SVKM's NMIMS University
School of Distance Learning

Quantitative Techniques

Date: 14.12.2007 **Marks: 100**
Time: 11.00 to 2.00

N.B.: (1) Solve any five questions
(2) Marks allotted to the questions are shown on r.h.s margin
(3) Make suitable assumptions, if required.
(4) Use of calculator is permitted

Q. 1 (a) Solve the following equations using Inverse Matrix Algebra (10)

$x - 2y + 3z = 4$
$2x + y - 3z = 5$
$-x + y + 2z = 3$

(b) A telephone company in a town has 500 subscribers on its list and collects fixed rental charges of Rs. 300 per year from each subscriber. The company proposes to increase annual charges and it is believed that for every increase of one rupee in the rental, one subscriber will discontinue. Find what increased annual rental will bring the maximum annual income to the company. (10)

Q. 2 (a) Calculate Mode and Median for the following data: (12)

Class	0 - 10	10 - 20	20 – 30	30 – 40	40 - 50
Frequency	2	8	24	20	6

Q.2 (b) Find coefficient of variation for the following data: (08)

Income in Thousand of Rs.	20 – 24	24 - 28	28 – 32	32 - 36	36 - 40	40 - 44
Managers	15	200	425	160	30	20

Q.3 (a) Find the co-efficient of skewness for the following data: (10)

Class	20 - 25	25 – 30	30 - 35	35 – 40	40 - 45	45 - 50
Frequency	10	40	50	55	35	10

Q.3 (b) The sales during Seven years have been given. Estimate the sales in the year 2006 (10)

Year	1999	2000	2001	2002	2003	2004	2005
Sales in Lacs	2	3	5	8	10	13	18

Q.4 (a) A bag contains 30 squares numbered from 1 to 40. One square is drawn at random. Find the probability that the number of the drawn square will be a multiple of (a) 5 or 7 (b) 8 to 11 (08)

Q.4 (b) A company has received on order to supply shoes to particular customer. It has three suppliers to supply leather for producing shoes. Company received 50% of the order from supplier S1, 40% from S2 and 10% from S3, respectively. (12)

A randomly selected shoe was found to be of poor quality. If the leather used for this shoe is bad, find the probability that it was supplied by supplier S1.

Q.5 (a) The monthly income distribution of the workers in a factory is normal, with mean Rs. 500 and standard deviation of Rs. 50. There were 228 workers getting income above Rs. 600 per month. How many workers were there in all? (10)

Q.5 (b) Write the characteristics of Normal Distribution curve. What are the applications of Normal Distribution in industries? (10)

Q.6 (a) 40% businessmen carry Laptop. In a sample of 15 businessmen –

(i) What is the probability that at least three have laptop?
(ii) What is the probability that exactly two have Laptop?
(iii) What is the probability that twelve do not have Laptop?

Q.6 (b) A factory manufacturing a product there is a chance of on an average 0.2 defective products. The product is supplied in packets of 10. Using appropriate distribution calculate the approximate number of packets containing – (10)
(i) no defective (ii) at most one defective and (iii) atleast one defective packets.

Q.7 (a) Solve the following Linear Programming problem graphically: (10)

Minimize $Z = 100x1 + 190x2$

Subject to $6x1 + 10x2 \geq 60000$

$7x1 + 9x2 \leq 63000$

$x1 \geq 4000$

$x1$ & $x2$ both ≥ 0

Q.7 (b) XYZ company is engaged in manufacturing five brands of packed snacks. It is having five manufacturing set-ups, each capable of manufacturing any of its brands one at a time. The cost to make a brand on these set-ups vary

according to the following table:

	S1	S2	S3	S4	S5
B1	4	6	7	5	11
B2	7	3	6	9	5
B3	8	5	4	6	9
B4	9	12	7	11	10
B5	7	5	9	8	11

S1, S2, S3, S4, S5 are the are the set-ups and B1, B2, B3, B4, B5 are the brands. Find the optimal assignment of products on these set-ups to minimize cost.

Q.8 A fertilizer company has three unites located in different locations. The company has to cater to markets in eastern, western, northern and southern regions. The transportation cost per ton, capacities and requirements are given in the matrix below:

Location Factory	Transportation cost (Rs.) per ton to marketing regions				Supplies capacities in tons
	North	South	East	West	
F1	410	395	400	435	90
F2	460	305	380	345	100
F3	300	375	455	405	50
Demand tons	60	50	85	45	

Determine the optimum schedule of shipment for the transportation problem using Vogel Approximation method and test the solution for optimality.

