University of Kelaniya – Sri Lanka
Centre for Distance & Continuing Education
Bachelor of Science (General) External
First year second semester examination - 2024 (2026 April)
(New Syllabus)
Faculty of Science

Statistics
STAT 17542- Optimization I

No. of Questions: **Four (04)** No. of Pages: **Two (02)** Time: **Two (02) Hours**

Answer **All** questions.

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1. *(a)* Describe briefly the following terms used in Linear Pragramming:
   (i) A Feasible Solution, *(ii)* Feasible Region, *(iii)* Alternative Optima.

   (b) A farmer has 10 hectares of land and wishes to cultivate rice and corn. Each hectare of rice requires 2 units of water and 3 units of fertilizer, while each hectare of corn requires 1 unit of water and 2 units of fertilizer. The available resources are 16 units of water and 24 units of fertilizer. The profit from rice and corn is Rs. 50 per hectare and Rs. 40 per hectare, respectively. The farmer aims to maximize his total profit by optimally allocating his land

   (i). Formulate the above problem as a Linear Programming Problem.
   (ii). Using the Graphical Method, find how the farmer allocates his land optimally to maximize his profit?

2. *(a)* Explain in what situations the Big-M method is used for solving Linear Programming problems.
   (b) How do you recognize a degenerate or infeasible solution when processing the Big-M Algorithm?

(c) Consider the following Linear Programming problem:

$$\begin{aligned} \text{Maximize } Z &= 5x_1 + 4x_2 \\ \text{Subject to: } & x_1 + x_2 \geq 5 \\ & 2x_1 + x_2 \leq 8 \\ & x_1 + 3x_2 = 9 \\ & X_1, X_2 \geq 0 \end{aligned}$$

Solve the above problem using Big-M Simplex Method.

3. *(a)* Briefly explain the process of Two-Phase Simplex Algorithm.
   (b) Find the optimal solution to the following Linear Programming problem by applying Two -Phase Simplex Algorithm.

$$\begin{aligned} &Maximize\ Z = 3x_1 - x_2 \\ &subject\ to \quad 2x_1 + x_2 \geq 2 \\ &\qquad\qquad x_1 + 3x_2 \leq 2 \\ &\qquad\qquad x_2 \leq 4 \\ &\qquad\qquad x_1, x_2 \geq 0 \end{aligned}$$

4. *(a)* State the differences between the Simplex Algorithm and Dual Simplex Algorithm.
   (b) Consider the following Linear Programming problem:

$$\begin{aligned} &Minimize\ Z = 3x_1 + 2x_2 \\ &subject\ to \quad 3x_1 + x_2 \geq 3 \\ &\qquad\qquad 4x_1 + 3x_2 \geq 6 \\ &\qquad\qquad x_1 + x_2 \leq 3 \\ &\qquad\qquad x_1, x_2 \geq 0 \end{aligned}$$

Find the optimal solution to above problem using Dual Simplex Method.

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