SOUTH EASTERN UNIVERSITY OF SRI LANKA
CENTRE FOR EXTERNAL DEGREES AND PROFESSIONAL LEARNING

SECOND EXAMINATION IN BACHELOR OF BUSINESS ADMINISTRATION (EXTERNAL) – 2011/2012
HELD IN JUNE / JULY 2013

BBA 27 QUANTITATIVE TECHNIQUES FOR MANAGEMENT

Answer all questions.
Calculator is allowed.

Time: Three Hours

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01. **a)** A hospital is reviewing its requirements for nursing care. The hospital wishes to maintain its high quality service at the lowest cost.

Two categories of nurses are employed, 'trained' and 'trainee'. Experience has shown that at least 100 trained nurses or equivalent is required. On the average a trained nurse costs the hospital Rs. 240,000 a year, a trainee nurse Rs. 96,000 a year (inclusive of salary, food, accommodation etc.). The number of trainee nurses cannot exceed 60 and for successful working practices the number of trainee nurses should not exceed the number of trained nurses. It is also required that at least 40 trainee nurses should be under training. According to the current job market a maximum of only 140 trained nurses could be recruited.

Solve this linear programming problem graphically that will determine the optimum combination of nurses to employ in order to minimize the total cost to the hospital.

(12 marks)

b) A manufacturer can produce four products using three resources. Contribution per unit of products and their constraints are given in the form of linear programming.

Maximize $Z = 40x_1 + 50x_2 + 90x_3 + 110x_4$

Subject to;

$x_1 + x_2 + x_3 + x_4 \leq 150$ (Labour hours)

$7x_1 + 5x_2 + 3x_3 + 2x_4 \leq 120$ (Inspection hours)

$3x_1 + 5x_2 + 10x_3 + 15x_4 \leq 100$ (Machine hours)

with $x_1, x_2, x_3, x_4 \geq 0$

The final simplex tableau for the above LP problem is given as follows;

Cj	40	50	90	110	0	0	0	Solution
Basis	X_1	X_2	X_3	X_4	S_1	S_2	S_3	Quantity
S_1	0	0.10	0	-0.21	1	-0.12	-0.07	130
X_1	1	0.57	0	-0.41	0	0.16	-0.05	15
X_3	0	0.33	1	1.62	0	-0.05	0.12	06
Zj	40	52.5	90	129.4	0	1.9	8.8	1140

i. Convert the above LP problem into standard form.

ii. Calculate the values for Cj-Zj values.

iii. Is the solution is optimal? Why?

iv. Interpret the optimal solution and shadow prices.

v. The firm is considering using an extra machine hours in the manufacturing process. Is it profitable to the company? If it is so, find the optimal range for the increase.

(12 marks)

c) Find the duality of the following LP problem.

Maximize (z) $= 180x_1 + 320x_2$

Subject to, $5x_1 + 3x_2 + \leq 1600$

$x_1 + 2x_2 \leq 860$

$9x_2 \geq 400$

$x_1, x_2 \geq 0$

(04 marks)

[Total: 28 marks]

02. 'Amazon Industries' manufactures electronic items and distributes them to its wholesale centers through three distribution out lets in different locations:

Distribution Out let	O_1	O_2	O_3
Quantity (units)	100	200	450

Based on the past experiences, the whole sale centers demand the following amount to satisfy the customers' needs in each month.

Wholesale Centers	C_1	C_2	C_3
Total Quantity	200	450	250

The distribution out let expects the cost per unit to vary with the whole sale centers as given below:

(Rs in '00)

Outlet / Wholesale center	O_1	O_2	O_3
C_1	35	60	52
C_2	80	35	65
C_3	62	75	100

You are required to:

i. Formulate Linear Programming model for the above transportation problem.

(04 marks)

ii. Solve the above transportation problem using Least Cost Method.

(05 marks)

iii. Find the optimal solution for the above transportation problem using MODI method.

(09 marks)

{Total: 18 marks}

03. **a)** Briefly explain for what kinds of managerial problems the assignment techniques are used.

(04 marks)

b) A company has sent four sales representatives to market their products to four selected zones. They have different sales potential in each zone. The following table shows the number of units that they could market during their assigned period.

		Zone			
		Z1	Z2	Z3	Z4
Sales representative	S1	120	145	196	101
	S2	110	96	140	170
	S3	140	80	140	170
	S4	126	142	115	182

The company wants to deploy the right person to right zone in order to maximize its profit. Find the optimal assignment of sales representativesr to zones.

(12 marks)

[Total: 16 marks]

04. **a)** Briefly describe the network techniques used to analyze the projects

(03 marks)

b) "The Everest Company", has planned to create new software for information system to be useful for organizations. The activity time estimates, and its immediate predecessor activities are given as follows;

Activity	Predecessor activities	Time (days)	Associated cost (Rs.)
A	-	04	6000
B	-	10	14000
C	B	08	7600
D	A	10	12000
E	C,D	12	12600
F	C,D	14	13600
G	E	12	12400
H	G,J	10	12000
I	F	12	12400
J	E,I	08	8000
K	H	06	1200
L	K	02	1000

An overall supervision cost associated with the project is estimated at Rs. 600 per day. You are required to;

i. Find the total completion time and the critical path activities
ii. State the feasible delay of the activities C,D,E, and G.
iii. find the probability that the project will be finished before 80 days. (Assume the standard deviation is 3.6).
iv. Find the total cost of the project.

(15 marks)

[Total: 18 marks]

05. a) Gama Company Ltd. has prepared the following payoffs of the following three decision alternatives in relation with their products.

Product Type	Nature of Demand ('000)		
	Good	Moderate	Poor
Model A	1200	9000	1000
Model B	850	1150	-200
Model C	700	0	1100

Probabilities for the nature of demand are estimated by the management as follows:

P (good) =0.40

P (Moderate) = 0.35 and

P (poor) = 0.25

Find the best alternative decision based on the following;

i. Expected Monetary Value
ii. Expected Opportunity Loss
iii. Maximin Criterion
iv. Maximax Criterion
v. Minimax Criterion

(10 marks)

b) Explain the terms in relation with queuing theory.

i. Arrival rate and service rate
ii. Queuing disciplines
iii. Components of queuing model
iv. Queue and Queuing system

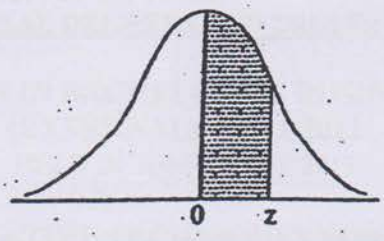
(10 marks)

[Total: 20 marks]

TABLE A.2

Area Under Normal Curve

$$z = \frac{x - \bar{x}}{\sigma}$$



z	0	1	2	3	4	5	6	7	8	9
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0754
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2258	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2518	0.2549
0.7	0.2580	0.2612	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2996	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990