Seventh Semester B.E. Degree Examination, Dec.2015/Jan.2016

Operations Research

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1 a. Briefly explain the four different types of OR models. **(08 Marks)**

  b. XYZ company manufactures two types of leather belts 'A' and 'B'. Both belts require the same length of leather belt and both belts are different kinds of buckles. The supply of leather is sufficient to make 800 belts per day (both types included). The number of buckles available for A and B type are 300/day and 650/day respectively. Each belt of type A requires twice as much time as required by a belt type B, to manufacture. The speed of production is such that in the absence of any constraint, with regard to buckles and leather, the company would able to produce 1000 belts of type B per day if only belt B is manufactured. The profit margin for belt A is ₹ 0.4/belt and for belt B is ₹ 0.3/belt. Set up the LP problem and solve the same graphically. **(12 Marks)**

2 a. Write the dual of the LP problem.

$$\text{Max } Z = 3x_1 + 4x_2 - 6x_3$$

Subject to $2x_1 + 5x_2 - x_3 \le 4$

$$6x_1 + 3x_2 + 2x_3 \le 7$$

$$2x_1 - 4x_2 + 5x_3 \le -5$$

$$x_1, x_2, x_3 \ge 0 \qquad \textbf{(04Marks)}$$

  b. Solve the following LP problem by Big – M method

Minimize $Z = 5x_1 + 3x_2$

Subject to $2x_1 + 4x_2 \le 12$

$$2x_1 + 2x_2 = 10$$

$$5x_1 + 2x_2 \ge 10$$

$$x_1, x_2 \ge 0 \qquad \textbf{(16Marks)}$$

3 a. Find the initial feasible solution to the following transportation problem by least cost method

Destination

Origin		P	Q	R	Supply
	A	5	7	8	70
	B	4	4	6	30
	C	6	7	7	50
	Demand	65	42	43	150

(08 Marks)

b. Find the initial feasible solution and then optimize by MODI method. **(12 Marks)**

	I	II	III	IV	V	
A	12	4	9	5	9	55
B	8	1	6	6	7	45
C	1	12	4	7	7	30
D	10	15	6	9	1	50
	40	20	50	30	40	

4 a. Write the difference between transportation & Assignment problems. **(04 Marks)**

b. Four new machines M_1, M_2, M_3 and M_4 are to be installed in the machine shop. There are 5 vacant palaces A, B, C, D and E available. The cost of locating machines to vacant places is shown below. Find the optimum assignment schedule. **(08 Marks)**

	A	B	C	D	E
M_1	9	11	15	10	11
M_2	12	9	∞	10	9
M_3	∞	11	14	11	7
M_4	14	8	12	7	8

c. Solve the following travelling salesman job **(08 Marks)**

		A	B	C	D	E
	A	∞	4	10	14	2
	B	12	∞	6	10	4
From City	C	16	14	∞	8	14
	D	24	8	12	∞	10
	E	2	6	4	16	∞

PART – B

5 a. Find the sequence for the following eight jobs, that minimizes the total elapsed time for completion of all jobs, each job being processed in the order CAB. Find the total elapsed time and idle time of each machine. **(10 Marks)**

Jobs	1	2	3	4	5	6	7	8
A	4	6	7	4	5	3	6	2
B	8	10	7	8	11	8	9	13
C	5	6	2	3	4	9	15	11

Machines

The entries give the time in hours on the machines.

b. Use the graphical method to minimize the time needed to process the following jobs on the machine shown, that is for each machine find the job which should be done first. Also calculate the total elapsed time. **(10 Marks)**

Job 1	Sequence of M/c	A	B	C	D	E
	Time	3	4	2	6	2
Job 2	Sequence of M/c	B	C	A	D	E
	Time	5	4	3	2	6

6 a. Define : i) pay off matrix   ii) Saddle point   iii) Two person zero sum game   **(06 Marks)**
   b. Slate the assumptions of Johnson's algorithm.   **(04 Marks)**
   c. Solve the game by graphical method.   **(10 Marks)**

	1	2	3	4	5
1	3	0	6	-1	7
2	-1	5	-2	2	1

7 a. Telephone users arrive at a booth following a Poisson distribution with an average time of 5 minutes between one arrival and the next. The time taken for a telephone call is on an average 3 minute and it follows an exponential distribution. What is the probability that the booth is busy? How many more booths should be established to reduce the waiting time to less than or equal to half of the present waiting time?   **(08 Marks)**
   b. A barber shop has two barbers and three chairs for customers. Assume that the customers arrive in Poisson fashion at a rate of 5 per hour and that each barber services customers according to an exponential distribution with mean 15 minutes. Further if a customer arrives and there are no empty chairs in the shop, he will leave. What is the expected number of customers in the shop?   **(12 Marks)**

8 a. Write the differences between PERT and CPM.   **(06 Marks)**
   b. A small maintenance project consists of the following jobs whose precedence relationship is given below.

Job	1 – 2	1 – 3	2 – 3	2 – 5	3 – 4	3 – 6	4 – 5	4 – 6	5 – 6	6 – 7
Duration (Days)	15	15	3	5	8	12	1	14	3	14

   i) Draw the network model.
   ii) Find the total float for each activity.
   iii) Find the critical path and total project duration.   **(14 Marks)**

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