

Paper ID [A0214]

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B.Tech. (Sem. 5th)**OPERATIONS RESEARCH (PE - 301)****Time : 03 Hours****Maximum Marks : 60****Instruction to Candidates:**

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A**Q1)****(10 × 2 = 20)**

- a) What do you mean by the canonical form of a linear programming problem?
- b) What are the limitations of LPP?
- c) State the necessary and sufficient condition for the existence of a feasible solution to a transportation problem.
- d) What do you mean by an unbalanced assignment problem?
- e) What are the advantages of duality?
- f) Differentiate between Jockeying and Reneging.
- g) Define Operations Research.
- h) List the advantages of simulation technique.
- i) Differentiate between float and slack.
- j) Define critical path.

Section - B

(4 × 5 = 20)

Q2) A small manufacturer employs 5 skilled men and 10 semi-skilled men for making a product in two qualities: a deluxe model and an ordinary model. The production of a deluxe model requires 2-hour work by a skilled man and 2-hour work by a semi-skilled man. The ordinary model requires 1-hour work by a skilled man and 3-hour work by a semi-skilled man. According to a worker union's rules, no man can work more than 8 hours per day. The profit of the deluxe model is Rs. 1,000 per unit and that of the ordinary model is Rs. 800 per unit. Formulate a linear programming model for this situation to determine the production volume of each model such that the total profit is maximized.

Q3) Solve the following LP problem graphically

$$\text{Maximize } z = 20x_1 + 10x_2$$

$$\text{Subject to } 10x_1 + 5x_2 \leq 50, 6x_1 + 10x_2 \leq 60, 4x_1 + 12x_2 \leq 48 \text{ and } x_1, x_2 \geq 0.$$

Q4) Solve the following LP problem using simplex method:

$$\text{Maximize } Z = 3x_1 + 2x_2 + 5x_3$$

$$\text{Subject to } x_1 + x_2 + x_3 \leq 9$$

$$2x_1 + 3x_2 + 5x_3 \leq 30$$

$$2x_1 - x_2 - x_3 \leq 8, x_1, x_2, x_3 \geq 0.$$

Q5) Solve the following LP problem using dual simplex method:

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

$$\text{Subject to } 2x_1 + x_2 \geq 2$$

$$-x_1 - x_2 \geq 1 \text{ and } x_1, x_2 \geq 0.$$

Q6) Find the initial basic feasible solution of the following transportation problem by Vogel's approximation method:

		Warehouses				
Factory	W1	W2	W3	W4	Capacity	
F1	10	30	50	10	7	
F2	70	30	40	60	9	
F3	40	8	70	20	18	
Requirement	5	8	7	14	34	

Section - C

(2 × 10 = 20)

- Q7) (a) A company has four machines on which to do the three jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following table:

Job/Machine	W	X	Y	Z
A	18	24	28	32
B	8	13	17	19
C	10	15	19	22

What are the job assignments which will minimize the total cost?

- (b) At a central warehouse, vehicles arrive at the rate of 18 per hour and the arrival rate follows Poisson distribution. The unloading time of the vehicles exponential distribution and the unloading rate is 6 vehicles per hour. There are 4 unloading crews. Find the following:
- Probability of having 0 and 3 customers in the system.
 - Find the average number of customers waiting in the queue and in the system.
 - Average waiting time of the customer in the queue and in the system.

- Q8) Two persons A and B work on a two stage assembly line. The distribution of activity times at their stages are the following:

Time in seconds	Time frequency for A	Time frequency for B
10	3	2
20	7	3
30	10	6
40	15	8
50	35	12
60	18	9
70	8	7
80	4	3

- Prepare a simulation operation line for 8 items
- Assuming B must wait until A completes the first item before starting work, will he have to wait to process any of the 8 items?

Random Numbers for A are 83, 70, 06, 12, 59, 46, 54, 04

Random Numbers for B are 51, 99, 84, 81, 15, 36, 12, 54.

Q9) A contractor identifies 12 tasks in a project with the following precedence restrictions and durations:

Task	Predecessors	Time period (days)
A	-	30
B	-	7
C	A	10
D	B,C	14
E	D	10
F	E	7
G	B,C	21
H	F,G	7
I	F,G	12
J	H,I	15
K	B	30
L	F,G,K	15

- Draw the PERT network for the above project.
- Determine the early and late start and finish times for all tasks.
- Identify the critical path
- What is the total and free slack of task K?

