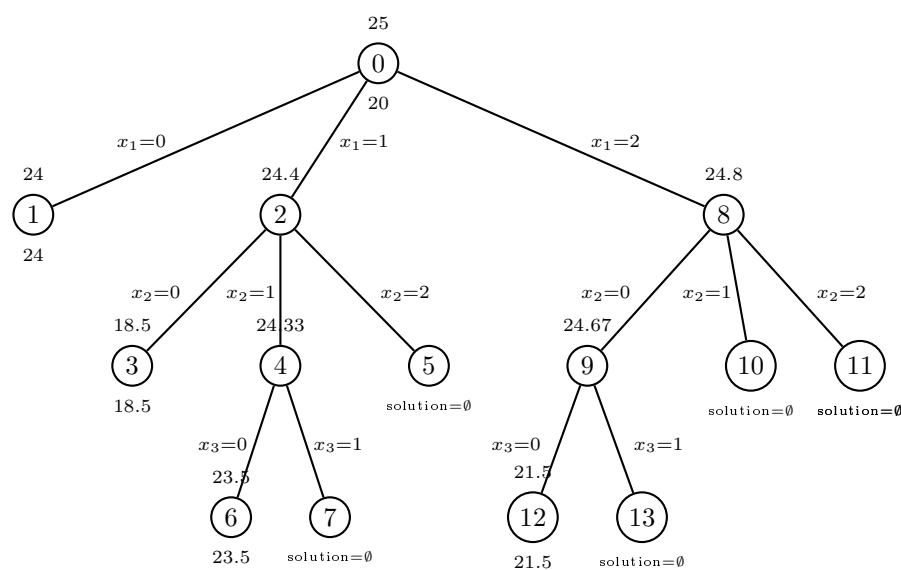# Solutions to Exercise Set 7

Problem 1

a) The best upper bound is 31. The best lower bound is 27 (node 5 with a lower bound of 27 is a priori the most interesting node to explore)

b) Node 6 can be discarded, nodes 3 and 5 need to be explored.

Problem 2

It is quite obvious that $x_1, x_2 \in \{0,1,2\}$. By solving the relaxed LP for each node, we get the following enumeration tree:

The optimal value is 24 and corresponds to node 1. The optimal solution is given by $x_2 = 2$ and $x_1 = x_3 = x_4 = 0$.

Problem 3

Within each node, we put first the order of the visit of the node and then the remaining amount of money to invest. Branch and Bound resolution:
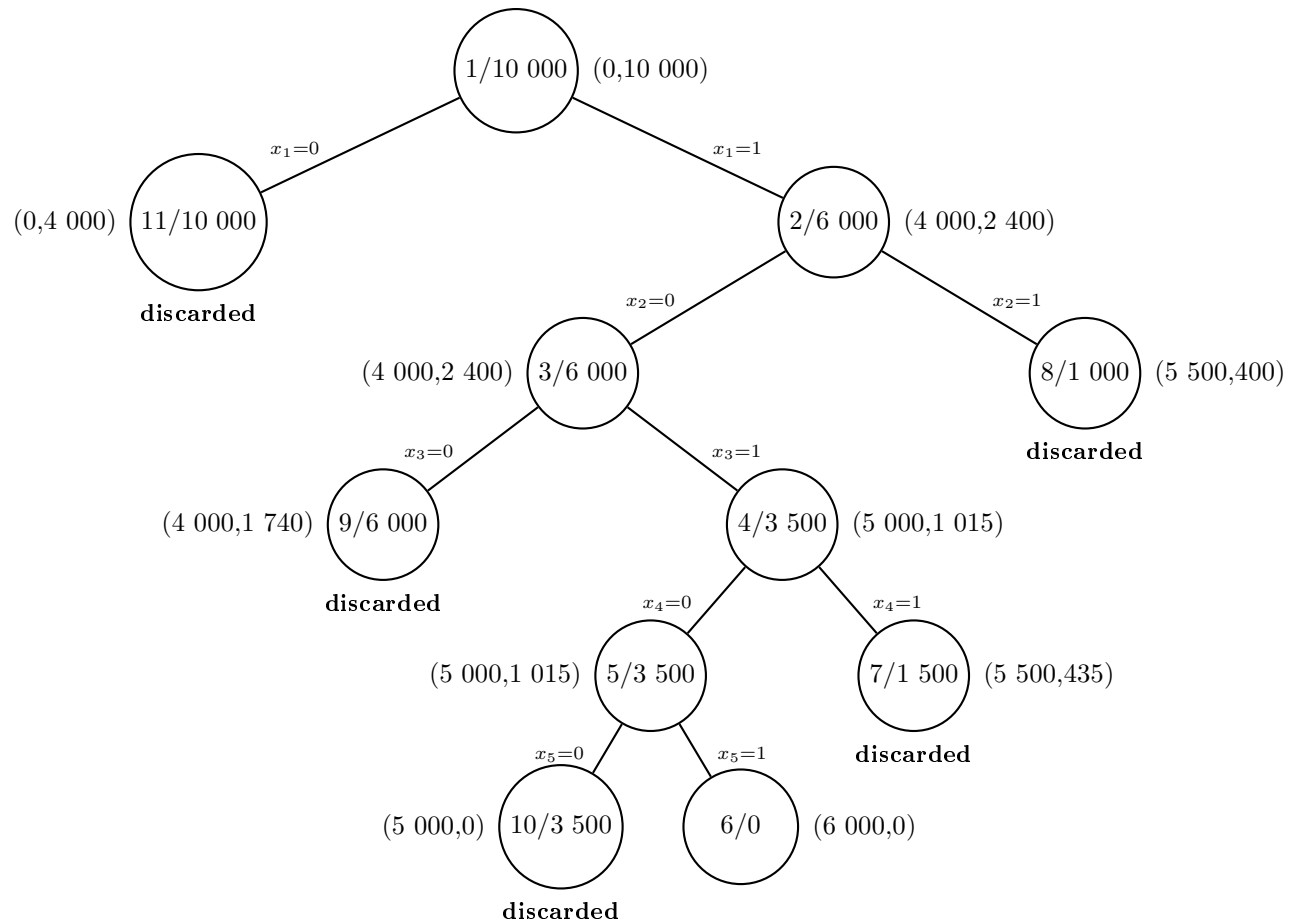
To maximize his profit, the investor needs to purchase items 1,3, and 5. In 1-year, he can sell these items for 10 000 + 6 000 = 16 000 francs.

Problem 4

Let's start with node 1. As we branch on $x_2 = 0$, then the problem we have to solve to find an upper bound is $max\ 9x_1$ subject to $1 \leq x_1 \leq 6$. The solution of this relaxation is $x_1 = 6$, $x_2 = 0$ and has a value of 54. This is also a feasible integer solution of the problem.

Let's continue with node 3. As the upper bound is 51 2/3, this node can be discarded.

The remaining node is node 4. This problem has no feasible solution. We conclude that the optimal solution is $x_1 = 6$ and $x_2 = 0$ and its value is 54.