Exam. Code : 108506
Subject Code : 2061

B.Com. 6th Semester
OPERATIONS RESEARCH
Paper—BCG-603

Time Allowed—Two Hours] [Maximum Marks—50

Note :— Attempt any **FOUR** questions. All questions carry equal marks.

1. "Operations Research is an aid for the executive in making his decisions by providing him with the needed quantitative information, based on the scientific method analysis". Discuss this statement in detail, illustrating it with O.R. applications.

2. A marketing manager wishes to allocate his annual advertising budget of Rs. 20,000 to two media A and B. The unit cost of message in media A is Rs. 1,000 and that in B is Rs. 1,500. Media A is monthly magazine and not more than one insertion is desired in one issue. At least 5 messages should appear in media B. The expected effected audience for unit messages in the media A is 40,000 and for media B is 55,000.

   (i) Develop a mathematical model.

   (ii) Solve it for maximizing the total effective audience using Simplex method.

3. Solve the following Assignment Problem. The data given in the table refer to production in units :

Operators	Machines			
	A	B	C	D
1	10	5	7	8
2	11	4	9	10
3	8	4	9	7
4	7	5	6	4
5	8	9	7	5

4. A firm owns facilities at seven places. It has manufacturing plants at places A, B and C with daily output of 500, 300 and 200 units of an item respectively. It has warehouses at places P, Q, R and S with daily requirements of 180, 150, 350 and 320 units respectively. Per unit shipping charges on different routes are given below :

To / From	P	Q	R	S
A	12	10	12	13
B	7	11	8	14
C	6	16	11	7

The firm wants to send the output from various plants to warehouses involving minimum transportation cost. How should it route the product so as to achieve its objective ?

5. (a) Define Queueing theory. Discuss its elements. Write down assumptions of singe channel model.

(b) 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 service 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 not 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 time 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 ?

6. (a) "The two-person, zero-sum game is unrealistic." Elucidate the statement bringing out the limitations of game theory, if any.

(b) Solve the problem given below :

Player B

Player A		1	2	3
	1	3	–1	4
	2	6	7	–2

7. (a) Define Critical Path. State the necessary and sufficient conditions of critical path. Differentiate PERT and CPM giving suitable examples.

(b) Solve the following L.P.P.

Maximize $Z = 3x_1 + 2x_2$

Subject to constraints

$$-2x_1 + x_2 \leq 1$$

$$x_1 \leq 2$$

$$x_1 + x_2 \leq 3$$

$$x_1, x_2 \leq 0$$

8. Draw the network diagram and determine the critical path for the following project :

Activity	1–2	1–3	1–4	2–5	3–6	3–7	4–7	5–8	6–8	7–9	8–9
Time estimate (Weeks)	5	6	3	5	7	10	4	2	5	6	4