

BA 310: Operations Research
Midterm Examination-Solutions

Question 1 (30 points)

Let X_i be one if activity i is to be frozen and zero otherwise, for $i=1, \dots, 4$.

1. The objective is to save as much cashflow as possible. Hence, the objective function will be

$$\text{Max } Z = -45000 X_1 + 66000 X_2 + 48000 X_3 + 54000 X_4 \quad (1)$$

The urgent need of 100,000 TND of cash flow is formulated as

$$45000 X_1 + 66000 X_2 + 48000 X_3 + 54000 X_4 \geq 100,000 \quad (2)$$

The firm must warrant the operation of at least 2 activities to keep in business is formulated as:

$$X_1 + X_2 + X_3 + X_4 \leq 2 \quad (3)$$

"If activity 1 or 2 is to be frozen, then activity 3 must preserve its operation" is formulated as follows:

$$X_1 + X_2 \leq 2(1 - X_3) \quad (4)$$

"If activities 1 & 2 are to be kept operational, then activity 4 must be frozen" can be formulated as:

$$1 - X_1 - X_2 \leq X_4 \quad (5)$$

Binary variables

$$X_i = 0, 1, i=1, \dots, 4 \quad (6)$$

2. Introduce a new binary variable, Y . Then, change (2) by (2)' & (2)'' where

$$45000 X_1 + 66000 X_2 + 48000 X_3 + 54000 X_4 \geq 130,000Y \quad (2)'$$

$$45000 X_1 + 66000 X_2 + 48000 X_3 + 54000 X_4 \leq 250,000Y \quad (2)''$$

Note that with $Y=1$, the saving in cashflow will be at least 130,000 from (2)'.
Otherwise, (2)'' will force the saving to be zero.

Question 2 (20 points)

Tic the correct statement in each of the following assertions

1. In a branch & bound method, we branch on
 - a. Any non-integer variable
 - b. Specific non-integer variables
2. When branching, the objective value of the relaxed LP's
 - a. Improves
 - b. Degrades
 - c. It depends on the particular case at hand
3. When we encounter an upper bound
 - a. An optimal solution is found
 - b. A feasible solution is found
 - c. An update of upper bounds can be made
 - d. None of the above
4. We stop branching when
 - a. An integer solution is found
 - b. An optimal solution is found
 - c. An infeasible solution is found
 - d. It is no more possible to find an optimal solution
 - e. Any of the above holds

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