

SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)

(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)

Chromepet, Chennai - 600 044.

B.Com. A&F - END SEMESTER EXAMINATIONS - APRIL 2025

SEMESTER - II

23UAFAT2002 - Operations Research

Total Duration : 2 Hrs.30 Mins.

Total Marks : 60

Section B

Answer any **SIX** questions ($6 \times 5 = 30$ Marks)

1. Determine all the basic feasible solutions of the equations:

$$2x_1 + 6x_2 + 2x_3 + x_4 = 3$$

$$6x_1 + 4x_2 + 4x_3 + 6x_4 = 2$$

2. A small-scale industry manufactures two products P and Q which are processed in a machine shop and assembly shop. Product P requires 2 hours of work in a machine shop and 4 hours of work in the assembly shop to manufacture while product Q requires 3 hours of work in the machine shop and 2 hours of work in the assembly shop. In one day, the industry cannot use more than 16 hours of machine shop and 22 hours of assembly shop. It earns a profit of rupees 3 per unit of product P and rupees. 4 per unit of product Q. Give a mathematical formulation of the problem as to maximise profit.
3. Find the basic feasible solution of the following problem using the Least Cost method:

Origin/ Distribution Centre	1	2	3	4	5	6	Availability
1	4	6	9	2	7	8	10
2	3	5	4	8	10	0	12
3	2	6	9	8	4	13	4
4	4	4	5	9	3	6	18
5	9	8	7	3	2	14	20
Requirement	8	8	16	3	8	21	

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4. Find the basic feasible solution of the following problem using Vogel's Approximation method:

Origin/ Distribution Centre	1	2	3	4	5	6	Availability
1	4	6	9	2	7	8	10
2	3	5	4	8	10	0	12
3	2	6	9	8	4	13	4
4	4	4	5	9	3	6	18
5	9	8	7	3	2	14	20
Requirement	8	8	16	3	8	21	

5. A computer centre has four expert programmers & needs to develop four application programmes. The head of the computer Centre, estimates the computer time (in minutes) required by the respective experts to develop the application programmes as follows:

Programmes	A	B	C	D
1	120	100	80	90
2	80	90	110	70
3	110	140	120	100
4	90	90	80	90

Find the assignment pattern that minimizes the time required to develop the application programmes.

6. A solicitor's firm employs typists on an hourly piece – rate basis for their daily work. There are five typists for service and their charges and speeds are different. According to the contract, only one job is given to one typist. Find the least cost allocation for the following data:

	P	Q	R	S	T
A	85	75	65	85	75
B	90	180	66	90	78
C	75	66	57	75	69
D	80	72	60	80	72
E	76	64	56	72	68

7. What are the elements of queueing system?

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8. Explain probability considerations in PERT analysis.

Section C

Answer any **THREE** questions ($3 \times 10 = 30$ Marks)

9. Express the following LPP in the standard form:

Minimise $Z=2x_1+x_2+4x_3$ subject to the constraints:

$$-2x_1+4x_2 \leq 4$$

$$x_1+2x_2+x_3 \geq 5$$

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

$$x_1 \geq 0, x_2 \geq 0, x_3 \geq 0.$$

10. A company is spending Rs.1,000 on transportation of its units from three plants to four distribution centres. The availability of unit per plant and requirement of units per distribution centre, with unit cost of transportation are given as follows:

D.					
Centres	D₁	D₂	D₃	D₄	Availability
Plants					
P₁	9	30	50	12	7
P₂	70	30	40	60	10
P₃	40	10	60	20	18
Requirement	5	8	7	15	

What is the maximum possible saving by optimum is attribution? Use the Stepping Stone method to solve the problem.

11. To stimulate interest and provide an atmosphere for intellectual discussion, the faculty of mathematical sciences in an institute decides to hold special seminars four contemporary topics - Statistics, Operations Research, Discrete Mathematics, Matrices. Each such seminar is to be held once a week. However, scheduling these seminars (one for each topic and not more than one seminar per a day) has to be done carefully so that the numbers of students unable to attend is kept to a minimum. A careful study indicates that the number of students who cannot attend a particular seminar on a specific day is as follows:

	Statistics	Operations Research	Discrete mathematics	Matrices
Monday	50	40	60	20
Tuesday	40	30	40	30
Wednesday	60	20	30	20
Thursday	30	30	20	30
Friday	10	20	10	30

Find an optimal schedule for the seminars. Also find the number of students who will be missing at-least one seminar.

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12. Relate the construction of network analysis.
13. Customers arrive at a window in a bank, according to a Poisson distribution with mean 10 per hour. Service time per customer is exponential with mean 5 minutes. The space in front of the window including that for the serviced customers can accommodate a maximum of three customers. Other customers can wait outside this space.
- (a) What is the probability that an arriving customer can go directly to the space in-front of the window?
 - (b) What is the probability that an arriving customer will have to wait outside the indicated space?

How long is an arriving customer expected to wait before being served?
