

SOUTH EASTERN UNIVERSITY OF SRI LANKA

THIRD EXAMINATION IN BACHELOR OF SICENCE IN INFORMATION TECHNOLOGY FOR MANAGEMENT STUDIES – 2009 / 2010 SEMESTER – I, AUGUST 2011

12

ITMS 3113 QUANTITATIVE TECHNIQUES FOR MANAGEMENT

Answer all questions

Time: 03 hours

Q 01. (a) Alpha Accessories company must determine the production quantities for next month for three different models computers x,y and z. Data per unit are given in the following table.

Model	Profit(Rs)	Sub-assembly Time (hrs)	Final Assembly time (hrs)	Quantity Inspection (hrs)
X	6000	1.5	1.0	0.5
Y	7500	2.0	2.5	1.0
Z	8200	1.8	0.9	0

The maximum time available for these resources are

Sub-assembly time	–	2400
Final-assembly time	–	3000
Quantity inspection	–	1800

Orders outstanding require that at least 200 units of X and 150 units of Y be produced.

Formulate a linear programming model for this problem.

(08 marks)

(b) A large scale micro soft company is reviewing its requirements for expanding the business all over the world. For this purpose the company wishes to recruit "Qualified IT Professionals" to the company to provide high quality service at lower cost.

Meanwhile, the company has signed a MOU (Memorandum Of Understanding) with a recognized university to recruit some "IT Students" as trainees every year.

Experience has shown that at least 100 qualified IT professionals are required. On the average of qualified IT professional costs the company Rs. 720,000 a year, a student trainee Rs. 180,000 a year (inclusive of salary food, accommodation etc). The number of student trainees can not exceed 60 and for successful working practices the

number of student trainees should not exceed the number of qualified IT professionals. It is also required that at least 40 student trainees should be under training. According to the current job market a maximum of 140 qualified IT professionals could be recruited.

Formulate a linear programming model and recommend the optimum combinations of recruitment in qualified IT professionals and IT student trainees.

(12 marks)

(c) A linear programming model for a certain problem is shown as follows;

$$\begin{aligned} \text{Maximize} \quad & 60A + 120B + 180C \\ \text{Subject to,} \quad & 7.5A + 5B + 3C \leq 1500 \\ & 3A + 0.3B + 5C \leq 8500 \\ & 4A + 0.3B + 1.1C \leq 7500 \\ & 0.25B + 2C \leq 4000 \end{aligned}$$

Non negativity $A, B, C \geq 0$

- i. Find the dual of the above primal problem
- ii. Convert this primal problem into standard form.

(08 marks)

(Total 28 marks)

Q 02. ABC Company has production operations in Colombo, Kandy Polonnaruwa and Supply Poultry feed for four distribution centres as shown below;

<u>Plant (Origin)</u>	<u>Production Capacity(Unit)</u>
Colombo	5,000
Kandy	6,000
Polonnaruwa	2,500

<u>Distribution Center (Destination)</u>	<u>Demand (units)</u>
Galle	6000
Gampaha	4000
Hambantota	2000
Kegalle	1500

The unit transportation cost from plant to each destination is given below;

	Galle	Gampaha	Hambantota	Kegalle
Colombo	3	2	7	10
Kandy	7	5	13	2
Polannaruwa	15	10	2	12

The management wants to determine how much of its production should be transported from each plant to reach distribution centre.

- i. Find the initial basic solution using Least Cost Method, and
(08 marks)
 - ii. Optimum solutions using MODI method.
(10 marks)
- (Total 18 marks)**

Q 03. 'Cyber world' is an IT based company specializing in BPO (Business process Outsourcing) wishes to recruit 5 personnel for the special tasks which are vacant in that company. The five personnel have been undergone a comprehensive training program, and they were assessed as to their suitability for various specialist tasks and the marks they obtained in the training program are given in the following table.

Specialist task	Trainee no:				
	1	2	3	4	5
System operator	82	20	82	60	60
System analyst	90	33	48	24	60
Web designer	76	64	68	60	76
Graphic designer	94	84	88	90	75

Based on the marks awarded what role should each of the trainees be given in the company?
(Total 14 marks)

04. "Sun Software Company" has planned to create a 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- Performance requirement	-	4	800
B – Collect information	-	20	4000
C – Analyse information	B	8	1600
D – Define performance requirement	A	10	2000
E – Design logical	C,D	13	2600
F – Design database	C,D	18	3600
G – Build code	E	12	2400
H – Test the system	G,J	10	2000
I – Purchase hardware components	F	12	2400
J – Assemble hardware	E,I	10	2000
K – Integrate hardware and software	H	6	1200
L- Release soft- ware	K	1	1000

An overall supervision cost associated with the project is estimated at Rs. 300/- per day. You are required to;

- Construct a project network for the above activities.
- Find the critical path and total completion time.
- Find the total float for the activities D, G, and J
- Find the probability that the project will be finished between 80 and 90 days.
(Assume standard deviation is 3.0)
- The project manager will be rewarded if he/she finish this project before 80 days.
Find the probability that the project manager will be rewarded.
- Find the total cost of this project.

(Total 20 marks)

- Q 05. a. "Ruba Internet Cafe" providing services to its customer with one checkout counter. Customers arrive at the shop at an average rate of 15 customers per hour. The service at the checkout counter takes an average 3 minutes per customer.

- i. Compute the following
- Probability that the system is busy.
 - The average number of customers in the system.
 - The average time a customer spends in the queue.

(06 marks)

- ii. The management of 'Ruba Internet Cafe' does not like to have overcrowding within the shop and the waiting time at the queue to exceed 5 minutes. So they decided to add another machine at the checkout counter for reducing the service time at the counter to 2 minutes.

Make relevant computation to show how the waiting time in the queue would be reduced.

(04 marks)

- b. The management of 'Gama company' has prepared the following payoffs of the following three decision alternatives of its product.

Pay off table (Rs. in Millions)

Decision Alternatives	States of nature		
	Low Demand	Moderate Demand	High Demand
Small facility	10	10	10
Medium facility	7	12	12
Large Facility	(4)	2	16
Probability	0.1	0.6	0.3

- i. What is the best decision alternatives under following criteria?

- Expected Monetary Value
- Expected Opportunity Loss

(04 marks)

- ii. Assuming that nothing is known about the demand probabilities, determine the best decision alternative based on the following criteria. (Assume the firm feels fairly optimistic and assign a value to alpha $\alpha = 0.6$.)

- Maximin criterion
- Minimax Criterion
- Criterion of realism

(06 marks)

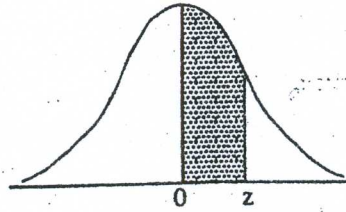
(Total 20 marks)



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	0.3390
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	0.4987
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990