INSTITUTO SUPERIOR DE AGRONOMIA

Test of Applied Operations Research - 30 May 2018

Number: Name:

---

1. (7val.) As the leader of a wildlife exploration venture, you would like to explore exactly four out of eight possible sites in order to maximize the annual profit. The sites are labeled as s_1, s_2, s_3, s_4, s_5, s_6, s_7 and s_8, and the expected associated annual profits (in 10^4 €) are given in the table below.

Site	s_1	s_2	s_3	s_4	s_5	s_6	s_7	s_8
Profit (10^4 €)	3	4	6	4	2.5	7	2	4.5

a) Formulate this problem in integer linear programming.

b) Find an optimal solution of the problem and calculate the corresponding profit.

c) Formulate constraints for the following conditions:

i) Sites s_3 and s_6 can not be explored simultaneously.

ii) If site s_2 is explored, then site s_5 must also be explored.

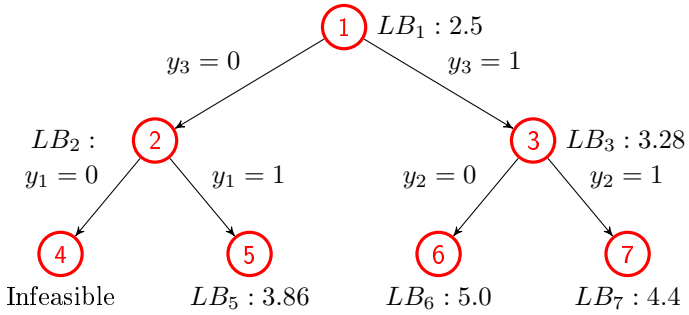
iii) If site s_3 and s_4 are both explored, then site s_7 must also be explored.

iv) If site s_3 and s_6 are both explored, then site s_8 can not be explored.

2. (3val.) Consider the mixed integer linear programming model

$$
\begin{array}{lrcl}
\text{Min} & Z = -2x + 3y_1 + 2y_2 + 3y_3 & & \\
\text{s.t.} & x + y_1 + y_2 + y_3 & \geq & 2 \\
& 10x + 5y_1 + 3y_2 + 4y_3 & \leq & 10 \\
& x & \geq & 0 \\
& y_1, \quad y_2, \quad y_3 & \in & \{0, 1\}
\end{array}
$$

and an incomplete branch-and-bound for the model, where node 1 represents its linear relaxation (LB_i is the objective function value of the optimal solution obtained at node i, displayed in the table below).



Node #	x	y_1	y_2	y_3
1	0.5	0	1	0.5
2	0.4	0.6	1	0
3	0.43	0	0.57	1
4	-	-	-	-
5	0.29	1	0.71	0
6	0.2	0.8	0	1
7	0.3	0	1	1

a) Compute LB_2.

b) Which nodes can be pruned?

c) Between which values does the objective function value of an optimal solution of the model lie?