'समानो मन्त्रः समितिः समानी'

UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 5th Semester Examination, 2023

DSE-P2-COMPUTER SCIENCE (54)

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.

The question paper contains DSE54-E1, DSE54-E2 and DSE54-E3.
The candidates are required to answer any *one* from *three* courses.
Candidates should mention it clearly on the Answer Book.

DSE54-E1

OPERATIONAL RESEARCH IN COMPUTER SCIENCE

1. Answer any ***five*** questions: 1×5 = 5

   (a) Define feasible solution.
   (b) What do you mean by degeneracy in LPP?
   (c) What are slack and surplus variable?
   (d) What is the test of optimality in the Simplex method?
   (e) Define dual of an LPP.
   (f) What is the purpose of MODI method?
   (g) How to balance a transportation problem?
   (h) How do you convert the maximization assignment problem into a minimization one?

2. Answer any ***three*** questions: 5×3 = 15

   (a) Suppose an organisation is manufacturing two products P_1 and P_2. The profit per tonne of the two products are Rs. 50 and Rs. 60 respectively. Both the products require processing in three types of machine. The following Table indicates the available machine hours per week and the time required on each machine for one tonne of P_1 and P_2. Formulate this product mix problem in the linear programming form.

Table Showing the available machine capacities and machine hour requirement of the two products

Profit/tonne	Product 1 Rs. 50	Product 2 Rs. 60	Total available Machine hours / weeks
Machine 1		2	300
Machine 2		34	509
Machine 3		4	812

(b) Solve using graphical method

$$\text{Maximize } 50x_1 + 60x_2$$

$$\text{Subject to } 2x_1 + x_2 \le 300$$

$$3x_1 + 4x_2 \le 509$$

$$4x_1 + 7x_2 \le 812$$

$$x_1 \ge 0,\ x_2 \ge 0$$

(c) Obtain an initial basic feasible solution to the following transportation problem using the Least Cost method.

	D_1	**D_2**	**D_3**	**D_4**	**Supplies**
S_1	20	25	28	31	200
S_2	32	28	32	41	180
S_3	18	35	24	32	110
Demands	150	40	180	170	

(d) Write the dual of the following LPP

$$\text{Minimize: } Z = 2x_2 + 5x_3$$

$$\text{Subject to: } x_1 + x_2 \ge 2$$

$$2x_1 + x_2 + 6x_3 \le 6$$

$$x_1 - x_2 + 3x_3 = 4$$

$$x_1,\ x_2,\ x_3 \ge 0$$

(e) Write the Hungarian method to solve an assignment problem.

3. Answer any ***two*** questions: 10×2 = 20

(a) Solve using simplex method.

$$\text{Maximize: } x_1 + x_2$$

$$\text{Subject to: } -2x_1 + x_2 \le 1$$

$$x_1 \le 2$$

$$x_1 + x_2 \le 3$$

$$x_1,\ x_2 \ge 0$$

(b) Find the optimum solution of the following transportation problem.

	D_1	**D_2**	**D_3**	**D_4**	**Supply**
S_1	21	16	25	13	11
S_2	17	18	14	23	13
S_3	32	27	18	41	19
Demand	6	10	12	15	

(c) Find the optimal solution of the following assignment problem.

	I_1	I_2	I_3	I_4	I_5
A	10	5	13	15	16
B	3	9	18	13	6
C	10	7	2	2	2
D	7	11	9	7	12
E	7	9	10	4	12

(d) Solve the following LPP using duality

$$\text{Maximize } Z = -3x_1 - 2x_2$$

$$\text{Subject to } x_1 + x_2 \geq 1$$

$$x_1 + x_2 \leq 7$$

$$x_1 + 2x_2 \geq 10$$

$$x_2 \leq 3$$

$$x_1, x_2 \geq 0$$

DSE54-E2

COMBINATORIAL OPTIMIZATION

1. Answer any ***five*** questions: 1×5 = 5

(a) What is artificial variable?

(b) What is degeneracy in LPP?

(c) Define a convex function.

(d) How to test the optimality in the Simplex method?

(e) Define duality in an LPP.

(f) What is integer programming?

(g) What is the process to calculate global minima?

