A list of problems to be solved by backtracking method.
Note that some problems have multiple variants … please send an email to our group or discuss with your lab instructor about them.

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1. Crosswords

Given a nxm matrix with forbidden positions and a list of words. Fill the matrix such that only words from the given list appear either vertically or horizontally. Find 1 solution.

2. Aquarium

In a pet store there are n types of fishes. For each type of fish we know the price and the list of compatible types. A buyer wants to populate his aquarium with a maximal number of types of fishes with no incompatibilities and by not exceeding a given amount of money. Find 1 solution.

3. Knapsack problem

Is given a knapsack of capacity M and a set of objects characterized by volume and utility (real number and shape does not matter). Find a subset of objects that have a maximal utility and whose volume does not exceed M.

4. Traveling salesman problem

There are n cities with direct connection between any of them. Distance between cities are positive numbers. Find a minimal path that starts from city 1, goes to all other cities exactly once and returns to city 1.

5. Hamiltonian path

There are n cities and some are connected. Find, if there is, a path that starts from city 1, goes to all other cities exactly once.

6. Maximal number of knights

On a nxm board place a maximal number of knights that don't check each other.

7. Minimal number of knights

Place a minimal number of knights that check each position on a nxm board.

8. Longest knight path

Find the longest path that a knight can travel on a nxm board such that each position is visited no more than 1 time.

9. Map coloring

Given a map of n countries and k colors. Find a coloring of the map such that 2 neighbor countries are not colored with the same color.

10. String of Domino pieces

Given a set of Domino pieces, find the longest string that you can construct such that second part of a piece is equal to the first part of the next one.

11. Generate decomposition

Given a value M and n coins of different values. Pay the value M using the given coins.

12. Maximal number of friends

Given a set of persons. For each person we know his list of enemies. Find the largest group of persons such that each of them is not the enemy of another person in the group.

13. Maximal number of friends in string arrangement

Given a set of persons. For each person we know his list of enemies. Construct the longest string of persons such that each 2 consecutive are not enemies.

14. Longest string in matrix

Given a matrix filled with letters. Find the longest string, containing only the same letter, which can be obtained by starting with any position and then moving horizontally and vertically (each cell can be visited no more than 1 time).

15. Numbers in circle

Given n numbers, find a placement of these numbers on a circle such that the sum of all products of 2 consecutive numbers is maximal.

16. Edge coloring

Given a graph with n nodes, find the minimal number of colors that are required to color all edges such that 2 edges sharing a vertex don't have the same color.

17. Towers of parallelepipeds

Given a set of rectangular parallelepipeds construct the highest tower such that each parallelepiped is placed on the top of a larger (or at least equal) one.

Questions? Send them to our group: