COSC1125/1127 Artificial Intelligence

School of Science (Computer Science)
RMIT University
Semester 1, 2018
A/Prof. Sebastian Sardina

Tutorial Sheet 2
Search II

Exercises

1. **From Tutorial 1.** Consider this problem: We have one 3 litre jug, one 5 litre jug and an unlimited supply of water. The goal is to get exactly one litre of water into either jug. Either jug can be emptied or filled, or poured into the other.

   For this problem give:

   (a) An appropriate data structure for representing a state.

   (b) The initial state.

   (c) The final states (there are 2).

   (d) A specification of the operators (or actions) which includes the preconditions that must be satisfied before the operator can be used and the new state generated.

   (e) What is the solution to the problem.

2. In the previous exercise, a representation for states and the full state space were developed. For the same problem, apply search strategies and note:

   - *The order in which nodes are created in memory.*
   - *The nodes that are not created in memory at all.*

   for the following search strategies:

   (a) Breadth first search with no checking for duplicate states.

   (b) Breadth first search with checking for duplicate states.

   (c) Depth first search with no checking for duplicate states.

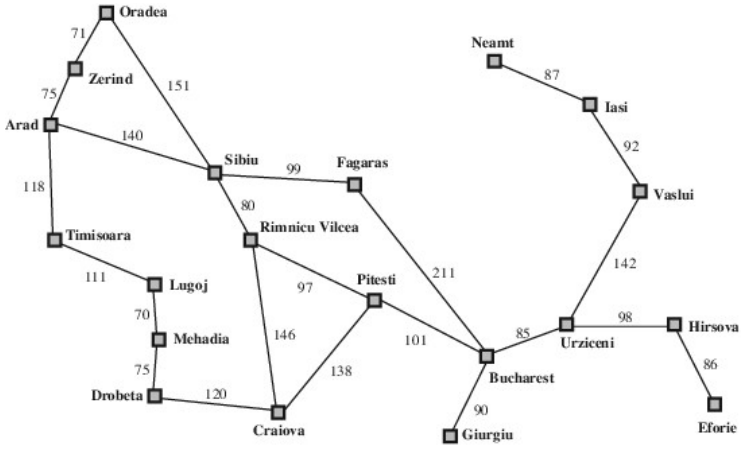
   (d) Depth first search with checking for duplicate states.

   (e) Iterative deepening with no checking for duplicate states.

   (f) Iterative deepening with checking for duplicate states.

   (g) Is bi-directional search possible for this problem?

3. Consider the problem of getting from Arad to Bucharest in Romania from Tutorial 1. Provide the part of the search space that is realized in memory and the order of node expansion if *uniform cost search* is used.



4. What are the dimensions we judge the various search algorithms? Discuss each of them for each algorithm.

5. (RN) Which of the following are true and which are false? Explain your answers.

   - Depth-first search always expands at least as many nodes as A search with an admissible heuristic.
   - $h(n) = 0$ is an admissible heuristic for the 8-puzzle.
   - A* is of no use in robotics because percepts, states, and actions are continuous.
   - Breadth-first search is complete even if zero step costs are allowed.
   - Assume that a rook can move on a chessboard any number of squares in a straight line, vertically or horizontally, but cannot jump over other pieces. Manhattan distance is an admissible heuristic for the problem of moving the rook from square A to square B in the smallest number of moves.

6. If you finish this sheet, you can start with the heuristic search algorithms in Tutorial Sheet 3. :-)

7. Finally, get your hands dirty by doing this fun Lab-Search sheet.

8. *You say more?* Lots of cool exercise in RN book, chapter 3....