Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
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. What are the phases of OR? **(05 Marks)**
    b. ABC company produces two products A and B. The profit contribution of each product has been estimated as Rs.20 for product A and Rs.24 for product B. Each product passes through three departments of the plant. The time required for each product and total time available in each department are as follows:

Department	Hours required		Available hours during the month
	Product A	Product B	
1	2	3	1500
2	3	2	1500
3	1	1	600

The company has a contract to supply at least 250 units of product B per month. Formulate the problem as a linear programming model and solve by graphical method. **(15 Marks)**

2   Use two-phase simplex method to
    Maximize $Z = 3x_1 + 2x_2 + 2x_3$
    Subject to $5z_1 + 7x_2 + 4x_3 \le 7$
    $-4x_1 + 7x_2 + 5x_3 \ge -2$
    $3x_1 + 4x_2 - 6x_3 \ge \dfrac{29}{7}$

    $x_1, x_2, x_3 \ge 0.$ **(20 Marks)**

3   a. National oil company has 3 refineries and four depots. Transportation costs per ton, capacities and requirements are given below. **(12 Marks)**

	D_1	D_2	D_3	D_4	Capacity (Tons)
R_1	5	7	3	10	700
R_2	8	6	14	13	400
R_3	12	10	9	11	800
Requirements (Tons)	200	600	700	400	

Determine optimum allocation of output.

    b. Suggest optimum assignment of 4 workers to 4 jobs. **(08 Marks)**

Jobs

	I	II	III	IV
A	8	10	12	16
B	11	11	15	8
C	9	6	5	14
D	15	14	9	7

Workers

4   Solve the following mixed integer problem by the branch and bound technique:
    Maximize $Z = x_1 + x_2$
    Subject to $2x_1 + 5x_2 \le 16$
    $6x_1 + 5x_2 \le 30$
    $x_1 \ge 0, x_2 \ge 0$ and integer. **(20 Marks)**

PART – B

5   a.   Define the following: i) Burst event; ii) Merge event; iii) Dummy activity.   **(06 Marks)**
    b.   A project has the following time schedule:

Activity	1- 2	1-3	1-4	2-5	3-6	3-7	4-6	5-8	6-9	7-8	8-9
Time in months	2	2	1	4	8	5	3	1	5	4	3

Draw network and compute: i) Critical path and duration; ii) Total float (slack).   **(14 Marks)**

6   a.   Define the following: i) Balking;   ii) Reneging;   iii) Jockeying.   **(06 Marks)**
    b.   A branch of ABC bank has only one typist. Since the typing work varies in length. The typing rate is randomly distributed approximating a poisson distribution with mean service rate of 8 letters per hour. The letters arrive at a rate of 5/hr. During the entire 8-hour workday. If the type writer is valued at Rs.1.50 per hour. Determine:
    i)   Equipment utilization.
    ii) The percent time that an arriving letter has to wait.
    iii) Average system time.
    iv) Average cost due to waiting on the part of type writer that is it remaining idle.
      (08 Marks)
    c.   Goods trucks arrive randomly at a stock yard with a mean of 8 trucks/hr. A crew of 4 operatives can unload a truck in 6 minutes. Trucks waiting in a queue to be unloaded are paid a waiting charge at the rate of Rs.60 per hour. Operatives are paid a wage rate of Rs.20 per hour. It is possible to augment the crew strength to 2 or 3 (of four operatives per crew) when the unloading time will be 4 minutes or 3 minutes respectively per truck. Find the optimal crew size.   **(06 Marks)**

7   a.   Define the following: i) Pure strategy;   ii) Mixed strategy;   iii) Two person-zero sum game;
    iv) Pay-off matrix.   **(08 Marks)**
    b.   Solve the following game by dominance principle:

Player B

$$\begin{array}{c c} & \begin{array}{c c c c c} I & II & III & IV & V \end{array} \\ \text{Player A} \begin{array}{c} I \\ II \\ III \\ IV \end{array} & \begin{bmatrix} 3 & 5 & 4 & 9 & 6 \\ 5 & 6 & 3 & 7 & 8 \\ 8 & 7 & 9 & 8 & 7 \\ 4 & 2 & 8 & 5 & 3 \end{bmatrix} \end{array}$$

      (05 Marks)

    c.   Solve the following game graphically:

$$\begin{array}{c c} & \begin{array}{c c c} BI & BII & BIII \end{array} \\ A \begin{array}{c} I \\ II \end{array} & \begin{bmatrix} 1 & 3 & 11 \\ 8 & 5 & 2 \end{bmatrix} \end{array}$$

      (07 Marks)

8   a.   What are the assumptions made in sequencing problem?   **(06 Marks)**
    b.   There are five jobs, each of which is to be processed through three machines, A, B and C in the order ABC processing times in hours are

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

Determine the optimum sequence for the five jobs and the minimum elapsed time. Also find the idle time for the three machines.   **(14 Marks)**

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