

SOUTH EASTERN UNIVERSITY OF SRI LANKA
FINAL EXAMINATION IN BACHELOR OF SCIENCE (MANAGEMENT AND
INFORMATION TECHNOLOGY) 2010/2011
SEMESTER-I, JULY/AUGUST, 2012

MIT 31013 QUANTITATIVE TECHNIQUES FOR MANAGEMENT

Answer all questions.
Calculator is allowed.

Time: Three Hours

01. (a) Acute Lanka Company makes two different types of glove: Type A and Type B. The company currently has orders for more gloves than it can produce in time for the upcoming season. Acute Lanka Company has available 450 hours in the cutting and sewing department, 350 hours in the finishing department, and 50 hours in the packaging department.

The production time requirements and the profit per box of one dozen are given below.

Type of glove	Production Time (hours/box)			Profit/box
	Cutting & sewing	Finishing	Packaging	
A	3	4	0.5	\$ 30
B	4	2	0.5	\$ 25

Also there is an agreement with the union that the maximum capacity of the production of gloves should be restricted to 200 units.

Solve this LP problem graphically in order to determine the combination of orders and the maximum profit to the company

(14 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.

$$\text{Maximize } Z = 4x_1 + 5x_2 + 9x_3 + 11x_4$$

$$\text{Subject to: } x_1 + x_2 + x_3 + x_4 \leq 150 \text{ (labour hours)}$$

$$7x_1 + 5x_2 + 3x_3 + 2x_4 < 120 \text{ (materials)}$$

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

$$\text{with } x_1, x_2, x_3, x_4 \geq 0$$

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

Cj	4	5	9	11	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
Z _j	4	5.25	9	12.94	0	0.19	0.88	114
C _j -Z _j								

- Convert the above L.P problem into standard form.
- Calculate the values for C_j-Z_j values.
- Is the solution is optimal? Why?
- Interpret the optimal solution and shadow prices.
- The firm is considering using an extra material in the manufacturing process. Is it profitable to the company? If it is so, find the optimal range for the increase.

(14 marks)

{Total: 28 marks}

02. A ladies fashion shop wishes to purchase the following quantities of summer dresses:

Dress size	I	II	III	IV
Quantity	100	200	450	150

Three manufacturers are willing to supply dresses. The quantities given below are the maximum they are able to supply of any given combination of orders for dresses:

Manufacturer	A	B	C
Total Quantity	200	450	250

The shop expects the cost per dress to vary with the manufacturer as given below:

		Size			
	Manu- facturer	I	II	III	IV
	A	25	40	50	70
	B	80	35	55	15
	C	60	75	95	25

You are required to:

- i. Solve the above transportation problem using North-West Corner Method.

(08 marks)

- ii. Show whether there is further improvement possible (Use Stepping Stone Method).

(10 marks)

{Total: 18 marks}

03. 'Gama Enterprises' uses an important raw material called R-1 in their production at four divisions. There are four suppliers that meet Gama's quality control standards. All of four of the suppliers can distribute R-1 in sufficient quantities to accommodate the needs of each division. The quantity of R-1 needed by each of Gama's divisions are as follows:

Division	Demand
D1	500
D2	300
D3	450
D4	400

The cost per kilogram (Rs.) for shipping and distributing from each supplier to each division is provided in the following table.

Divisions	Suppliers			
	S1	S2	S3	S4
D1	5.30	3.50	4.10	2.75
D2	2.80	1.20	6.40	1.00
D3	4.70	3.60	6.30	5.60
D4	3.40	2.80	4.00	3.60

Gama believes in spreading its business among suppliers so that the company will be less affected by supplier problems (labour strike or resource unavailability). Company's policy requires that each division have a separate supplier.

Required:

- For each supplier-division combination, compute the total cost of supplying the division's demand.
- Determine the optimal of supplier to divisions and the total cost.

{Total: 16 marks}

04. A company is considering the possibility of restructuring its business process from conservative method. Activities of the project with estimates of activity times are listed below by the change agent.

Activity	Predecessor activities	Time (weeks)	Associated cost (Rs *000)
A	-	03	15
B	-	06	06
C	F,D	08	21
D	B	10	28
E	-	07	24
F	A	09	18
G	E	06	18
H	G	06	30
I	G	12	08
J	C,H	05	10
K	I,J	08	32
L	K	03	14

An overall supervision cost associated with the project is estimated at Rs. 5000 per week.

You are required to:

- Find the critical path and total completion time of this project.
- State the feasible delays of the activities E, F and K.
- Find the probability that the project will be finished between 38 and 42 weeks. (Assume the standard deviation is 3.6)
- The Change Agent will be rewarded if he will be able to complete the project before 44 weeks. Find the probability that he would be rewarded.
- Find the total cost of the project.

{Total: 18 marks}

05. (a) "Co-op city" is a self-service grocery with one checkout counter. Shoppers arrive at the shop at an average rate of 15 customers per hour. The average the customers fill their shopping basket and join the queue at the checkout counter and the service at the checkout counter takes an average 3 minutes per customer. The grocery management does not like to overcrowd within the shop and the waiting time at the queue to exceed 5 minutes.

- i. Calculate the average waiting time of a customer in the queue and state whether this organization's goal has been achieved.
- ii. The management contemplates adding a helper to the checkout counter for reducing the service time at the counter to 2 minutes. Whether the opening of another counter is to be recommended rather than using a person as a helper.

(10 marks)

(b) Dheema Company Ltd. has prepared the following payoffs of the following three decision alternatives in relation with their products.

Decision alternatives	States of nature	
	High Demand (Rs.'000)	Low Demand (Rs.'000)
To produce Model A	800	600
To produce Model B	500	600
To produce Model C	300	-100

You have been given the following further information:

- Probabilities for the states of nature are estimated by the management as follows:
 P (High demand) 0.60
 P (Low demand) 0.40
- The firm feels a fairly optimistic and assign a value to α 0.7

Find the best alternative decision based on the following criteria.

- i. Expected Monetary Value
- ii. Expected Opportunity Loss
- iii. Maximax Criterion
- iv. Minimax Criterion
- v. Criterion of Realism

(10 marks)

{Total: 20 marks}

State of Nature	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Formulae:

$$L = \lambda(\mu - \lambda)$$

$$W = \frac{L}{\lambda}$$

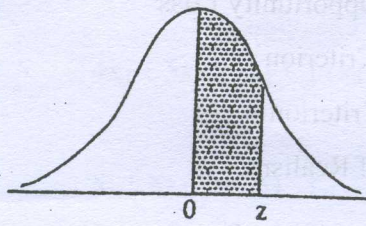
$$Lq = \frac{\lambda^2}{\mu(\mu - \lambda)}$$

$$Wq = \frac{Lq}{\lambda}$$

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