EASTERN UNIVERSITY SRI LANKA
FACULTY OF COMMERCE AND MANAGEMENT

FOURTH YEAR, SECOND SEMESTER EXAMINATION IN
BACHELOR OF COMMERCE 2011/2012 (July 2014)

COC 4073 OPERATIONS RESEARCH

Answer All Questions   **Time: 03 Hours**

Calculator permitted. Use the table attached.

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

$$\text{Maximize} \quad Z = 3X_1 + 4X_2$$
$$\text{Subject to} \quad 2X_1 + X_2 \leq 10$$
$$X_1 + 4X_2 \leq 36$$
$$X_1 + 2X_2 \leq 10$$
$$X_1 \geq 5$$
$$X_2 \geq 7$$

(07 Marks)

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

$$\text{Minimize} \quad Z = 4X_1 + X_2$$
$$\text{Subject to} \quad 3X_1 + X_2 = 2$$
$$4X_1 + 3X_2 \geq 6$$
$$X_1 + 2X_2 \leq 3$$
$$X_1, X_2 \geq 0$$

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

(18 Marks)

(Total 25 Marks)

02. i) Distinguish between assignment and transportation problems.

(04 Marks)

ii) A taxi company has six taxicabs at different locations and five customers who have called for service. The distance (in km) from each taxi's present location to each customer is shown in the following table.

Cab	Customer				
	1	2	3	4	5
A	7	2	4	10	7
B	5	1	5	6	6
C	8	7	6	5	5
D	2	5	2	4	5
E	3	3	5	8	4
F	6	2	4	3	4

a. Determine the optimal assignment pattern that will minimize the total distance travelled.
b. Provide the alternative assignment pattern, if possible, to maintain the same result you have in (a) above
c. Formulate this problem as a linear programming model.

(16 Marks)

(Total 20 Marks)

03. A company has three plants in which it produces a standard product. It has fou agencies in different parts of the country where this product is sold. The productio cost varies from factory to factory and the selling price from market to market. Th shipping cost per unit of the product from each market to each of the agencies i known and stable. The relevant data are given in the following tables.

Plant	Weekly production capacity (Units)	Unit production cost (Rs.)
1	400	18
2	300	24
3	800	20

Agency	Demand (Units)	Unit selling price (Rs.)
1	300	32
2	400	35
3	300	31
4	500	36

Unit shipping cost (in Rs.):

Plant	Agency			
	1	2	3	4
1	2	5	7	3
2	8	4	6	2
3	3	4	4	5

You are required to
   a. Produce the unit profit matrix table.
   b. Determine the optimal transportation plan so as to maximize the profit.

(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 consumption	12,000 units (360 days)
Cost per unit	Rs.11
Ordering cost	Rs. 12 per order
Inventory carrying charges	24%
Normal lead time	15 days
Safety stock	30 day's consumption

You are required to find out:
- a. How much should be ordered each time.
- b. When should the order be placed.
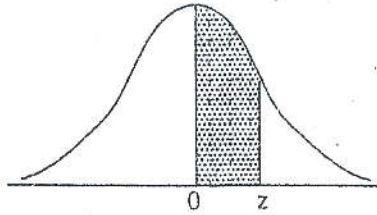- c. The inventory level (ideally) immediately before the material order is received.

(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	0.3830
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