Indian Institute of Information Technology (IIIT) Manipur
Assessment II, February 2023

Course Title: **Optimization Techniques** | Course Code: **MA301**

Semester: CSE VI | Maximum Marks: 25

Date of Examination: 22 February 2023 | Time: 60 minutes

Part A (5×2 marks = 10 marks)

Instructions

- All questions are compulsory in this part.
- If you just write True/False then you will only get 1 mark if correct. To get full credit please also explain your reasoning.

Questions

Write whether the following statements are true or false. In each case explain your reasoning.

1. If the ith constraint in the primal is of $\geq$ type then the ith variable in the dual is also of $\geq$ type.
2. If the primal has no feasible solution but the dual has feasible solution then the dual has unbounded solution.
3. The following matrix is unimodular: $\begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \end{pmatrix}$.
4. Every loop (as defined for the symbolic matrix in the transportation problem) must have an even number of cells.
5. The following matrix is a doubly stochastic matrix: $\begin{pmatrix} 0 & 1 & 0 \\ 1 & -1 & 1 \\ 0 & 1 & 0 \end{pmatrix}$.

Part B (3×5 marks = 15 marks)

Instructions

- Question 6 is compulsory in this part. For questions 7 and 8, you can choose to do either part (a) or part (b).
- If you do both parts for a question then marks will be awarded only for the first answered part (which is not crossed-out), even if the solution is not complete.

Questions

6. Find the starting basic feasible solutio (bfs) using Vogel's Approximation Method for the following transportation tableau:

	13	18	14
10	2	1	4
15	6	3	2
20	4	2	3

Mention clearly the steps you are following and the resulting bfs that you obtain.

7. Explain mathematically how you can convert an unbalanced transportation problem into a balanced transportation problem:

   (a) if $\sum_{i=1}^{m} a_i > \sum_{j=1}^{n} b_j$.

   OR

   (b) if $\sum_{i=1}^{m} a_i < \sum_{j=1}^{n} b_j$.

8. (a) Explain mathematically with details the stopping criterion or, the optimality conditions for the balanced transportation problem.

   OR

   (b) Mention the mathematical steps required to implement the Hungarian algorithm. Make sure you write down all relevant details, including definitions of terms used.