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n	r	P = .10	P = .20	P = .25	P = .30	P = .40	P = .50
20	0	.12158	.01152	.00317	.00080	.00004	.00000
	1	.39175	.06918	.02431	.00764	.00032	.00002
	2	.67693	.020808	.09126	.03545	.00361	.00020
	3	.86705	.41145	.22516	.10709	.01596	.00129
	4	.95583	.62966	.41454	.23751	.05095	.00591
	5	.98875	.80421	.61717	.41637	.12560	.02069
	6	.99761	.91331	.78578	.60001	.25001	.05766
	7	.99958	.96786	.89319	.77227	.41589	.13159
	8	.99994	.99002	.95907	.88667	.59560	.25172
	9	.99999	.99741	.98514	.95204	.75534	.41190
	10	1.00000	.99944	.99606	.87286	.87248	.58910
	11		.99990	.99906	.99480	.94347	.74828
	12		.99998	.99932	.99872	.97897	.86841
	13		1.00000	.99997	.99974	.99353	.94234
	14			1.00000	.99996	.99839	.97931
	15				.99999	.99968	.99409
	16				1.00000	.99995	.99871
	17					.99999	.99980
	18					1.00000	.99996
	19						1.00000
25	0	.07179	.00373	.00075	.00013	.00000	.00000
	1	.27121	.02739	.00702	.00157	.00005	.00000
	2	.53709	.09823	.03211	.00698	.00043	.00001
	3	.76359	.23389	.09621	.03324	.00237	.00008
	4	.90791	.42067	.21374	.09047	.00947	.00046
	5	.96660	.61559	.37828	.19349	.02936	.00254
	6	.99052	.78004	.56110	.34365	.07357	.00782
	7	.99774	.89068	.72651	.51185	.15355	.02164
	8	.99954	.95323	.85036	.67693	.27353	.05389
	9	.99992	.98267	.92867	.81056	.42462	.11476
	10	.99999	.99445	.97033	.90220	.53577	.21218
	11	1.00000	.99846	.98927	.95575	.73228	.34502
	12		.99963	.99663	.98253	.84623	.50000
	13		.99992	.99906	.99401	.92220	.65498
	14		.99999	.99979	.99822	.96501	.78782
	15		1.00000	.99996	.99955	.98683	.88524
	16			.99999	.99990	.99657	.94612
	17			1.00000	.99998	.99879	.97836
	18				1.00000	.99972	.99268
	19					.99995	.99795
	20					.99999	.99954
	21					1.00000	.99992
	22						.99999
	23						1.00000

TABLE 1

THE CUMULATIVE BINOMIAL DISTRIBUTION

n	r	P = .10	P = .20	P = .25	P = .30	P = .40	P = .50
5	0	.59049	.32768	.23730	.16807	.07776	.03125
	1	.91854	.73728	.63281	.52822	.33696	.18750
	2	.99144	.94208	.89648	.83692	.68256	.50000
	3	.99954	.99328	.98437	.96922	.91296	.81250
	4	.99999	.99968	.99902	.99757	.98976	.96875
	5	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
10	0	.34868	.10737	.05631	.02825	.00605	.00098
	1	.73610	.37581	.24403	.14931	.04636	.01074
	2	.92981	.67780	.52559	.38278	.16729	.05469
	3	.98720	.87913	.77536	.64901	.38325	.17187
	4	.99837	.96721	.92187	.84973	.63310	.37695
	5	.99985	.99363	.98027	.95265	.83376	.62305
	6	.99999	.99914	.99649	.98941	.94524	.82812
	7	1.00000	.99992	.99958	.99841	.98771	.94531
	8		1.00000	.99997	.99985	.99832	.99023
	9			1.00000	.99999	.99990	.99902
	10				1.00000	1.00000	1.00000
	11				1.00000	1.00000	1.00000
15	0	.20589	.03518	.01336	.00475	.00047	.00003
	1	.54904	.16713	.08018	.03527	.00517	.00049
	2	.81594	.39602	.23609	.12683	.02711	.00369
	3	.94444	.64816	.46129	.29387	.09050	.01758
	4	.98728	.83577	.68649	.51549	.21728	.05923
	5	.99775	.93895	.85163	.72163	.40322	.15088
	6	.99969	.98194	.94338	.86886	.60981	.30362
	7	.99997	.99576	.98270	.94999	.78690	.50000
	8	1.00000	.99921	.99581	.98476	.90495	.69638
	9		.99989	.99921	.99635	.96617	.84912
	10		.99999	.99988	.99939	.99065	.94077
	11		1.00000	.99999	.99991	.99807	.98242
	12			1.00000	.99999	.99972	.99631
	13				1.00000	.99997	.99951
	14					1.00000	.99997
	15						1.00000

