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Seventh Semester B.E. Degree Examination, Dec.2014/Jan.2015

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. Define operations research. Explain the phases of operations research. **(06 Marks)**
 b. A firm manufactures two products A and B on which the profit earned per unit are ` 3 and ` 4 respectively. Each product is processed on two machines M_1 and M_2 . Product A requires one minute of processing time on M_1 and two minutes on M_2 while B requires one minute on M_1 and one minute on M_2 . Machine M_1 is available for not more than 7 hrs. 30 mins while machine M_2 is available for 10 hrs during any working day. Find the number of units of product A and B to be manufactured to get maximum profit. **(14 Marks)**
- 2 a. Solve the following LPP using simplex method:
 Maximize $Z = 3x_1 + 2x_2$
 Subject to constraints $x_1 + x_2 \leq 4$
 $x_1 - x_2 \leq 2$
 $x_1, x_2 \geq 0$ **(10 Marks)**
- b. Solve the given problem by using Big-M method:
 Maximize $Z = -2x_1 - x_2$
 Subject to constraints $3x_1 + x_2 = 3$
 $4x_1 + 3x_2 \geq 6$
 $x_1 + 2x_2 \leq 4$ and
 $x_1, x_2 \geq 0$. **(10 Marks)**
- 3 a. ABC limited has three production shops supplying a product to 5 warehouses. The cost of production varies from shop to shop, cost of transportation from shop to shop, cost of transportation from shop to warehouses also varies. Each shop has a specific production capacity of each warehouse has certain amount of requirement. The cost of transportation are as given below:

Shop	Warehouse					Capacity	Cost for production
	I	II	III	IV	V		
A	6	4	4	7	5	100	14
B	5	6	7	4	8	125	16
C	3	4	6	3	4	175	15
Requirement	60	80	85	105	70		

Find the optimum quantity to be supplied from each shop to different warehouse at minimum cost. **(12 Marks)**

- b. A ABC company has 5 tasks and 5 persons to perform. Determine the optimal assignment that minimizes the total cost.

Jobs	Machines				
	A	B	C	D	E
P	6	7	5	9	4
Q	7	5	10	9	6
R	5	4	3	6	5
S	8	3	5	6	4
T	4	7	5	6	6

(08 Marks)

- 4 a. Explain the importance of integer programming. (05 Marks)

- b. Solve the following linear programming by Gomory technique:

$$\text{Maximize } Z = x_1 + x_2$$

$$\text{Subject to } 2x_1 + x_2 \leq 6$$

$$4x_1 + 5x_2 \leq 20$$

$$x_1, x_2 \geq 0 \text{ and integers.}$$

(15 Marks)

PART - B

- 5 a. Define the following:

i) Normal time

ii) Crash time

iii) Free float

(06 Marks)

- b. R and D activity has 7 activities for which the three time estimates are given below along with its preceding activity.

Activity	Preceding activity	Optimistic time (a)	Most likely time (m)	Pessimistic time (b)
A	-	4	6	8
B	A	6	10	12
C	A	8	18	24
D	B	9	9	9
E	C	10	14	18
F	A	5	5	5
G	D, E, F	8	10	12

i) Draw PERT network.

ii) Find EST, LST and slack for each node.

iii) Find critical path and expected project duration.

(14 Marks)

- 6 a. Briefly explain queuing system and its characteristics. (06 Marks)

- b. Arrival rate of telephone call at a telephone booth are according to Poisson distribution, with an average time of 9 minutes between two consecutive arrivals. The length of telephone call is assumed to be exponentially distributed, with mean 3 minutes.

i) Determine the probability that a person arriving at the booth will have to wait.

ii) Find the average queue length.

iii) The telephone company will install a second booth when convinced that an arrival would expect to have to wait at least four minutes for the phone. Find the increase in flow rate of arrivals which will justify a second booth.

iv) What is the probability that he will have to wait for more than 10 minutes before the phone is free?

(14 Marks)

7 a. Explain clearly the following terms:

- i) Pay off matrix
- ii) Saddle point
- iii) Fair game

(06 Marks)

b. Use dominance rule to find the optimum strategies for both the player.

	B_1	B_2	B_3	B_4	B_5	B_6
A_1	4	2	0	2	1	1
A_2	4	3	1	3	2	2
A_3	4	3	7	-5	1	2
A_4	4	3	4	-1	2	2
A_5	4	3	3	-2	2	2

(07 Marks)

c. Solve the game by graphical method:

	b_1	b_2
a_1	1	-3
a_2	3	5
a_3	-1	6
a_4	4	1

(07 Marks)

8 a. Define: (i) Total elapsed time, (ii) Idle time.

(04 Marks)

b. List the assumption made while dealing with sequencing problem.

(04 Marks)

c. We have five jobs each of which must go through the machines A, B and C in the order ABC. Determine a sequence for job that will minimize the total elapsed time and idle time for each machine.

Job number	Processing time in hours				
	1	2	3	4	5
Machine A	5	7	6	9	5
Machine B	2	1	4	5	3
Machine C	3	7	5	6	7

(12 Marks)
