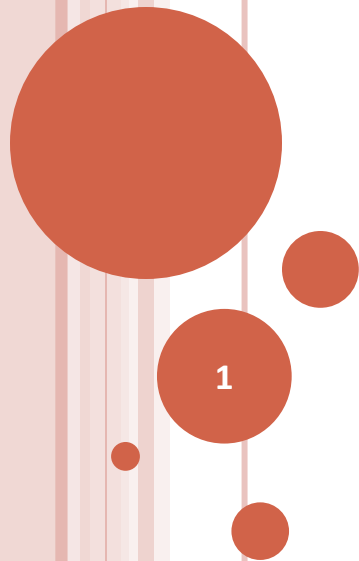


ALGORITHMS - COMPLEXITY

Structure of problems:

What makes problems hard?

Examples



STRUCTURE OF PROBLEMS – PATH PROBLEMS

- Shortest Path problem is solvable in polynomial time:
 - Dijkstra's algorithm
- Longest Path problem is NP-complete
 - Exercises:
 1. Provide an input instance for this problem for which Dijkstra's algorithm – naively modified – will fail.
 2. Argue that **Greedy Choice and Optimal Sub-structure** properties do not hold for this problem.
 3. Provide an intuitive explanation of why this problem is much more difficult than the Shortest Path problem

STRUCTURE OF PROBLEMS – NETWORK PROBLEMS

- Broadcast Path problem is tractable
 - There exist polynomial time algorithms for Minimal Spanning Trees.
- Multicast Path (Steiner Tree) problem is **NP-Complete**
 - Exercises:
 1. Provide input instances for this problem for a typical MST algorithm – naively modified – will fail.
 2. Argue that **Greedy Choice and Optimal Sub-structure** properties do not hold for this problem.
 3. Provide an intuitive explanation of why this problem is much more difficult than the MST problem