Indian Institute of Information Technology (IIIT) Manipur
Assessment I, January 2023

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

Semester: CSE VI Maximum Marks: 25

Date of Examination: 24 January 2023 Time: 60 minutes

Part A (5×2 marks = 10 marks)

Instructions

- All questions are compulsory in this part.
- Question 4 has two parts, each part carries 1 mark. Question 5 has three parts in the answer, writing only one part will fetch 0.5 marks, and writing only two parts will fetch 1.5 marks.

Questions

1. Write down the standard form of an LPP using matrix notation. Explain all quantities or notations that you use.
2. Write down the simplex tableau of the LPP that you described in the previous question.
3. Why is it sufficient to consider only maximization (or, minimization) problems and not both type of problems while studying the simplex method?
4. What do we mean when we say a set of n vectors, $\{v_1, v_2, \ldots, v_n\}$ are linearly independent in a vector space V over the field F? Write down three linearly independent vectors in $\mathbb{R}^3$.
5. Write down the title, author and publisher of any book that you are following for this course. (*This need not be the recommended textbook for the course.*)

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. Write down the Simplex algorithm, either as a step by step process or as a flowchart. Briefly explain what each step does/means.
7. Solve the following LPP: **Max** $z = 3x_1 + 2x_2$ **subject to** $2x_1 + x_2 \leq 18, 2x_1 + 3x_2 \leq 42, 3x_1 + x_2 \leq 24, x_1 \geq 0, x_2 \geq 0$, using
   (a) Graphical method,
   OR
   (b) Simplex algorithm.

8. Solve any one of the following problems:

   (a) Company A produces three different products X, Y and Z. The time required for manufacturing, quality control and packaging for these products is given in Table 1 below (the times are given in hours per product). How many of each type of products should be produced to obtain a maximum profit?

Process	Product X	Product Y	Product Z	Total Time Available
Manufacturing	1	2	1.5	$12,000$
Quality Control	$\frac{2}{3}$	$\frac{2}{3}$	1	$4,600$
Packaging	0.5	$\frac{1}{3}$	0.5	$2,400$
Profit	11	16	15	–

Table 1: Question 8(a)

   (b) Company A advertises its products in television, radio, and newspapers. The costs and estimates for audience coverage are given in Table 2 below. The local newspaper limits the number of weekly advertisements from a single company to ten. Moreover, in order to balance the advertising among the three types of media, no more than half of the total number of advertisements should occur on the radio, and at least 10%. should occur on television. The weekly advertising budget is INR $18,200$. How many advertisements should be run in each of the three types of media to maximize the total audience?

	Television	Newspapers	Radio
Cost per advertisement	INR $2,000$	INR 600	INR 300
Audience per advertisement	$100,000$	$40,000$	$18,000$

Table 2: Question 8(b)