



সমানো মন্ত্র: সমিতি: সমানী

**UNIVERSITY OF NORTH BENGAL**  
BBA LL.B. Honours 2nd Semester Examination, 2023

**OPERATION RESEARCH**

**PAPER CODE: FC04**

Time Allotted: 3 Hours

Full Marks: 100

*The figures in the margin indicate full marks.*

**Answer any four questions and Questions No. 7 is compulsory to attempt**

1. Solve the following LPP using the Simplex Method: 20

Maximize  $Z = 12x_1 + 16x_2$

Subject to,

$$10x_1 + 20x_2 \leq 120$$

$$8x_1 + 8x_2 \leq 80$$

$$x_1 \text{ and } x_2 \geq 0$$

2. Minimize  $Z = 2x_1 - 3x_2 + 6x_3$  20

Subject to,

$$3x_1 - x_2 + 2x_3 \leq 7$$

$$2x_1 + 4x_2 \geq -12$$

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

$$x_1, x_2 \text{ and } x_3 \geq 0$$

Solve the above LPP using the Simplex Method.

3. Consider the details of a project as shown in the following table: 10+5+5

Activity	Immediate Predecessor(s)	Duration (Month)
A	—	2
B	—	5
C	—	4
D	B	5
E	A	7
F	A	3
G	B	3
H	C, D	6
I	C, D	2
J	E	5
K	F, G, H	4
L	F, G; H	3
M	I	12
N	J, K	8

- (a) Construct the critical path method network.

- (b) Determine the critical path and project completion time.
- (c) Compute the total float and free float for non-critical activities.

4. Two products 'A' and 'B' are to be manufactured. Single unit of 'A' requires 2.4 minutes of punch press time and 5 minutes of assembly time, while single unit of 'B' requires 3 minutes of punch press time and 2.5 minutes of welding time. The capacity of punch press department, assembly department and welding department are 1200 minutes/week, 800 minutes / week and 600 minutes / week respectively. The profit from 'A' is ₹60 and from 'B' is ₹70 per unit. Formulate Linear programming problem such that, profit is maximized. 20
5. In a factory, the machine breakdown on an average rate is 10 machines per hour. The Idle time cost of a machine is estimated to be Rs. 20 per hour. The factory works 8 hours a day. The factory manager is considering 2 mechanics for repairing the machines. The first mechanic A takes 5 minutes on an average to repair a machine and demands wages Rs. 10 per hour. The second mechanic B takes about 4 minutes in repairing a machine and demand wages at the rate of Rs. 15 per hour. Assuming that the rate of machine breakdown is Poisson distributed and the repair rate is exponentially distributed, which of the two mechanics should be engaged. 20
6. Obtain the initial basic feasible transportation cost by (i) North West Corner Method and (ii) Vogel's Approximation Method 10+10

	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	Supply
S <sub>1</sub>	4	8	8	76
S <sub>2</sub>	16	24	16	82
S <sub>3</sub>	8	16	24	77
Demand	72	102	41	

7. Write short notes: (Attempt any *four*) 5×4 = 20
- (a) Uses of Operation Research
  - (b) Critical Path Method (CPM)
  - (c) Project Evaluation and Review Technique
  - (d) Evolution of Operation Research
  - (e) Limitation of Operation Research
  - (f) Earliest time and Latest time in CPM.

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