'समानो मन्त्रः समितिः समानी'

UNIVERSITY OF NORTH BENGAL

BCA Honours 5th Semester Examination, 2022

DSE-P2-BACHELOR OF COMPUTER APPLICATION (54)

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.
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 (BCADSE4)

OPERATIONAL RESEARCH

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

   (a) What are the limitations of graphical method in linear programming?

   (b) Define Duality in LPP.

   (c) Define Artificial Variable.

   (d) If there are four decision variables in an LPP, which method will you use to find an optimal solution?

   (e) Define Decision variable.

   (f) Write a necessary and sufficient condition for the existence of a feasible solution to the general transportation problem.

   (g) What is PERT?

   (h) What happens to a basic feasible solution of a transportation problem if one or more basic variables assume a zero value?

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

   (a) Use the graphical method to solve the following LP problem:

   Minimize $Z = 40x_1 + 36x_2$

   Subject to: $5x_1 + 3x_2 \geq 45$

   $x_1 \leq 8 \quad x_2 \leq 10$

   $x_1, x_2 \geq 0$

   (b) Write the linear program formulation of a transportation problem.

   (c) A company manufactures two products A and B. Each unit of B takes twice as long to produce as one unit of A and if the company were to produce only A it would have time to produce 2000 units per day. The availability of the raw material is sufficient to produce 1500 units per day of both A and B combined. Product B requiring a special Ingredient only 600 units can be made per day. If A fetches a profit of Rs. 2 per unit and B a profit of Rs. 4 per unit, formulate the optimum product minimum.

(d) Obtain an initial basic feasible solution to the following transportation problem using the North-West Corner Rule.

	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	

(e) For an activity with optimistic time of completion 3 days, pessimistic time of completion 5 days and most probable time of completion 4 days, find its expected time of completion and variance of the job time.

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

(a) Solve the following problem by simplex method

Minimize $Z = x_1 - 3x_2 + 2x_3$

Subject to the constraints: $3x_1 - x_2 + 2x_3 \le 7$

$-2x_1 + 4x_2 \le 12$,

$-4x_1 + 3x_2 + 8x_3 \le 10$,

$x_1, x_2, x_3 \ge 0$

(b) A company has three production facilities S_1, S_2 and S_3 with production capacity of 7, 9 and 18 units (in 100s) per week of a product, respectively. These units are to be shipped to four warehouses D_1, D_2, D_3 and D_4 with requirement of 5, 8, 7 and 14 units (in 100s) per week, respectively. The transportation costs (in rupees) per unit between factories to warehouses are given below. Obtain an optimal solution.

	D_1	D_2	D_3	D_4	Capacity
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	34

(c) Draw the A project consists of seven activities for which the relevant data are given below:

Activity	**Preceding activities**	**Duration (days)**
A	—	4
B	—	7
C	—	6
D	A, B	5
E	A, B	7
F	C, D, E	6
G	C, D, E	5

(i) Draw the network.

(ii) Identify the critical path and find the project completion time.

(d) A company has 4 machines to do 3 jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given below. Determine the job assignments which will minimize the total cost.

$$\begin{bmatrix} 18 & 24 & 28 & 32 \\ 8 & 13 & 17 & 18 \\ 10 & 15 & 19 & 22 \end{bmatrix}$$

DSE54:E2 (BCADSE5)

COMBINATORIAL OPTIMIZATION

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

(a) Define a convex function.

(b) Define Duality in LPP.

(c) What are the applications of Integer programming?

(d) Define local optima with respect to optimization.

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

(f) Are convex functions continuous?

(g) What are convex sets?

(h) "It is difficult to find the optimum value with a nonlinear objective function." True or False?

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

(a) Explain the differences between local and global optima taking an example.

(b) Discuss the cutting plan method for optimization.

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

(d) Use simplex method to solve the following LP problem

Maximize $Z = x_1 + x_2 + 3x_3$

Subject to $3x_1 + 2x_2 + x_3 \le 3$

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

$x_1, x_2 \ge 0$

(e) What is degeneracy? How can it be solved?

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

(a) Discuss the branch and bound technique to solve the travelling salesman problem with an example.

(b) Explain the steps to solve a LPP problem by Simplex algorithm with an example.

(c) Solve the following problem by simplex method

Minimize $Z = x_1 - 3x_2 + 2x_3$

Subject to the constraints: $3x_1 - x_2 + 2x_3 \le 7$,

$-2x_1 + 4x_2 \le 12$,

$-4x_1 + 3x_2 + 8x_3 \le 10$,

$x_1, x_2, x_3 \ge 0$

(d) Use dual simplex method to

Maximize $Z = -3x_1 - 2x_2$

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:E3 (BCADSE6)
NUMERICAL METHODS

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

(a) How many significant digits does the floating point number 0.03140×10^3 have?

(b) Define absolute error.

(c) The relative error in an approximate solution is 0.004%. The number of significant digits in the solution that we can trust is _____.

(d) What are Eigen Values?

(e) What is the sufficient condition for Gauss-Seidel method to converge?

(f) Define round off error, with an example.

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

(a) Evaluate $\sqrt{15}$ using Newton-Raphson's formula.

(b) Deduce the Regula-Falsi formula towards approximation of the non-linear equation $f(x) = 0$.

(c) Give a concise algorithm for bisection method.

(d) Discuss the convergence of Newton-Raphson's method.

(e) Find all the eigen values of the matrix $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$.

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

(a) Solve the system of equations using Gauss-Seidel iterative methods.

$20x - y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$.

(b) Find the value of $y(1.1)$ using Runge-Kutta method of fourth order, given

$$\frac{dy}{dx} = y^2 + xy; \quad y(1) = 1$$

(c) Evaluate $\int_0^1 (x^3 + 1)dx$ using Simpson's $1/3$ rule.

(d) Find the real root of the equation $x^2 - 3x - 5 = 0$ by regula falsi method correct up to four significant figures.

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