

## B.Com. - 6th Semester

(2721)

## Paper : BCG-603 Operations Research

Time allowed: 2 hrs.

Max. Marks: 50

Note: There are EIGHT questions of equal marks. Candidates are required to attempt any FOUR questions.

## Section A

Q.1 Define Operations research. Discuss its nature and scope.

Q.2 Solve following L.P.P.:

Maximize  $Z = 5x_1 + 3x_2$

Subject to constraints:

$$x_1 + x_2 \leq 6$$

$$2x_1 + 3x_2 \leq 12$$

$$x_1 \leq 3$$

$$x_2 \leq 3$$

$$x_1, x_2 \geq 0$$

## Section B

Q.3 Solve the following transportation problem for optimality:

Factory	Warehouses				Supply (units)
	X	Y	Z	W	
A	25	55	40	60	60
B	35	30	50	40	140
C	36	45	26	66	150
D	35	30	41	50	50
Demand (units)	90	100	120	140	

Contd....P/2

(2)

Q.4. Suggest the optimal assignment schedule for the following assignment problem:

Salesman	Sales ( ₹ in lakh )			
	I	II	III	IV
A	80	70	75	72
B	75	75	80	85
C	78	78	82	78

## Section C

Q.5 (a) What is queuing theory? In what types of problem situations can it be applied successfully? Discuss giving examples.

(b) Solve the following game:

		B's Strategy	
		B <sub>1</sub>	B <sub>2</sub>
A's Strategy	A <sub>1</sub>	28	0
	A <sub>2</sub>	2	12
	A <sub>3</sub>	4	7 (5,5)

Q.6 At a certain petrol pump, customers arrive in a Poisson process with an average time of five minutes between successive arrivals. The time taken at the petrol pump to serve customers follows exponential distribution with an average of two minutes. You are required to obtain the following:

- Arrival and service rates.
- The utilisation parameter.
- Probability that there shall be four customers in the system.
- Probability that there are more than four customers in the system.
- Expected queue length.
- Expected number of customers in the system.
- Expected time that a customer has to wait in the queue.
- Expected time that a customer has to spend in the system.
- It is decided to open a new service point when the customers' expected waiting time rises to three times the present level. What increased flow of customers will justify this?

(3)

## Section D

Q.7. The following table shows for each activity needed to complete the project the normal time, the shortest time in which the activity can be completed of a building contract and the cost per day for reducing the time of each activity. The contract includes a penalty clause of ₹ 100 per day over 17 days. The overhead cost per day is ₹ 160.

Activity	Normal time in Days	Shortest time in days	Cost of Reduction per Day (₹)
1-2	6	4	80
1-3	8	4	90
1-4	5	3	30
2-4	3	3	-
2-5	5	3	40
3-6	12	8	200
4-6	8	5	50
5-6	6	6	-

The cost of completing the eight activities in normal time is ₹ 6,500.

- (a) Calculate the normal duration of the project, its cost and the critical path.  
 (b) Calculate and plot on a graph the cost/time function for the project and state:  
 (i) the lowest cost and associated time.  
 (ii) the shortest time associated cost.

Q.8 (a) What is critical path? State the necessary and sufficient conditions of critical path. Can a project have multiple critical paths?

(b) What are the three time estimates used in the context of PERT? How are the expected duration of a project and its standard deviation calculated? (5,5)

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