

Problem Set for Brute Force Design Strategy

1. For the N Queens Problem
 - a. An input instance to this problem is specified by ____
 - b. A solver's decision is to ____
 - c. A solver needs to make ____ decisions
 - d. A decision has ____ alternatives
 - e. Give an example of a decision and one of its alternatives
 - f. Give an example of a combo of decisions, and describe what it means in terms of the problem
 - g. How many decision combos are there for this problem?
 - h. How would you systematically generate the decision combos, one at a time?
 - i. What would a solver check to verify whether a decision combo is a solution?
2. For the 0-1 Knapsack Problem
 - a. An input instance to this problem is specified by ____
 - b. A solver's decision is to ____
 - c. A solver needs to make ____ decisions
 - d. A decision has ____ alternatives
 - e. Give an example of a decision and one of its alternatives
 - f. Give an example of a combo of decisions, and describe what it means in terms of the problem
 - g. How many decision combos are there for this problem?
 - h. How would you systematically generate the decision combos, one at a time?
 - i. What would a solver check to verify whether a decision combo is feasible?
 - j. What would a solver check to verify whether a decision combo is a solution?
 - k. Would the runtime of a brute force solver for this problem be polynomial?
3. For the Traveling Salesperson Problem (TSP), seeking to find a minimum cost tour
 - a. An input instance to this problem is specified by ____
 - b. A solver's decision is to ____
 - c. A solver needs to make ____ decisions
 - d. A decision has ____ alternatives
 - e. Give an example of a decision and one of its alternatives
 - f. Give an example of a combo of decisions, and describe what it means in terms of the problem
 - g. How many decision combos are there for this problem?
 - h. What would a solver check to verify whether a decision combo is feasible?
 - i. What would a solver check to verify whether a decision combo is a solution?
 - j. Would the runtime of a brute force solver for this problem be polynomial?

- k. If a brute force TSP solver takes 1 hour to run with an input graph that has 20 locations, how long would this solver take to run with an input that has 21 locations?
4. For the Sudoku Problem, with generalized rectangular boxes
 - a. An input instance to this problem is specified by ____
 - b. A solver's decision is to ____
 - c. A solver needs to make ____ decisions
 - d. A decision has ____ alternatives
 - e. Give an example of a decision and one of its alternatives
 - f. Give an example of a combo of decisions, and describe what it means in terms of the problem
 - g. How many decision combos are there for this problem?
 - h. How would you systematically generate the decision combos, one at a time?
 - i. What would a solver check to verify whether a decision combo is feasible?
 - j. What would a solver check to verify whether a decision combo is a solution?
 - k. Would the runtime of a brute force solver for this problem be polynomial?
 - l. Describe one way to make a brute force solver for this problem better than naively inefficient.
5. For the Satisfiability (SAT) Problem
 - a. An input instance to this problem is specified by ____
 - b. A solver's decision is to ____
 - c. A solver needs to make ____ decisions
 - d. A decision has ____ alternatives
 - e. Give an example of a decision and one of its alternatives
 - f. Give an example of a combo of decisions, and describe what it means in terms of the problem
 - g. How many decision combos are there for this problem?
 - h. How would you systematically generate the decision combos, one at a time?
 - i. What would a solver check to verify whether a decision combo is a solution?
 - j. Would the runtime of a brute force solver for this problem be polynomial?
 - k. Describe one way to make a brute force solver for this problem better than naively inefficient.
 - l. Explain why unsatisfiable inputs are the ones that would make a brute force SAT solver do the most work.
 - m. If a brute force SAT solver takes 1 hour to run with an input that is an unsatisfiable instance with 30 Boolean variables, how long would this solver take to run with an unsatisfiable input with 32 Boolean variables?
6. Write the crucial portions of the shift table for Horspool's String Matching Algorithm when pattern = "racecar"
7. When we imagine a search space as a tree, a node represents a ____ and the edges from a node represent the ____.

8. A brute force algorithm explores the ____ (inner nodes/leaves) of its search space.
9. What is the main difference between a breadth-first and a best-first traversal of a tree?
Which traversal (depth-, breadth- or best-first) is typically implemented recursively?