Chapter 3 Exercises

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CECS 545 – Artificial Intelligence

# 3.10: Define in your own words the following terms:

## State

A state is a representation of one’s attributes and understanding.

## State Space

A state space is the space of possible states.

## Search Tree

A search tree is a collection of nodes arranged in a logical manner that improves searchability.

## Search Node

A search node is an atomic unit of a search tree.

## Goal

A goal is something that is trying to be achieved.

## Action

An action is a form of effort that alters the environment..

## Successor Function (Transition Model)

A successor function returns a list of possible reachable states within one move from a given location.

## Branching Factor

The branching factor is the number of nodes reachable by a given node.

# 3.14: Which of he 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

False. A\* is less efficient than dfs.

## H(n) = 0 is an admissible heuristic for the 8-puzzle.

True.

## A\* is of no use in robotics because percepts, states, and actions are continuous.

False. A\* is useful in robotics.

## Breadth-first search is complete even if zero step costs are allowed.

True. BFS does not require there to be step costs.

## 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.

False.

# 3.15: Consider a state space where the start state is number 1 and each state k has two successors: numbers 2k and 2k+1.

## Draw the portion of the state space for states 1 to 15.

1

2 3

4 5 6 7

8 9 10 11 12 13 14 15

## Suppose the goal state is 11. List the order in which nodes will be visited for breadth-first search, depth-limited search with limit 3, and iterative deepening search.

### BFS

1,2,3,4,5,6,7,8,9,10,11

### Depth-limited search with limit 3

1,2,4,8,9,5,10,11

### Iterative deepening

1; 12,3; 1,24,5,6,7,8,9,10,11,12,13,14,15

## How well would bidirectional search work on this problem? What is the branching factor in each direction of bidirectional search?

This would not be a great problem for bidirectional search as there is no clear distinction between each branch in a general sense such as all branches on the right being greater and all of the branches on the left being less.