University of Kelaniya – Sri Lanka
Centre for Distance & Continuing Education
Bachelor of Science (General) External
First year second semester examination - 2023 (June 2025)
(New Syllabus)
Faculty of Science

Statistics
STAT 17542- Optimization

No. of Questions: **Four (04)** No. of Pages: **Two (02)** Time: **Two (2) Hours**

Answer **All** questions.

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1. *(a)* Describe briefly the following terms used in Optimization Theory:
(i) A Solution, *(ii)* Feasible Region, *(iii)* Feasible Solution.

(b) A bakery produces two types of cookies: chocolate chip and caramel. The bakery anticipates daily demand for a minimum of 80 caramelized & 120 chocolate chip cookies. Due to a lack of raw materials and labor, the bakery can produce 120 caramel cookies and 140 chocolate chip cookies daily. For the bakery to be viable, it must sell a minimum of 240 cookies each day. Every chocolate chip cookie served generates Rs. 1.50 in profit, whereas each caramel biscuit generates Rs. 3.00 profit. The bakery owner wishes to maximize the daily profit.

(i). Formulate the above problem as a Linear Programming Problem.
(ii). Using Graphical Method, find how many units of each cookie should be manufactured to maximize profit?

2. *(a)* In which situation do we use Big-M method in solving Linear Programming problems? Explain.

(b) How do you recognize a degenerate or infeasible solution while using the Big-M Algorithm?

(c) Consider the following Linear Programming problem:

$$\begin{aligned} &\text{Maximize } Z = X_1 - X_2 + 3X_3 \\ &\text{Subject to: } \quad X_1 + X_2 \leq 20 \\ &\qquad\qquad\quad X_1 + X_3 = 5 \\ &\qquad\qquad\quad X_2 + X_3 \geq 10 \\ &\qquad\qquad\quad X_1, X_2, X_3 \geq 0 \end{aligned}$$

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 applying Two-Phase Simplex Algorithm.

$$\begin{aligned} &\text{Minimize } Z = X_1 + X_2 \\ &\text{Subject to: } \quad 2X_1 + X_2 \geq 4 \\ &\qquad\qquad\quad X_1 + 7X_2 \geq 7 \\ &\qquad\qquad\quad X_1, X_2 \geq 0. \end{aligned}$$

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

$$\begin{aligned} &\text{Maximize } \quad Z = -2X_1 - X_2 \\ &\text{Subject to: } \quad 3X_1 + X_2 \geq 3 \\ &\qquad\qquad\quad 4X_1 + 3X_2 \geq 6 \\ &\qquad\qquad\quad X_1 + 2X_2 \geq 3 \\ &\qquad\qquad\quad X_1, X_2 \geq 0. \end{aligned}$$

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

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