UNIVERSITY OF NORTH BENGAL
B.Sc. Honours 5th Semester Examination, 2022

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 and 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 FOR COMPUTER SCIENCE

GROUP-A
Answer any *five* questions   1×5 = 5

1. What is the significance of simplex method in solving LPP?

2. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$ find $2A + B$.

3. Define rank of a matrix.

4. What is the difference between feasible solution and optimal solution?

5. What are the different methods of solving a transportation problem?

6. What is the condition for optimality in a maximization problem?

7. What is an artificial variable?

8. What are absorbing states?

Turn Over

GROUP-B

Answer any *three* questions $5\times3 = 15$

9.   Solve graphically

$$\text{Max } z = 10x_1 + 6x_2$$

Subject to: $x_1 + x_2 \leq 2$

$$2x_1 + x_2 \leq 4$$

$$3x_1 + 8x_2 \leq 12$$

$$x_1, x_2 \geq 0$$

10.   Find the total cost using north-west corner method

	W_1	W_2	W_3	W_4	Capacity
F_1	95	105	80	15	12
F_2	115	180	40	30	7
F_3	195	180	95	70	5
Requirement	5	4	4	11	

11.   Solve using Hungarian method cell values represent cost of assigning job A, B, C and D to machines I, II, III and IV.

		Machines			
		I	II	III	IV
	A	10	12	19	11
Jobs	B	5	10	7	8
	C	12	14	13	11
	D	8	15	11	9

12.   Explain the different variations of simplex method.

13.   Solve the following problem using simple simplex.

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

Subject to: $6x_1 + 4x_2 \leq 24$

$$x_1 + 2x_2 \leq 6$$

$$-x_1 + x_2 \leq 1$$

$$x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

GROUP-C

Answer any *two* questions

$10 \times 2 = 20$

14. Explain the Markov Chains algorithm, stating an example.

15. Solve the following LPP

$$\text{Minimize } z = 3x + 5y$$

Subject to: $2x + 3y \geq 12$

$$-x + y \leq 3$$
$$x \leq 4$$
$$y \geq 3$$
$$x, y \geq 0$$

16. Solve the following LPP

$$\text{Minimize } z = x_1 + 4x_2$$

Subject to: $2x_1 + x_2 \leq 8$

$$x_1 + 2x_2 \geq 6$$
$$x_1, x_2 \geq 0 \text{ and integers}$$

17. Solve using cutting plane algorithm

$$\text{Maximize } z = 7x_1 + 10x_2$$

Subject to: $-x_1 + 3x_2 \leq 6$

$$7x_1 + x_2 \leq 35$$
$$x_1, x_2 \geq 0 \text{ and integers}$$

DSE54-E2

COMBINATORIAL OPTIMIZATION

GROUP-A

Answer any *five* questions

$1 \times 5 = 5$

1. What is slack variable and surplus variable?

2. What is infeasible state in Simplex method?

3. What is alternative optima?

4. Define Combinatorial Optimization.

5.   What is global and local optima?

6.   What is degeneracy in simplex method?

7.   What is Neighbourhood in optimization?

8.   What is primal and dual of a problem?

GROUP-B

Answer any *three* questions   5×3 = 15

9.   Explain the Dantzig-Wolfe algorithm.

10.   What are convex sets and functions in optimization? Explain.

11.   Solve graphically

$$\text{Max } z = 2x_1 + 3x_2$$

Subject to: $2x_1 + x_2 \leq 4$

$$x_1 + 2x_2 \leq 5$$

$$x_1, x_2 \geq 0$$

12.   Find the dual of the given problem

$$\text{Max } z = 5x_1 + 12x_2 + 4x_3$$

Subject to: $x_1 + 2x_2 + x_3 \leq 10$

$$2x_1 - x_2 + 3x_3 = 8$$

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

13.   Explain the different variations of simplex method.

GROUP-C

Answer any *two* questions   10×2 = 20

14.   Solve the following:

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

Subject to: $x_1 + x_2 \leq 5$

$$10x_1 + 6x_2 \leq 45$$

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

15. Find the solution using cutting plane method

$$\text{Max } z = x_1 + x_2$$

$$\text{Subject to: } 3x_1 + 2x_2 \le 5$$

$$x_2 \le 2$$

$$x_1, x_2 \ge 0 \text{ and integer}$$

16. Solve the following

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

$$\text{Subject to: } 5x_1 + 4x_2 \le 24$$

$$x_1 + 2x_2 \le 6$$

$$-x_1 + x_2 \le 1$$

$$x_2 \le 2$$

$$x_1, x_2 \ge 0$$

17. Using Simplex method and principle of duality solve the following

$$\text{Min } z = 9x_1 + 4x_2 + 10x_3$$

$$\text{Subject to: } 2x_1 + x_2 + 3x_3 \ge 6$$

$$6x_1 + x_2 + x_3 \ge 9$$

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

DSE54-E3

NUMERICAL METHODS

GROUP-A

Answer any *five* questions from the following $1 \times 5 = 5$

1. Write a name of an iterative method. 1

2. Name a direct method for solving simultaneous algebraic equations? 1

3. What is the value of the determinant $\begin{pmatrix} 3 & 5 & 2 \\ 7 & 4 & 5 \\ 1 & 2 & 3 \end{pmatrix}$? 1

4. What is the advantage of using the Gauss-Jordan method? 1

5. What is the other name of factorization method? 1

6. What is the condition applied in the factorization method? 1

7. What will be the value of $f'(x)$ in Newton-Raphson method if the curve $f(x)$ is constant? 1

8. What is the other name of Jacobi's method? 1

GROUP-B

Answer any *three* questions of the following $5 \times 3 = 15$

9. State and explain the Trapezoidal rule geometrically. 5

10. Write formulas for absolute error and relative error. If the represented value of X_1 is 3.1428 and its actual value is $X_1 = 3.14285$, find the absolute and relative errors. 5

11. Solve the following system of linear equations using Gauss Elimination method: 5

$$x_1 + x_2 + x_3 = 3$$
$$4x_1 + 3x_2 + 4x_3 = 11$$
$$9x_1 + 3x_2 + 4x_3 = 16$$

12. Use Newton-Raphson method performing only 2 iterations, to find a root of the equation $x^3 - 2x - 5 = 0$ near the value 2. 5

13. State formulae for each of the following interpolations: 5
    (i) Newton's Forward Difference Formula.
    (ii) Stirling's Formula.

GROUP-C

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

14. Find the approximate value of $I = \int_0^1 \dfrac{dx}{2 + 3x}$ using Simpson's $\dfrac{1}{3}$ rule. 10

15. Solve the following system by iteration method: 10

$$27x + 6y - z = 85$$
$$6x + 15y + 2z = 72$$
$$x + y + 54z = 110$$

16. Given $\dfrac{dy}{dx} = \dfrac{x - y}{2}$, $y(0) = 1$. Find $y(0.2)$, step length = 0.1 using fourth order Runge-Kutta Method. 10

17. Solve the following system of equations using Gauss-Seidel method: 10

$$8x - 3y + 2z = 20$$
$$4x + 11y - z = 33$$
$$6x + 3y + 12z = 36$$

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