UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 5th Semester Examination, 2021

DSE-P2-COMPUTER SCIENCE (54)

Time Allotted: 2 Hours   Full Marks: 40

The figures in the margin indicate full marks.
All symbols are of usual significance.
Answer all questions with internal choices.

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

1.   Answer any *five* questions: $1 \times 5 = 5$

(a) What is called unit matrix?

(b) Define rank of a matrix.

(c) Show that $\begin{vmatrix} 5 & 2 & 3 \\ 7 & 3 & 4 \\ 9 & 4 & 5 \end{vmatrix} = 0$

(d) When we get infinite number of solutions in a linear programming problem?

(e) In simplex method, when can we say the current solution is the optimal solution?

(f) Give the advantage to solve the dual rather than to solve the primal of an LPP.

(g) Why artificial variables are used along with surplus variables in LPP?

(h) Can we say an assignment problem is a special type of transportation problem?

GROUP-B

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

2.   Find the initial basic feasible solution by North West corner rule of the following   5
        transportation problem.

Destination

Source	D_1	D_2	D_3	D_4	Supply
S_1	2	3	11	7	6
S_2	1	0	6	1	1
S_3	5	8	15	9	10
Demand	7	5	3	2	

3. Use graphical method to solve the following   5

    Maximize $Z = 15x_1 + 20x_2$

    Subject to $x_1 + 2x_2 \geq 10$

    $\qquad 2x_1 - 3x_2 \leq 6$

    $\qquad x_1 + x_2 \geq 6$

    $\qquad x_1, x_2 \geq 0$

4. Find the rank of the matrix $A = \begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & -4 \\ -3 & 1 & -2 \end{bmatrix}$ 5

5. Compute the inverse of the matrix $A = \begin{bmatrix} 1 & 6 & 4 \\ 0 & 2 & 3 \\ 0 & 1 & 2 \end{bmatrix}$ 5

6. What is dual simplex method? Give the differences between regular simplex   5
    method and dual simplex method.

GROUP-C

Answer any *two* questions $10 \times 2 = 20$

7. Use dual simplex method to solve   10

    Maximize $Z = -3x_1 - 2x_2$

    Subject to $x_1 + x_2 \geq 1$

    $\qquad x_1 + x_2 \leq 7$

    $\qquad x_1 + 2x_2 \geq 10$

    $\qquad x_2 \leq 3$

    $\qquad x_1, x_2 \geq 0$

8. Solve by simplex method   10

    Maximize $Z = 5x_1 + 3x_2$

    Subject to $\quad x_1 + x_2 \leq 2$

    $\qquad 5x_1 + 2x_2 \leq 10$

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

    and $\qquad x_1, x_2 \geq 0$

9. Describe the mathematical formulation of an assignment problem. Explain the   10
    steps of the Hungarian method for solving assignment problems.

10.   Solve the following transportation problem.   10

	D$_1$	D$_2$	D$_3$	D$_4$	Supply
O$_1$	6	1	9	3	70
O$_2$	11	5	2	8	55
O$_3$	10	12	41	7	70
Demand	85	35	50	45	

DSE54-E2

COMBINATORIAL OPTIMIZATION

1.   Answer any *five* questions: $1\times5 = 5$

   (a) What is global optimum?
   (b) What do you mean by degeneracy?
   (c) Which method is used to solve LPP without artificial variables?
   (d) What do you understand by optimization problems?
   (e) What do you understand by feasible solution?
   (f) What is Neighbourhood in optimization?
   (g) What is LPP?
   (h) What is convex set?

2.   Answer any *three* questions: $5\times3 = 15$

   (a) Explain Cutting Plane algorithm.

   (b) Explain strong duality in LPP.

   (c) Explain Dantzig-Wolfe algorithm.

   (d) Write short notes on Exhaustive search method.

   (e) Write short note on Simplex Method.

3.   Answer any *two* questions: $10\times2 = 20$

   (a) Explain the Travelling Salesman Problem (TSP). Which approximation algorithm is suitable to solve the TSP? Justify your answer.

   (b) Explain Variable Neighbourhood Search (VNS) algorithm with suitable example.

   (c) Write algorithm for Dual Simplex method. Further explain the algorithm.

   (d) Find solution of the following using Branch and Bound method:

   Maximize $Z = 5x_1 + 6x_2 + 4x_3$

   Subject to $5x_1 + 3x_2 + 6x_3 \leq 20$

   $x_1 + 3x_2 \leq 12$

   $x_1, x_3 \geq 0$

   $x_2 \geq 0$ and integer

DSE54-E3

NUMERICAL METHODS

1.   Answer any *five* questions: $1 \times 5 = 5$

   (a) What do you mean by transcendental equation?

   (b) What are the advantages of Regula Falsi Method?

   (c) What is statistical inference?

   (d) When the Newton-Raphson method may fail?

   (e) What is polynomial interpolation?

   (f) What are the disadvantages of Newton-Raphson's method?

   (g) Write down the advantages of Modified Euler Method.

   (h) What is the main difference between the Jacobi and Gauss-Seidel?

2.   Answer any *three* questions: $5 \times 3 = 15$

   (a) Find the root which lies between 1 and 2 of $f(x) = 2x^3 - 2.5x - 5 = 0$ using Newton-Raphson's method.

   (b) Find a root which lies between 1 and 2 of $f(x) = x^3 + 2x^2 + 10x - 20$ using the Regula-Falsi method.

   (c) Determine the root of the given equation $x^2 - 3 = 0$ using Bisection Method.

   (d) A real root of the equation $f(x) = x^3 - 5x + 1 = 0$ lies in the interval (0, 1). Perform Secant Method for finding root.

   (e) What are iterative methods and how do they differ from direct methods?

3.   Answer any *two* questions: $10 \times 2 = 20$

   (a) Solve the following system of equations using Gauss-Seidel iterative method
   $$8x - y + z = 18$$
   $$2x + 5y - 2z = 3$$
   $$x + y - 3z = -6$$

   (b) Solve the following equations using Jacobi's iteration method
   $$28x + 4y - z = 32$$
   $$x + 3y + 10z = 24$$
   $$2x + 17y + 4z = 35$$

   (c) Using Runge-Kutta method of fourth order, solve $\dfrac{dy}{dx} = \dfrac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2, 0.4$

   (d) Solve the following set of equations by Gauss Elimination method:
   $$x + 3y + 10z = 24$$
   $$2x + 17y + 4z = 35$$
   $$28x + 4y - z = 32$$

——×——