

29 APR 2015

**EASTERN UNIVERSITY SRI LANKA**  
**FACULTY OF COMMERCE AND MANAGEMENT**

**FOURTH YEAR, SECOND SEMESTER EXAMINATION IN**  
**BACHELOR OF COMMERCE 2011/2012 (March/April 2015) – SPECIAL REPEAT**

**COC 4073 OPERATIONS RESEARCH**

Answer All Questions

Time: 03 Hours

Calculator permitted. Use the table attached.

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- i) Show graphically the following linear programming model has infeasible solution.

$$\begin{array}{ll} \text{Maximize} & Z = 3X_1 + 4X_2 \\ \text{Subject to} & 2X_1 + X_2 \leq 10 \\ & X_1 + 4X_2 \leq 36 \\ & X_1 + 2X_2 \leq 10 \\ & X_1 \geq 5 \\ & X_2 \geq 7 \end{array}$$

(07 Marks)

- ii) a. You are given the following linear programming model and required to determine its optimal solution by simplex method.

$$\begin{array}{ll} \text{Maximize} & Z = 10X_1 + 15X_2 + 20X_3 \\ \text{Subject to} & 2X_1 + 4X_2 + 6X_3 \leq 24 \\ & 3X_1 + 9X_2 + 6X_3 \leq 30 \\ & X_1, X_2, X_3 \geq 0 \end{array}$$

- b. Write the dual model for the above primal problem.

(18 Marks)

(Total 25 Marks)

- i) Distinguish between assignment and transportation problems.

(04 Marks)

- ii) A company is faced the problem of assigning 4 machines to 6 different jobs (one machine to one job only). The profits (in Rs.) are estimated as follows.

Job	Machine			
	A	B	C	D
J1	30	60	30	60
J2	70	10	40	40
J3	30	80	50	80
J4	60	40	30	70
J5	50	20	40	30
J6	50	70	60	40

- a. Determine the optimal assignment pattern that will maximize the total profit.  
 b. Formulate this problem as a linear programming model.

(16 Marks)

(Total 20 Marks)

03. Rajah Limited has five destinations (D1, D2, D3, D4, D5) to receive the goods from four distribution centers (S1, S2, S3, S4). The estimated transportation cost per unit (in rupees) from each supplying center to destinations and the quantity supplied and demanded are:

Center	Destination					Supply
	D1	D2	D3	D4	D5	
S1	5	7	1	1	2	100
S2	4	8	2	1	2	100
S3	5	7	5	4	4	200
S4	6	7	2	3	6	200
Demand	50	150	150	150	50	

You are required to find minimum cost of transportation by using least cost based initial allocation and MODI method for optimality testing.

(20 Marks)

04. A construction company is preparing a PERT Network for laying the foundation of a new art museum. Consider the following set of activities, their Predecessor requirement and three time estimates of completion time.

Activity	Predecessor	Time Estimates (Weeks)		
		Optimistic	Most likely	Pessimistic
A	-	2	3	4
B	-	8	8	8
C	A	7	9	11
D	B	6	6	6
E	C	9	10	11
F	C	10	14	18
G	C, D	11	11	11
H	F, G	6	10	14
I	E	4	5	6
J	I	3	4	5
K	H	1	1	1

- a) Draw the PERT Network
- b) Compute the slack for each activity and determine the critical path.
- c) The contract specifies a Rs. 500 per week penalty for each week the completion of the project extends beyond 37 weeks. What is the probability that this company will have to pay a maximum penalty of Rs. 15,000?

(20 Marks)

05 i) Briefly explain:

- a) Necessity of maintaining inventory
- b) Components of inventory costs

(05 Marks)

ii) The purchase manager of an organization has collected the following information regarding the product X:

Annual demand	10,000 units
Cost per item	Rs.20
Interest on the locked-up capital	15%
Order processing cost for each order	Rs.150
Inspection cost per lot	Rs.500
Follow up cost for each order	Rs.100
Pilferage while holding inventory	5%
Other holding cost	15%
Other procurement cost for each order	Rs.250
Discount for a minimum order quantity of 2,000 items	5%

What should be the ordering policy of the purchase manager?

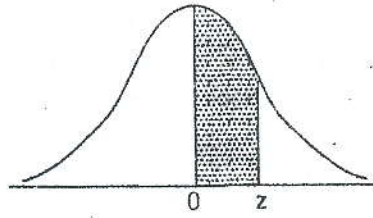
(10 Marks)

(Total 15 Marks)

TABLE

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	0.3828
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	0.4440
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4544
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	0.4915
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