VERITAS UNIVERSITY, ABUJA
FACULTY OF NATURAL & APPLIED SCIENCES
Department of Computer and Information Technology

Rainfall, harmattan Semester
2023/2024 Academic session
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CSC 333: Computational Science and Numerical Method.

Assignment

Objective: The objective of this assignment is to develop a Linear Programming (LP) model for a real-world Operations Research (OR) problem. This assignment will challenge your ability to formulate models to optimize decision-making processes.

Due date: 27th November, 2023. Time: 11AM (in-person submission)

Submission Guidelines:

i. This assignment should be done handwritten and submitted in person
ii. Include your name, matric number, date, and course title.

Grading Criteria

i. Clear identification and understanding of the problem
ii. Depth of analysis and model formulation
iii. Creativity and feasibility of brainstormed solutions
iv. Justification for selected solution and presentation

Problem 2: Classroom Resource Allocation

A university offers three courses (Course X, Course Y, and Course Z) that require classroom space and teaching assistants. Each course has a different enrollment, classroom space requirement, and teaching assistant requirement. The university wants to allocate classrooms and teaching assistants to maximize the overall student enrollment while staying within the constraints of available classrooms and teaching assistants.

- Course X:
  - Enrollment: 50 students
  - Classroom space requirement: 2 classrooms per week
  - Teaching assistant requirement: 1 assistant

- Course Y:
  - Enrollment: 40 students
  - Classroom space requirement: 3 classrooms per week
  - Teaching assistant requirement: 2 assistants

- Course Z:
  - Enrollment: 30 students
  - Classroom space requirement: 1 classroom per week
  - Teaching assistant requirement: 1 assistant

The university has 5 classrooms and 4 teaching assistants available. Formulate a linear programming model to maximize student enrollment while respecting the constraints. Solve graphically

Problem 3: Factory Production resource Allocation

A factory produces three types of products: Product X, Product Y, and Product Z. The production process requires labor, raw materials, and machine hours. Each product has a different contribution to profit, and there are constraints on the availability of resources.

- Profit per unit:
  - Product X: $10
  - Product Y: $15
  - Product Z: $12

- Resource requirements per unit:
  - Labor: Product X requires 2 hours, Product Y requires 3 hours, and Product Z requires 1 hour.

- Raw materials: Product X requires 1 unit, Product Y requires 2 units, and Product Z requires 1.5 units.
- Machine hours: Product X requires 1 hour, Product Y requires 2 hours, and Product Z requires 1 hour.

The factory has 100 hours of labor, 50 units of raw materials, and 60 machine hours available per day. Formulate a linear programming model to maximize the daily profit while respecting the resource constraints. Solve graphically

Problem 3: Agriculture produce optimization

A farmer has 20 hectares for growing barley and swedes. The farmer has to decide how much of each to grow. The cost per hectare for barley is £30 and for swedes is £20. The farmer has budgeted £480. Barley requires 1 man-day per hectare and swedes require 2 man-days per hectare. There are 36 man-days available. The profit on barley is £100 per hectare and on swedes is £120 per hectare. Find the number of hectares of each crop the farmer should sow to maximize profits. Solve using the graphical method.

Problem 4: Distribution

A distribution firm has to transport 1200 packages using large vans which can take 200 packages each and small vans which can take 80 packages each. The cost of running each large van is £40 and of each small van is £20. Not more than £300 is to be spent on the job. The number of large vans must not exceed the number of small vans. Formulate this problem as a linear programming problem given that the objective is to minimize costs. Solve graphically

Problem 5: manufacturing and production

A company buying scrap metal has two types of scrap metal available to him. The first type of scrap metal has 30% of metal A. 20% of metal B and 50% of metal C by weight The second scrap has 40% of metal A. 10% of metal B and 30% of metal C. The company requires at least 240 kg. of metal A. 100 kg. of metal B and 290 kg. of metal C. The price per kg. of the two scraps are Rs. 120 and Rs. 160 respectively. 'Determine the optimum quantities of the two scraps to be purchased so that the requirements of the three metals are satisfied at a minimum cost. Solve graphically