Khemis Miliana University
Faculty of Science and Technology
Mathematics and Computer Science Department

جامعة جيلالي بونعامة– خميس مليانة
كلية العلوم والتكنولوجيا
قسم الرياضيات و الاعلام الالي

Module : Operations Research 1

Responsible: Dr. I. Ait Abderrahim

Tutorial sheet 2

Problem: Company production optimization

A company owns two flour mills viz. A and B, which have different production capacities for high, medium and low quality flour. The company has entered a contract to supply flour to a firm every month with at least 8, 12 and 24 quintals of high, medium and low quality respectively. It costs the company Rs.2000 and Rs.1500 per day to run mill A and B respectively. On a day, Mill A produces 6, 2 and 4 quintals of high, medium and low quality flour, Mill B produces 2, 4 and 12 quintals of high, medium and low quality flour respectively. How many days per month should each mill be operated in order to meet the contract order most economically.

Task: 1. Solve the problem using python programming language.

2. Run the same problem with different values that you should explain in your answer. What corresponds to what?

Solution: cpp

```
#include <iostream>

int main() {
   const int costA = 2000;
   const int costB = 1500;

   // Contractual requirements
   const int highRequirement  = 8;
   const int mediumRequirement  = 12;
   const int lowRequirement  = 24;

   int minCost = INT_MAX;
   int optimalDaysA, optimalDaysB;

   // Brute-force search within a reasonable range (adjust as needed)
   for (int daysA = 0; daysA <= 10; ++daysA) {
      for (int daysB = 0; daysB <= 10; ++daysB) {
         // Production from each mill
         int productionA  = 6 * daysA + 2 * daysB;
         int productionB  = 2 * daysA + 4 * daysB;
         int productionC = 4 * daysA + 12 * daysB;

         // Check if the production meets the requirements
         if (productionA >= highRequirement  && productionB >= mediumRequirement  && productionC
>= lowRequirement)  {
            // Calculate the total cost
            int totalCost = costA * daysA + costB * daysB;
```

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```
            // Update optimal solution if the cost is lower
            if (totalCost < minCost) {
                minCost = totalCost;
                optimalDaysA = daysA;
                optimalDaysB = daysB;
            }
        }
    }
}

// Print the results
std::cout << "Optimal number of days for Mill A: " << optimalDaysA << std::endl;
std::cout << "Optimal number of days for Mill B: " << optimalDaysB << std::endl;
std::cout << "Total Cost: " << minCost << std::endl;

return 0;
}
```

Solution: Python

```
from pulp import LpProblem, LpVariable, lpSum, LpMinimize

# Create a linear programming problem
model = LpProblem(name="Mill_Operation_Optimization", sense=LpMinimize)

# Decision variables
x = LpVariable(name="x", lowBound=0, cat="Integer")
y = LpVariable(name="y", lowBound=0, cat="Integer")

# Objective function
model += 2000 * x + 1500 * y, "Total_Cost"

# Constraints
model += 6 * x + 2 * y >= 8, "High_Quality_Flour_Constraint"
model += 2 * x + 4 * y >= 12, "Medium_Quality_Flour_Constraint"
model += 4 * x + 12 * y >= 24, "Low_Quality_Flour_Constraint"

# Solve the linear programming problem
model.solve()

# Print the results
print("Optimal number of days for Mill A:", int(x.value()))
print("Optimal number of days for Mill B:", int(y.value()))
print("Total Cost:", int(model.objective.value()))
```

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Correct answer: