

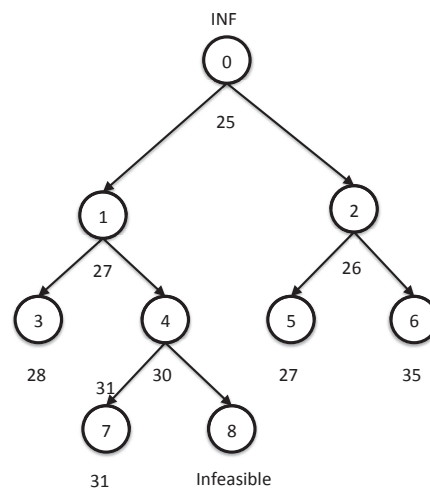
Enseignant: M. Bierlaire

Optimisation en nombres entiers

Question 1:

(À résoudre sur le tableau par le chargé de cours)

Consider an enumeration tree (in a minimization problem). In this tree, each node is identified by a number. Moreover, each node contains information about its lower bound which is represented below the node. Some of the nodes have also an upper bound value (a feasible solution) that is presented above the node.



- Express the tightest possible lower and upper bound on the optimal value.
- Which nodes can be pruned and which ones must be explored further in the tree.

Question 2:

(À résoudre par les étudiants en classe)

Soit le problème d'optimisation mixte en nombres entiers suivant:

$$\begin{array}{llllll}
 \min & x_1 & + & 3x_2 & & \\
 \text{s.c.} & x_1 & + & 5x_2 & \geq & 8 \\
 & x_1 & + & 2x_2 & \geq & 4 \\
 & & & x_1, x_2 & \geq & 0 \\
 & & & x_1 & \text{entier} &
 \end{array}$$

- En utilisant la méthode graphique, trouvez toutes les solutions optimales.
- quelle est la différence entre la valeur de la fonction d'objective de la solution optimale de ce problème et la valeur du problème relaxé?

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Question 3:

(À résoudre par les étudiants en classe s'il y a le temps, sinon à résoudre à la maison)

The coach of a swim team needs to assign swimmers to a 200-meters medley relay team to send to the Junior Olympics. Since most of his best swimmers are very fast in more than one stroke, it is not clear which swimmer should be assigned to each of the four strokes. The five fastest swimmers and the best time (in seconds) they have achieved in each of the strokes (for 50 meters) are presented in the following table: (You should keep in mind that each style should be assigned to exactly one swimmer)

Stroke	Carl	Chris	David	Tony	Ken
Backstroke	37.7	32.9	33.8	37.0	35.4
Breaststroke	43.4	33.1	42.2	34.7	41.8
Butterfly	33.3	28.5	38.9	30.4	33.6
Freestyle	29.2	26.4	29.6	28.5	31.1

1. Present the mathematical formulation of this problem
2. Transform the above model into the assignment problem (Problème d'affectation) and represent its mathematical model
3. Find the optimal solution and express the optimal assignment