115	0.2471	0.2049	0.1848	0.1306	0.0872	0.0604	0.0547
	2	0.0020	0.0406	0.1240	0.2097	0.2753	0.3115	0.3177	0.3073	0.2985	0.2613	0.2140	0.1740	0.1641
	3		0.0036	0.0230	0.0617	0.1147	0.1730	0.2269	0.2561	0.2679	0.2903	0.2918	0.2786	0.2734
	4		0.0002	0.0026	0.0109	0.0287	0.0577	0.0972	0.1280	0.1442	0.1935	0.2388	0.2676	0.2734
	5			0.0002	0.0012	0.0043	0.0115	0.0250	0.0384	0.0466	0.0774	0.1172	0.1543	0.1641
	6				0.0001	0.0004	0.0013	0.0036	0.0064	0.0084	0.0172	0.0320	0.0494	0.0547
	7						0.0001	0.0002	0.0005	0.0006	0.0016	0.0037	0.0068	0.0078
8	0	0.9227	0.6634	0.4305	0.2725	0.1678	0.1001	0.0577	0.0390	0.0319	0.0168	0.0084	0.0046	0.0039
	1	0.0746	0.2793	0.3826	0.3847	0.3355	0.2670	0.1977	0.1561	0.1373	0.0896	0.0548	0.0352	0.0313
	2	0.0026	0.0515	0.1488	0.2376	0.2936	0.3115	0.2965	0.2731	0.2587	0.2090	0.1570	0.1183	0.1094
	3	0.0001	0.0054	0.0331	0.0839	0.1468	0.2076	0.2541	0.2731	0.2786	0.2787	0.2568	0.2273	0.2188
	4		0.0004	0.0046	0.0185	0.0459	0.0865	0.1361	0.1707	0.1875	0.2322	0.2627	0.2730	0.2734
	5			0.0004	0.0026	0.0092	0.0231	0.0467	0.0683	0.0808	0.1239	0.1719	0.2098	0.2188
	6				0.0002	0.0011	0.0038	0.0100	0.0171	0.0217	0.0413	0.0703	0.1008	0.1094
	7					0.0001	0.0004	0.0012	0.0024	0.0033	0.0079	0.0161	0.0277	0.0313
	8							0.0001	0.0002	0.0002	0.0007	0.0017	0.0033	0.0039
n	k	0.01	0.05	0.10	0.15	0.20	0.25	0.30	1/3	0.35	0.40	0.45	0.49	0.50

e. n = 9

k	0.01	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.99
0	0.914	0.630	0.387	0.134	0.040	0.010	0.002	0.000	0.000	0.000	0.000	0.000	0.000
1	0.997	0.929	0.775	0.436	0.196	0.071	0.020	0.004	0.000	0.000	0.000	0.000	0.000
2	1.000	0.992	0.947	0.738	0.463	0.232	0.090	0.025	0.004	0.000	0.000	0.000	0.000
3		0.999	0.992	0.914	0.730	0.483	0.254	0.099	0.025	0.003	0.000	0.000	0.000
4		1.000	0.999	0.980	0.901	0.733	0.500	0.267	0.099	0.020	0.001	0.000	0.000
5			1.000	0.997	0.975	0.901	0.746	0.517	0.270	0.086	0.008	0.001	0.000
6				1.000	0.996	0.975	0.910	0.768	0.537	0.262	0.053	0.008	0.000
7					1.000	0.996	0.980	0.929	0.804	0.564	0.225	0.071	0.003
8						1.000	0.998	0.990	0.960	0.866	0.613	0.370	0.086
9							1.000	1.000	1.000	1.000	1.000	1.000	1.000

f. n = 10

k	0.01	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.99
0	0.904	0.599	0.349	0.107	0.028	0.006	0.001	0.000	0.000	0.000	0.000	0.000	0.000
1	0.996	0.914	0.736	0.376	0.149	0.046	0.011	0.002	0.000	0.000	0.000	0.000	0.000
2	1.000	0.988	0.930	0.678	0.383	0.167	0.055	0.012	0.002	0.000	0.000	0.000	0.000
3		0.999	0.987	0.879	0.650	0.382	0.172	0.055	0.011	0.001	0.000	0.000	0.000
4		1.000	0.998	0.967	0.850	0.633	0.377	0.166	0.047	0.006	0.000	0.000	0.000
5			1.000	0.994	0.953	0.834	0.623	0.367	0.150	0.033	0.002	0.000	0.000
6				0.999	0.989	0.945	0.828	0.618	0.350	0.121	0.013	0.001	0.000
7				1.000	0.998	0.988	0.946	0.833	0.617	0.322	0.070	0.012	0.000
8					1.000	0.998	0.989	0.954	0.851	0.624	0.264	0.086	0.004
9						1.000	0.999	0.994	0.972	0.893	0.651	0.401	0.096
10							1.000	1.000	1.000	1.000	1.000	1.000	1.000

g. n = 15

k	0.01	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.99
0	0.860	0.463	0.206	0.035	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	0.990	0.829	0.549	0.167	0.035	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	1.000	0.964	0.816	0.398	0.127	0.027	0.004	0.000	0.000	0.000	0.000	0.000	0.000
3		0.995	0.944	0.648	0.297	0.091	0.018	0.002	0.000	0.000	0.000	0.000	0.000
4		0.999	0.987	0.836	0.515	0.217	0.059	0.009	0.001	0.000	0.000	0.000	0.000
5		1.000	0.998	0.939	0.722	0.403	0.151	0.034	0.004	0.000	0.000	0.000	0.000
6			1.000	0.982	0.869	0.610	0.304	0.095	0.015	0.001	0.000	0.000	0.000
7				0.996	0.950	0.787	0.500	0.213	0.050	0.004	0.000	0.000	0.000
8				0.999	0.985	0.905	0.696	0.390	0.131	0.018	0.000	0.000	0.000
9				1.000	0.996	0.966	0.849	0.597	0.278	0.061	0.002	0.000	0.000
10					0.999	0.991	0.941	0.783	0.485	0.164	0.013	0.001	0.000
11					1.000	0.998	0.982	0.909	0.703	0.352	0.056	0.005	0.000
12						1.000	0.996	0.973	0.873	0.602	0.184	0.036	0.000
13							1.000	0.995	0.965	0.833	0.451	0.171	0.010
14								1.000	0.995	0.965	0.794	0.537	0.140
15									1.000	1.000	1.000	1.000	1.000

$P(r) = {}^{n}C_{r} p^{r} q^{(n-r)}$

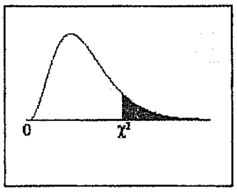
$P(x) = \frac{e^{-\lambda}\lambda^{x}}{x!}$ where, e = 2.71828.....

$\bar{x} - E < \mu < \bar{x} + E$ where, $E = z_{\alpha/2}(\sigma/\sqrt{n})$ or $E = t_{\alpha/2}(s/\sqrt{n})$

$\hat{p} - E < p < \hat{p} + E$ where, $E = Z\sqrt{\hat{p}(1-\hat{p})/n}$

$$\chi^2_{STAT} = \sum_{\text{all cells}} \frac{(f_o - f_e)^2}{f_e}$$

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