

Exam. Code : 108505

Subject Code : 2840

B.Com. 5<sup>th</sup> Semester

OPERATIONS RESEARCH

Paper—BCG-505

Time Allowed—3 Hours] [Maximum Marks—50

SECTION—A

**Note** :— Attempt any *ten* parts. Each part carries 1 mark.

1. (a) Define operations research and discuss its limitations.
- (b) Write down assumptions of queueing theory.
- (c) Define two person zero sum game.
- (d) Explain assumptions of L.P.P. giving examples.
- (e) What is an unbalanced transportation problem ?
- (f) Discuss cost model of queueing theory.
- (g) Explain the various types of floats.
- (h) What do you mean by prohibited routes in assignment problems ?
- (i) Write general L.P.P. model.

- (j) "A game refers to a situation of business conflict."  
Comment on the situation.
- (k) Discuss the importance of artificial variables.
- (l) What do you understand by travelling salesman problem ? Discuss its applications.

### SECTION—B

**Note** :— Attempt any *two* questions . Each question carries  
10 marks.

2. Each month a store owner can spend at most Rs. 1,00,000 on Products A and B. One unit of Product A costs the store owner Rs. 1,000 and one unit of Product B costs him Rs. 1,500. Each unit of Product A is sold for a profit of Rs. 400 while each unit of Product B is sold for a profit of Rs. 700. The store owner estimates that at least 15 units of Product A but not more than 80 are sold each month. He also estimates that the number of units of Product B sold is at the most half the Product A. How many units each of Product A and Product B should be sold in order to maximize the profit ? 10

3. (a) What is meant by a transportation problem ? Discuss North West Corner Method and Least Square Method of initial solution giving suitable examples.

(b) Explain Hungarian method of assignment problems giving suitable example. 5,5

4. Define linear programming. Discuss its applications in various functional areas quoting examples from real life. 10

5. Five workers are available to do five different jobs. From past records, the time (in hours) that each worker takes to do a job is known and is given in the following matrix :

Men	Jobs				
	I	II	III	IV	V
A	2	9	2	7	1
B	6	8	7	6	1
C	4	6	5	3	1
D	4	2	7	3	1
E	5	3	9	5	1

Find the assignment of workers to jobs that will minimize the total time taken. 10

## SECTION—C

**Note** :— Attempt any *two* questions . Each question carries  
10 marks.

6. The rate of arrival of customers at a bank counter follows Poisson distribution, with an average time of 10 minutes between one customer and the next. The duration of a phone call is assumed to follow exponential distribution, with mean time of 3 minutes.
- (i) What is traffic intensity ?
  - (ii) What is the probability that a person arriving at bank will have to wait ?
  - (iii) What is the average length of the non-empty queues that form from time to time ?
  - (iv) What is the average a customer spends in the system ?
  - (v) Bank will install a second counter when it is convinced that the customers would expect waiting for at least 3 minutes for their turn. By how much time should the flow of customers increase in order to justify a second counter ?  $2 \times 5 = 10$

7. Solve the following game :

Player A	Player B					
		I	II	III	IV	V
1	4	2	0	2	1	1
2	4	3	1	3	2	2
3	4	3	7	-5	1	2
4	4	3	4	-1	2	2
5	4	3	3	-2	2	2

10

8. (a) "The two-person, zero-sum game is unrealistic." Elucidate the statement bringing out the limitations of game theory, if any.
- (b) Draw the Network Diagram and determine the critical path and duration of the project (in days) :

Activity	Duration (days)	Predecessor(s)
A	2	—
B	3	—
C	4	A,B

Activity	Duration (days)	Predecessor(s)
D	5	C
E	2	D
F	3	D
G	4	E
H	2	F
I	2	G,H

5,5

9. The data for a PERT network is given in the following table :

Activity nodes (i-j)	Time duration (days)		
	Optimistic	Most likely	Pessimistic
1-2	2	4	6
1-3	6	6	6
1-4	6	12	24
2-3	2	5	8
2-5	11	14	28
3-4	15	24	45
3-6	3	6	9
4-6	9	15	27
5-6	4	10	16

- (i) Draw a network and estimate the earliest and latest event times for all nodes and hence derive critical path.

- (ii) Estimate the expected duration of the project and corresponding variance.
- (iii) What is the probability that the project duration will exceed 60 days ?
- (iv) What is the chance of completing the project between 45 and 54 days ?
- (v) What is the probability of completing the project within 30 days ? 2×5=10