(h) What is the difference between primal simplex and dual simplex method?

2. Answer any ***three*** questions: 5×3 = 15

(a) Suppose an organisation is manufacturing two products P_1 and P_2. The profit per tonne of the two products are Rs. 50 and Rs. 60 respectively. Both the products require processing in three types of machine. The following Table indicates the available machine hours per week and the time required on each machine for one tonne of P_1 and P_2. Formulate this product mix problem in the linear programming form.

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Machine 2		34	509
Machine 3		4	812

(b) Solve using graphical method

Maximize: $x_1 + x_2$

Subject to: $-2x_1 + x_2 \leq 1$

$x_1 \leq 2$

$x_1 + x_2 \leq 3$

$x_1, x_2 \geq 0$

(c) Discuss the Dantiz-Wolfe algorithm in detail.

(d) Write the dual of the following LPP.

Maximize: $Z = 3x_1 + x_2 + 2x_3 - x_4$

Subject to: $2x_1 - x_2 + 3x_3 + x_4 = 1$

$x_1 + x_2 - x_3 + x_4 = 3$

$x_1, x_2, x_3 \geq 0, x_4$ unrestricted in sign

(e) Discuss the branch and bound technique to solve the travelling salesman problem.

3. Answer any ***two*** questions: 10×2 = 20

(a) Solve using dual simplex method

Maximize: $Z = -3x_1 - x_2$

Subject to: $x_1 + x_2 \geq 1$

$x_1 + 3x_2 \geq 2$

$x_1, x_2 \geq 0$

(b) Find the optimum integer solution to the following LPP

Maximize: $Z = x_1 + 2x_2$

Subject to: $2x_2 \leq 7$

$x_1 + x_2 \leq 7$

$2x_1 \leq 11$

$x_1, x_2 \geq 0$ and x_1, x_2 are integers

(c) Solve using simplex method

Maximize: $50x_1 + 60x_2$

Subject to: $2x_1 + x_2 \le 300$

$3x_1 + 4x_2 \le 509$

$4x_1 + 7x_2 \le 812$

$x_1 \ge 0,\ x_2 \ge 0$

(d) Solve the following LPP using duality.

Maximize: $Z = -3x_1 - 2x_2$

Subject to: $x_1 + x_2 \ge 1$

$x_1 + x_2 \le 7$

$x_1 + 2x_2 \ge 10$

$x_2 \le 3$

$x_1,\ x_2 \ge 0$

DSE54-E3

NUMERICAL METHODS

GROUP-A

Answer any *five* of the following 1×5 = 5

1. What do you mean by percentage error?
2. If $\pi = 3.14$ is used in placed of 3.14156, find the relative error.
3. Which interpolation formula is suitable if argument x of $f(x)$ is near the end of the table?
4. Define the term interpolation.
5. What is the major drawback of Lagrange Polynomial?
6. Write the error term of Simpson's $\frac{1}{3}$rd rule.
7. What is the advantage of Gauss-Seidel method over Gauss-Jacobi method?
8. What is eigen value?

GROUP-B

Answer any *three* of the following 5×3 = 15

9. Draw the flow-chart of interpolation using Newton's Forward difference.
10. Find the root of $\cos x = xe^x$ by Newton Raphson method correct to 3 decimals.

11. Evaluate $\int_2^4 x \log x \, dx$, by Simpson's $\frac{1}{3}$rd rule and Trapezoidal rule.

12. Find a positive root of $f(x) = 2x - \log_{10} x - 7$ using iterative method.

13. Discuss least square curve fitting algorithm.

GROUP-C

Answer any *two* of the following $10 \times 2 = 20$

14. Use Lagrange's Interpolation formula to find the value of y when $x = 10$; if the following values of x and y are given

x	5	6	9	11
y	12	13	14	16

15. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule.

16. Apply Runge-Kutta method of order 4 to find an approximate value of y for $x = 0.2$ in steps of 0.1, if $\frac{dy}{dx} = x + y^2$ given that $y = 1$ when $x = 0$.

17. Evaluate $y(2.1)$ using Taylor series expansion for $y' = 1 - \frac{y}{x}$ with $y(2) = 2$ correct upto 5 decimal places.

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