

Paper Code:

Paper: **OPERATIONS RESEARCH**

Full Marks: 70

Time: 3 hours

Answer any five questions in which  
Q. NO. 1 is compulsory

The figures in the right-hand margin indicate marks.  
Candidates are required to give their answers  
in their own words as far as practicable.

### GROUP-A (Compulsory)

Each part of question carries 1 mark.

1 × 10 = 10

1. Choose the correct answer:

(i) The costs involve the rent of storage space or depreciation and interest even if the own space is used, known as:

- (a) Handling cost (b) ☒ Storage costs  
(c) Handling Record-keeping cost (d) None of these

(ii) The raw materials which are kept in stock for using in the production of goods is called

- (a) ☒ Raw material inventory (b) Finished goods inventory  
(c) Work-in-process inventory (d) None of these.

(iii) A project scheduling problem

- (a) cannot be formulated as a linear programming problem  
(b) ☒ can be formulated as a linear programming  
(c) Updating of the project is not possible  
(d) None of these

(2v) In time-cost trade-off analysis

- ☒ (a) cost decreases linearly as time increases.
- ☐ (b) cost increases linearly as time increases
- ☐ (c) cost at normal time is zero
- ☐ (d) None of the above

(V) In cutting plane algorithm, each cut involves the introduction of

- ☐ (a) an equality constraints
- ☒ (b) less than or equal to constraints.
- ☐ (c) greater than or equal to constraints.
- ☐ (d) an artificial variable.

(vi) Branch and Bound method divides the feasible solution space into smaller parts by

- ☐ (a) enumerating
- ☒ (b) branching
- ☐ (c) bounding
- ☐ (d) all of the above.

(vii) The pay-off value for which each player in a game always selects the same strategy is called the -

- ☐ (a) equilibrium point
- ☐ (b) saddle point
- ☒ (c) both (a) & (b)
- ☐ (d) none of these.

(viii) A mixed strategy game can be solved by

- ☐ (a) matrix method
- ☐ (b) algebraic method
- ☐ (c) graphical method
- ☒ (d) all of the above

(ix) The size of the pay-off matrix of a game can be reduced by using the principle of

- ☒ (a) dominance
- ☐ (b) rotation reduction
- ☐ (c) game inversion
- ☐ (d) game transpose

(x) A linear programming problem in which all or some of the decision variables are constrained to assume non-negative integer values is called

- ☒ (a) Integer Programming Problem
- ☐ (b) mixed integer programming problem
- ☐ (c) both (a) and (b)
- ☐ (d) None of these

Group-B

Answer any four questions

Each question carries 15 marks.

15 × 4 = 60

2 (a) Discuss deterministic inventory model without lead time. [10]

(b) A contractor has to supply 10,000 bearings per day to an automobile manufacturer. He finds that, when he starts production run, he can produce 25,000 bearings per day. The cost of holding a bearing in stock for a year is Rs. 2 and the set up cost of a production run is Rs. 1,800. How frequently should production run be made? [5].

3 (a) A small project consists of seven activities for which the relevant data are given below

Activity	Preceding Activities	Activities Duration (Days)
A	—	4
B	—	7
C	A, B	6
D	A, B	5
E	C, D, E	7
F	C, D, E	6
G	C, D, E	5

(i) Draw the network and find the project completion time. [5]

(ii) Calculate total float for each of the activities and highlight the critical path. [5]

(iii) Draw the time scaled diagram. [5]



## Group-B

4. A project consists of eight activities with the following relevant information:

Activity	Immediate predecessor	Estimated duration (days)		
		optimistic	Most likely	Pessimistic
A	—	1	1	7
B	—	1	4	7
C	—	2	2	8
D	A	1	1	1
E	B	2	5	14
F	C	2	5	8
G	D, E	3	6	15
H	F, G	1	2	3

(i) Draw the PERT network and find out the expected project completion time. [5]

(ii) What duration will have 95% confidence for project completion? [5]

(iii) If the average duration for activity F increases to 14 days, what will be its effect on the expected project completion time which will have 95% confidence. [5]

5. Find the optimum integer solution to the following LPP:

Maximize  $z = x_1 + 4x_2$  subject to the constraints:

$$2x_1 + 4x_2 \leq 7, \quad 5x_1 + 3x_2 \leq 15, \quad x_1, x_2 \geq 0 \text{ and are integers}$$

6. Describe Gomory's method of solving an all-integer linear programming problem

GROUP-B

7. Explain what do you understand by a saddle point of a matrix game. Show that if dominance occurs in the pay-off matrix of  $2 \times 2$  game, then there is saddle point. Is the converse true? [15]

8.(a) solve the following game whose pay-off matrix is given by [7]

Player B

	I	II	III
Player A I	-2	5	-2
II	-4	-6	-4
III	-4	10	-7

(b) Define two-person, zero-sum game. The pay-off matrix of a game is as given below! Find the solution of game to A and B. [8]

Player B

	I	II	III	IV
Player A I	-2	0	0	3
II	3	2	1	2
III	-4	-3	0	5
IV	5	3	-4	-6

Answer of objective question -

Q. NO. - 1

(i) (b) (ii) (a) (iii) (b) (iv) (a) (v) (b)

(vi) (b) (vii) (c) (viii) (d) (ix) (a) (x) (a)

[1]



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[2]

