UNIT V

BACKTRACKING AND BRANCH-AND-BOUND

Backtracking – N-Queens Problem – Hamiltonian Circuit Problem – Subset Sum Problem – Branch-and- Bound – Travelling Salesman Problem

Finding Hamiltonian Circuits in Graphs

A Hamiltonian circuit or tour of a graph is a path that starts at a given vertex, visits each vertex in the graph exactly once, and ends at the starting vertex. Some graphs do not contain Hamiltonian circuits.

- Problem: Find a Hamiltonian circuit in a graph G = (*V*,*E*)
  - Sub-problem: Does G contain a Hamiltonian circuit?
  - No known easy algorithm for checking this…
- One solution: Search through *all paths* to find one that visits each vertex exactly once
  - Can use your favorite graph search algorithm (DFS!) to find various paths
- This is an *exhaustive search* ("brute force") algorithm
- Worst case → need to search all paths How many paths??

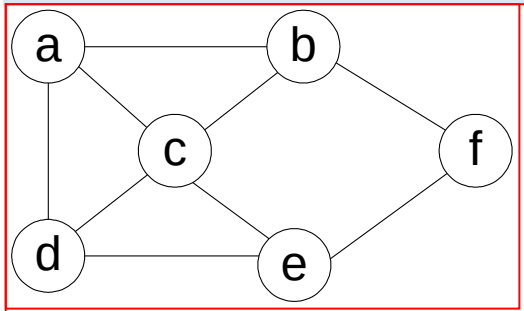
Hamilton Circuits and Paths

- A ciruit that visits every vertex of a graph is called a Hamilton circuit.
- A path that visits every vertex of a graph is called a Hamilton path.

The three Rules

- Rule1. If a vertex x has degree 2, both edges incident to x must be part of any Hamilton circuit.
- Rule 2. No proper subcircuit can be formed when building a Hamilton circuit.
- Rule 3. Once the Hamilton circuit is required to use two edges at a vertex x, all other edges incident to x must be removed from consideration.

Example: Hamiltonian Circuit Problem



Subset Sum Problem

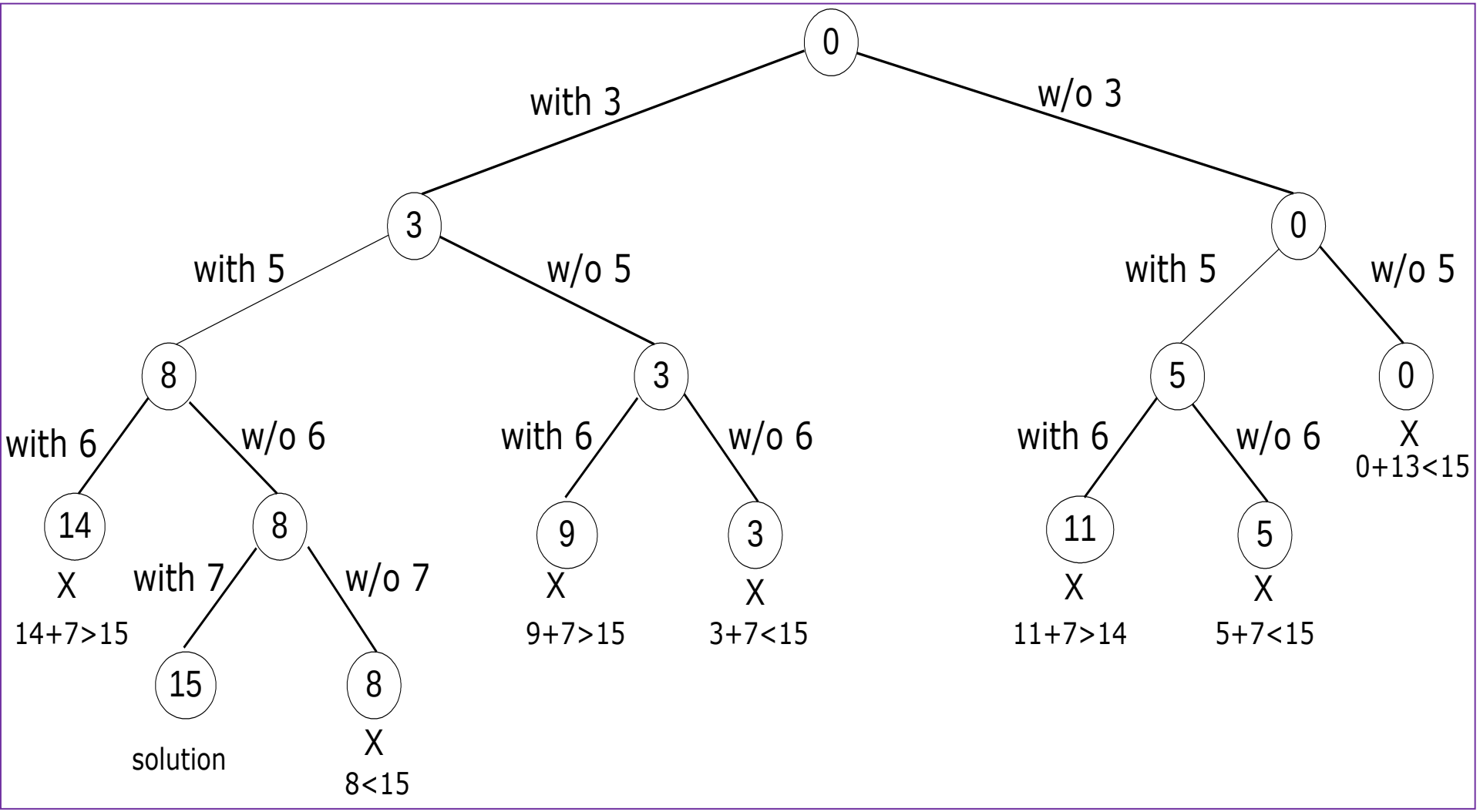
- As our last example, we consider the subset-sum problem: find a subset of a given set A = {a1, . . . , an} of n positive integers whose sum is equal to a given positive integer d.

- For example, for A = {1, 2, 5, 6, 8} and d = 9 there are two solutions: {1, 2, 6} and {1, 8} Of course, some instances of this problem may have no solutions.

- It is convenient to sort the set's elements in increasing order. So, we will assume that $a1 < a2 < \ldots < an$.

- The state-space tree can be constructed as a binary tree like that in For the instance $A = \{3, 5, 6, 7\}$ and $d = 15$.

Example: Subset Sum Problem {3,5,6,7} sum=15




Thank You