SOUTH EASTERN UNIVERSITY OF SRI LANKA

SECOND YEAR EXAMINATION IN BACHELOR OF BUSINESS ADMINISTRATION / BACHELOR OF COMMERCE (EXTERNAL) 2009/2010

DECEMBER, 2010

BBA/BCOM 27 QUANTITATIVE TECHNIQUES FOR MANAGEMENT

Answer all questions.
Graph paper will be provided. Calculator is allowed. **Time: Three Hours**

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01. (a) The Gama Paint Company is a privately owned manufacturing firm, specializing in the production of paints. The selling prices and the associate unit variable costs for the two types of paints that they manufacture are shown in the table below;

Paint type	**selling price(Rs. per liter)**	**variable cost (Rs. per liter)**
C-lux	480	270
D-lux	600	370

Each liter of C-lux paint requires six minutes of skilled labour and each liter of D-lux paint requires twelve minutes of skilled labour. In a given day, there are 400 man hours of skilled labour available. Also there are 100 liters of an important blending chemical available each day, where each liter of C-lux paint needs 0.05 liters of the blending chemical and each D-lux needs 0.02 liters of the chemical. The processing capacity at the plant is limited to 3,000 liters of paints per day. In addition, there is an agreement with the unions that at least 2,000 liters of paints are produced each day. Gama management would like to determine the daily production volume of each of the two paints that will maximize total contribution. Solve this linear programming problem graphically.

(12 marks)

(b) A simplex tableau for a LP problem is given below.

Mix		12	14	0	0
	Quantity	x	y	s_1	s_2
x	3	1	0	-1 / 4	3 / 4
y	2	0	1	1 / 2	-1 / 2
z_j	64	12	14	4	2

i. Identify the C_j-Z_j values for this table.

ii. Is this solution is optimal? Why?

iii. What are the shadow prices for S_1 and S_2?

iv. Compute the maximum decrease/increase over which the shadow price for s_1 is valid.

v. Compute the valid range for the increase/decrease of the price of product Y.

(12 marks)

(c) Find the duality of the following LP problem.

Maximize (z) $= 8x_1 + 3x_2 + 4x_3$

Subject to, $x_1 + 3x_2 + 5x_3 \leq 69$

$2x_1 + 6x_3 \leq 77$

$x_i \geq 0$

(04 marks)

[Total: 28 marks]

02. The Royal Potary Company has order to be completed next month for three of its distribution out lets are given in the table below.

Distribution Out let	Orders(units)
D1	4,000
D2	2,400
D3	1,600

There are three warehouses available for the manufacturing operations, and all three can produce at the same production rate. However, the unit costs of these products vary

depending upon the machine used. The unit cost and transportation cost of distributing the items to warehouses are shown below.

(Rs. in '00)

From \ To	D1	D2	D3
W1	12	13	11
W2	14	13	15
W3	11	10	13

Furthermore, it is known the capacity for the next month for W2 and W3 is 3,000 units and for W1 is 2,000.

Considering the above transportation problem, answer the following questions;

i. Find an initial basic solution using Least Cost Method.

ii. Determine the optimal solution using any one of the two methods.

[Total: 18 marks]

03. The Road Development Authority (RDA) had decided, as a matter of top priority, to build a new road joining the two main cities of Kalmunai and Hambantota. Because of the need to complete the project as quickly as possible, the work has been divided in to four stages which are to be built simultaneously. There are five companies large enough to undertake the construction of any of the four stages and each company has been invited to submit a tender for each stage of the project. The tenders (in million rupees) are shown below.

		Stage			
		1	2	3	4
Company	A	84	63	82	68
	B	92	62	no bid	67
	C	86	67	78	no bid
	D	86	62	76	70
	E	94	66	83	72

Determine the optimal assignment which would give the minimum total cost of the project.

[16 marks]

04. **(a)** What is meant by PERT/CPM in network analysis.

(03 marks)

(b) The Project manager of a company has analyzed a project, and the activities have been listed below along with their durations and immediate predecessors.

Activity	Immediate Predecessors	Duration days
A	-	13
B	A	2
C	A	6
D	B	20
E	B	4
F	C	3
G	E,F	4
H	F	3
I	D	5
J	D	10
K	C	5
L	G,I	2
M	G,I,J	3
N	H,K	12
O	L,M,N	2

i. Construct the project planning diagram for the above data.

ii. What are the critical path activities and the expected project completion time?

iii. The manager decides to make delay the activities J by 3 days, E by 15 days, and K by 10 days.

State the feasibility of these delays based on the total float.

iv. Find the probability of completing the project between 45 and 55 days. (Assume the variance is 3.95)

v. If the project manager does not complete this work before 54 days, a penalty would be imposed on him. Find the probability that the manager has to pay the penalty.

(15 marks)

[Total: 18 marks]

05. The management of Alpha Company Ltd. has prepared the following payoffs of the following three decision alternatives in relation with their products.

Product	Nature of Demand		
	Good (Rs.'000)	Moderate (Rs.'000)	Poor(Rs.'000)
A	360	200	100
B	600	300	200
C	400	100	-150

You have been given the following further information;

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

  P (good) =0.50

  P (Moderate) = 0.30 and

  P (poor) = 0.20

- The firm feels a fairly optimistic and assign a value to $\alpha = 0.7$

Find the best alternative decision based on the following criteria.

i. Expected Monetary Value
ii. Expected Opportunity Loss
iii. Maximin Criterion
iv. Minimax Criterion
v. Criterion of Realism **(10 marks)**

06. Customers arrive at one payment counter in a private bank according to Poisson probability distribution with an average rate of 10 customers per hour. The service time at the counter follows exponential distribution, having an average of 4 minutes per customer. (Assume one employee is employed in a single channel system).

i. Find the probability that the counter is idle.

ii. The manager is planning to employ another employee to serve in the same counter believing to reduce the excess waiting time of the customers but there will be an additional cost for the employee 300/= per hour. Show how the average waiting time in the queue and the queuing system is reduced.

iii. Briefly explain the queuing discipline in Queuing Theory. **(10 marks)**

[Total:20 marks]

Formula:

$$P(\text{x arrivals}) = \frac{e^{-\lambda}\,\lambda^{x}}{X!}$$

$$P(T \leq t) = 1 - e^{-\mu t}$$

$$L = \frac{\lambda}{\mu - \lambda}$$

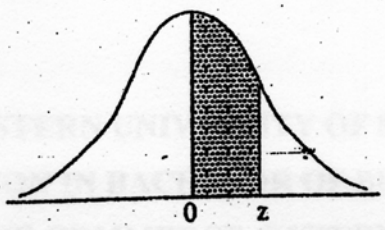
$$Lq = \frac{\lambda^{2}}{\mu(\mu - \lambda)}$$

$$P_0 = 1 - \lambda / \mu$$

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