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Table A-II The Cumulative Poisson Distribution

r	μ = .1	μ = .2	μ = .3	μ = .4	μ = .5
0	.90484	.81873	.74082	.67302	.60653
1	.99532	.98248	.96306	.93845	.90980
2	.99985	.99885	.99640	.99207	.98561
3	1.00000	.99994	.99973	.99922	.99825
4		1.00000	.99998	.99994	.99983
5			1.00000	1.00000	.99999
6					1.000000

r	μ = .6	μ = .7	μ = .8	μ = .9	μ = 1.0
0	.54881	.47658	.44933	.40657	.36788
1	.87810	.84419	.80879	.77248	.73576
2	.97688	.96586	.95258	.93714	.91970
3	.99811	.99425	.99092	.98664	.98101
4	.99961	.99921	.99859	.99766	.99634
5	.99993	.99991	.99982	.99966	.99941
6	1.00000	.99999	.99998	.99995	.99991
7		1.00000	1.00000	1.00000	.99999
8					1.00000

r	μ = 2	μ = 3	μ = 4	μ = 5	μ = 6
0	.13534	.04979	.01832	.00674	.00248
1	.40601	.019915	.09158	.04043	.01735
2	.67668	.42319	.23810	.12465	.06197
3	.85712	.64723	.43347	.26503	.15120
4	.94735	.81525	.62884	.44049	.28506
5	.98344	.91608	.78513	.61596	.44588
6	.99547	.96649	.88933	.76213	.60630
7	.99890	.98810	.94887	.86663	.74399
8	.99975	.99620	.97864	.93191	.84724
9	.99995	.99890	.99187	.96817	.91608
10	.99999	.99971	.9976	.98630	.95738
11	1.00000	.99993	.99908	.99455	.97991
12		.99998	.99973	.99798	.99117
13		1.00000	.99992	.99930	.99637
14			.99998	.99977	.99860
15			1.00000	.99993	.99949
16				.99998	.99982
17				1.00000	.99994
18					.99998
19					1.00000

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4		1.00000	.99998	.99994	.99983
5			1.00000	1.00000	.99999
6					1.000000

r	μ = .6	μ = .7	μ = .8	μ = .9	μ = 1.0
0	.54881	.47658	.44933	.40657	.36788
1	.87810	.84419	.80879	.77249	.73576
2	.97688	.96586	.95258	.93714	.91970
3	.99812	.99425	.99062	.98554	.98101
4	.99961	.99921	.99859	.99766	.99634
5	.99996	.99991	.99982	.99966	.99941
6	1.00000	.99999	.99998	.99996	.99991
7		1.00000	1.00000	1.00000	.99999
8					1.00000

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6	.99547	.96649	.88933	.76213	.60630
7	.99890	.98810	.94887	.86663	.74398
8	.99975	.99620	.97864	.93191	.84724
9	.99995	.99890	.99187	.96817	.91608
10	.99999	.99971	.9976	.98630	.95738
11	1.00000	.99993	.99908	.99455	.97991
12		.99998	.99973	.99795	.99117
13		1.00000	.99992	.99930	.99637
14			.99998	.99977	.99860
15			1.00000	.99993	.99949
16				.99998	.99982
17				1.00000	.99994
18					.99998
19					1.00000

AREA UNDER THE NORMAL CURVE

The area is measured from the mean, $X = 0$, to any ordinate, $x = X$.
The results to given for values of x/s at intervals of 0.01.

$u = \frac{0}{s}$	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0000	0040	.0080	.0120	.0159	.0199	.0239	.3279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.1987	.1026	.1064	.1183	.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	.2089	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	2389	.2422	.2454	.2486	.2518	.2549
0.7	2580	.2611	.2642	.2673	.2704	.2734	2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.2076	.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	.4065	.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	.4430	.4441
1.6	.4452	.4463	.4474	.4485	.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	.4762	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4799	.4803	.4808	.4812	.4817
2.1	.4821	.4825	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4865	.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	.4980	.4980	.4981
2.9	.4981	.4982	.4983	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.49865	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.49903	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993