Seventh Semester B.E. Degree Examination, June/July 2015
Operations Research

Time: 3 hrs.   Max. Marks:100

Note: 1. *Answer any FIVE full questions, selecting atleast TWO questions from each part.*
2. *Use of statistical tables is permitted.*

PART - A

1 a. List and briefly explain the various phases of O.R. study and state the limitations of O.R. models. **(10 Marks)**

   b. The XYZ Company has been a producer of electronic circuits for Television sets and certain printed circuit boards for Radios. The company has decided to expand into full scale production and marketing of AM and AM - FM radios. It has built a new plant that can operate 48 hours per week. Production of an AM radio in the new plant will require 2 hours and production of AM. FM radio will require 3 hours. Each AM radio will contribute Rs 40 to profit, while an AM – FM radio will contribute Rs 80 to profits. The marketing department , after extensive research, has determined that a maximum of 15 AM radio, and 10AM – FM radios can be sold each week. Formulate a L.P. model to determine the optimal production mix of AM and AM -- FM radios that will maximize profits and solve the problem using Graphical method. **(10 Marks)**

2 a. Obtain the Dual problem of the following Primal problem

   Min $Z = 2x_1 - 5x_2 - 2x_3$

   Subject to $3x_1 - 1x_2 + 2x_3 \leq 9$

   $2x_1 - 4x_2 \geq 14$

   $-4x_1 + 3x_2 + 8x_3 = 12$

   $x_1, x_2 \geq 0$ and x_3 is unrestricted. **(04 Marks)**

   b. Use BIG – M method to solve the following LPP

   Min $Z = 2x_1 + x_2$

   Subject to $3x_1 + x_2 = 3$

   $4x_1 + 3x_2 \geq 6$

   $x_1 + 2x_2 \leq 3$

   $x_1, x_2 \geq 0$. **(16 Marks)**

3 a. The owner of a machine shop has four machines available to assign the jobs for the day. Five jobs are offered with the expected profit in ₹ for each machine on each job is as follows. Find the assignment of the machines to the jobs that will result in a maximum profit, which job to be declined. **(10 Marks)**

	A	B	C	D	E
1	62	78	50	101	82
2	71	84	61	73	59
3	87	92	111	71	81
4	48	64	87	77	80

   b. Solve the following Travelling, Salesman problem given by the following data $C_{12} = 20$, $C_{13} = 4$, $C_{14} = 10$, $C_{23} = 5$, $C_{34} = 6$, $C_{25} = 10$, $C_{35} = 6$, $C_{45} = 20$ when $C_{ij} = C_{ji}$ and C_{ij} value is not given, then there is no route between Cities i and j. **(10 Marks)**

4   a. List and briefly explain the methods of Integer programming problem. **(06 Marks)**

     b. Solve the following I.P.P.

Max. $Z = x_1 + x_2$

Subject to $3x_1 + 2x_2 \leq 12$

$$x_2 \leq 2$$

$x_1, x_2 \geq 0$ and integers. **(14 Marks)**

PART - B

5   a. A project consists of the following activities with their duration in days and the precedence relationship.

Activity	A	B	C	D	E	F	G	H	I
Precedence	-	A	A	B, C	A	D, E	C	F, G	H
Duration (days)	10	12	5	7	9	10	8	10	9

      i) Draw the network for the above information   ii) Identify the critical path and duration   iii) Calculate EST, EFT, LST, LFT, TF. **(10 Marks)**

     b. A project schedule has the following characteristics :

Activity	1-2	2-3	2-4	3-5	4-5	4-6	5-7	6-7	7-8	7-9	8-10	9-10
t_m	2	2	3	4	3	5	5	7	4	6	2	5
t_o	1	1	1	3	2	3	4	6	2	4	1	3
t_p	3	3	5	5	4	7	6	8	6	8	3	7

      i) Draw a project work, identify the critical path and its expected duration and variance.

      ii) What is the probability of completing the project in 30 day schedule time?

      iii) What due data has 90% chance of being met? **(10 Marks)**

6   a. Briefly explain characteristics of the Queuing system and classification of queuing models using KENDAL and LEE notations. **(10 Marks)**

     b. Arrivals at a Telephone booth are considered to be Poisson distribution at an average time of 8min between one arrival and the next. The length of the phone call is distributed exponentially with a mean of 4min. Determine

      i) Expected fraction of the day that the phone will be in use   ii) Expected number of units in the queue   iii) What is the probability that an arrival will have to wait more than 6min in queue for service?   iv) What is the probability that more than 5 units are in the system? **(10 Marks)**

7   a. Define and briefly explain the following terms with respect to GAME theory.

      i) PURE STRATEGY   ii) SADDLE POINT   iii) VALUE OF GAME   iv) TWO PERSON ZERO SUM GAME   v) PAY - OFF. **(10 Marks)**

     b. Solve the following TWO PERSON ZERO SUM GAME by Graphical Method. **(10 Marks)**

		B				
		I	II	III	IV	V
A	1	-5	5	0	-1	8
	2	8	-4	-1	6	-5

8 a. When passing is not allowed, solve the following problem giving an optimal solution.

Machine **(10 Marks)**

		M_1	M_2	M_3	M_4	M_5
	A	9	7	4	5	11
JOB	B	8	8	6	7	12
	C	7	6	7	8	10
	D	10	5	5	4	8

b. Find the sequence that minimized the total time required in performing the job on 3 machines in the order CBA.

Machine **(10 Marks)**

JOB	A	B	C
1	8	3	8
2	7	4	3
3	6	5	7
4	9	2	2
5	10	1	5
6	9	6	1

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