Indian Institute of Information Technology (IIIT) Manipur
Re-Assessment I, March 2023

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

Semester: CSE VI Maximum Marks: 25

Date of Examination: 10 March 2023 Time: 60 minutes

Part A (5×2 marks $= 10$ marks)

Instructions

- All questions are compulsory in this part.

Questions

1. Explain what is rank of a matrix with a suitable (non-trivial) example.
2. Mention four advantages of the revised simplex method over the usual simplex method.
3. Explain what is cycling in the simplex method.
4. Define the inverse of a matrix and write a formula of the inverse of a matrix using the cofactors of the matrix.
5. If $B_R = \begin{pmatrix} 1 & -c_B^T \\ 0 & B \end{pmatrix}$, then prove that $B_R^{-1} = \begin{pmatrix} 1 & c_B^T B^{-1} \\ 0 & B^{-1} \end{pmatrix}$.

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. Verify whether the following problem is unbounded or bounded?
Maximize $2x_2 + x_3$ subject to $x_1 - x_2 \leq 5, -2x_1 + x_2 \leq 3, x_2 - 2x_3 \leq 5$ and $x_1, x_2, x_3 \geq 0$.
7. (a) Explain mathematically (with all relevant details), the stopping criterion or optimality in the simplex method.

OR

(b) Use the simplex method to determine a solution of the following set of linear equations:

$$x + y = 4$$
$$2x + y = 10.$$

8. (a) Solve the following LPP: Maximize $a + 2b + 3c + \cdots + 26z$ subject to

$$\begin{aligned} a + b + \cdots + z &\le 1 \\ b + \cdots + z &\le 2 \\ &\vdots \\ z &\le 26 \\ a, b, \ldots, z &\ge 0. \end{aligned}$$

OR

(b) A set S is called convex is for $0 \le \ell \le 1$ and $x, u \in S$, we have $\ell x + (1-\ell)u \in S$. Prove that, for a standard LPP the feasible region is a convex subset of $\mathbb{R}^n$.