

(i) Printed Pages: 4

Roll No. ....

(ii) Questions : 14 Sub. Code : 

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Exam. Code : 

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**Bachelor of Commerce 6<sup>th</sup> Semester**  
**(2055)**

**OPERATIONAL RESEARCH**

**Paper : BCM-605**

**Time Allowed : Three Hours** [Maximum Marks : 80]

**Note :—**(1) Attempt any **FOUR** questions from Section A. Each question carries **5** marks.

(2) Attempt any **TWO** questions each from Sections B and C. Each question carries **15** marks.

**SECTION—A**

1. Analyze the various limitations of Operations Research.
2. Differentiate between gradual failure and sudden failure.
3. Solve the following problem graphically :

$$\text{Max. } Z = 5x_1 + 4x_2$$

$$\text{subject to } 2x_1 - 4x_2 \leq 1$$

$$2x_1 + 4x_2 \geq 3$$

$$\text{where } x_1, x_2 \geq 0.$$

4. Construct the dual of the following problem :

$$\text{Max. } Z = 12x_1 + 15x_2 + 9x_3$$

$$\text{subject to } 8x_1 + 16x_2 + 12x_3 \leq 25$$

$$4x_1 + 8x_2 + 10x_3 \geq 80$$

$$7x_1 + 9x_2 + 8x_3 = 105$$

$$\text{where } x_1, x_2, x_3 \geq 0.$$

5. XYZ, a manufacturing company is using a machine whose purchase price is Rs. 65,000. The installation charges amount to Rs. 18,000 and the machine has a scrap value of only Rs. 8,000 because the firm has a monopoly of this type of work. The maintenance cost in various years is given in the following table :

Year	1	2	3	4	5	6	7	8	9
Cost	1250	3750	5000	7500	10500	14500	20000	24000	30000

Determine after how many years should the machine be replaced in economic consideration assuming that the machine replacement can be done only at the year end.

6. In a game of machine coins with two players, suppose A wins one unit of value when there are two heads, wins nothing when there are two tails and loses  $1/2$  unit of value when there are one head and one tail. Determine the pay off matrix, the best strategy for each player and the value of game to A.

### SECTION—B

7. Define Operational Research. Explain the scope and significance of Operation Research.
8. Solve the following problem by simplex method :

$$\text{Max. } Z = 4x_1 + 5x_2 - 3x_3$$

$$\text{subject to } x_1 + x_2 + x_3 = 10$$

$$x_1 - x_2 \geq 1$$

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

$$\text{where } x_1, x_2, x_3 \geq 0.$$

9. Solve the following transportation problem to maximize profits and give criterion for optimality :

	I	II	III	IV	Capacity
A	40	25	22	33	200
B	44	35	30	30	60
C	38	38	28	30	140
Demand	80	40	120	60	

10. The Captain of a cricket team has to allot five middle batting positions to five batsmen. The average runs scored by each batsman at this position are as follows :

From	I	II	III	IV	V
P	40	40	35	25	50
Q	42	30	16	25	27
R	50	48	40	60	50
S	20	19	20	18	25
T	58	60	59	55	53

Find the assignment of batsman to positions which would give the maximum number of runs.

### SECTION—C

11. What is decision making under uncertainty ? What are the assumptions in decision making under uncertainty ? What are its limitations ? Give some examples.
12. Solve the following game :

		A			
B		I	II	III	IV
	I	6	4	8	0
	II	6	8	4	8
	III	8	4	8	0
	IV	0	8	0	16

13. The following mortality rates have been observed for certain type of light bulbs :

Week	1	2	3	4	5
% failing by the end of week	10	25	50	80	100

There are 1000 bulbs in use and it costs Rs. 5 to replace an individual bulb which has burnt out. If all the bulbs are replaced simultaneously it would cost Rs. 2 per bulb. It is proposed to replace all bulbs at fixed intervals, whether they have burnt out or not and to continue replacing burnt out bulbs as and when they fail. At what intervals should all the bulbs be replaced ?

14. The Cargo Honda Ltd. manufactures around 150 scooters. The daily production varies from 146 to 154 depending upon the availability of raw materials and other working conditions :

Production per day	146	147	148	149	150	151	152	153	154
Probability	0.04	0.09	0.12	0.14	0.11	0.10	0.20	0.12	0.08

The finished scooters are transported in a specially arranged lorry accommodating 150 scooters. Using following random numbers :

80, 81, 76, 75, 64, 43, 18, 26, 10, 12, 65, 68, 69, 61, 57, stimulate the process to find out :

- What will be the average number of scooters waiting in the factory ?
- What will be the average number of empty space on the lorry ?