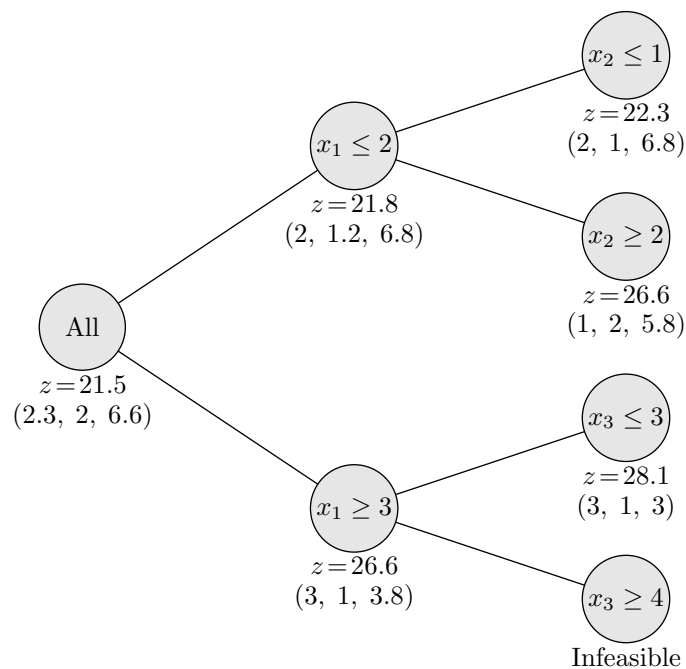


Exercise 12

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Assume that we are solving a pure integer program with three decision variables. The goal is to minimize the objective function and the branch-and-bound method is used to solve the problem.

At an intermediate stage we have the branching tree as shown below. Each circle represents the LP relaxation of a sub-problem. The additional constraint of each sub-problem is shown within each circle, the optimum values and optimum solutions of the LP relaxations are shown under each circle.



- Give, if possible, an upper bound for the optimum value that is as tight as possible. Explain why this bound holds or why it is not possible to give an upper bound.
- Give, if possible, a lower bound for the optimum value that is as tight as possible. Explain why this bound holds or why it is not possible to give a lower bound.