

CSE 630: Artificial Intelligence

Homework 2

1. Bi-Directional Search:

- A) The n-queens problem: Bi-directional search cannot be used in this case as we do not know the final goal state required. Since a bi-directional search consists of 2 searches, one from the initial state and the other from the goal state, it cannot be used in this case
- B) The Kevin Bacon game: A bi-directional search can be used to find the solution in this case. Since we know both the initial state as well as the goal state, we can start a search from both the actors to find a path to the other.

2. Sudoku:

State Variables: The 4 x 4 matrix of the Sudoku configuration at that node.

Initial State: The 4 x 4 matrix of the Sudoku given.

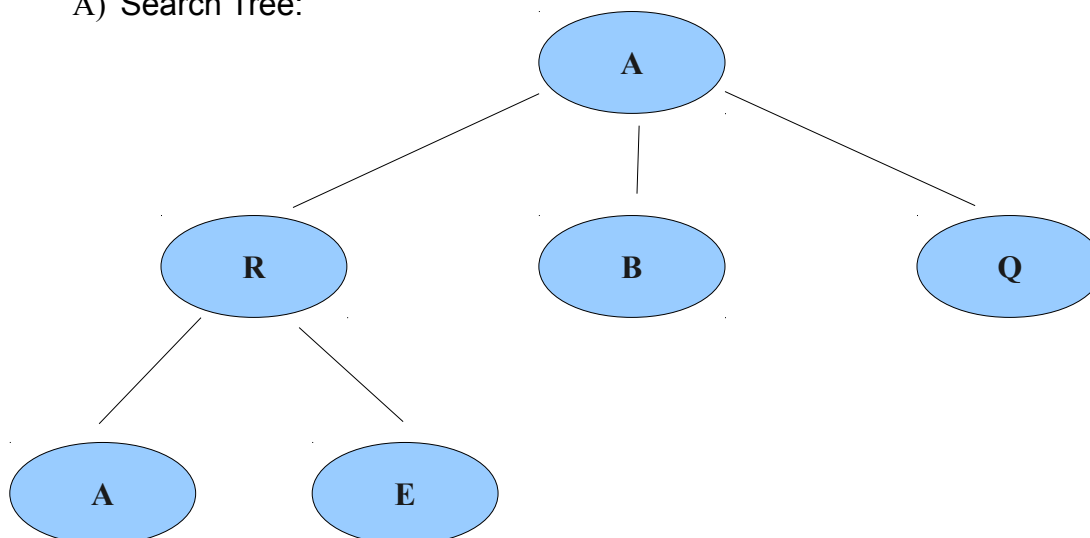
Operators: fill_next_empty_item_with_1
fill_next_empty_item_with_2
fill_next_empty_item_with_3
fill_next_empty_item_with_4

These items will only be filled if the resulting state is a valid state. Else skipped.

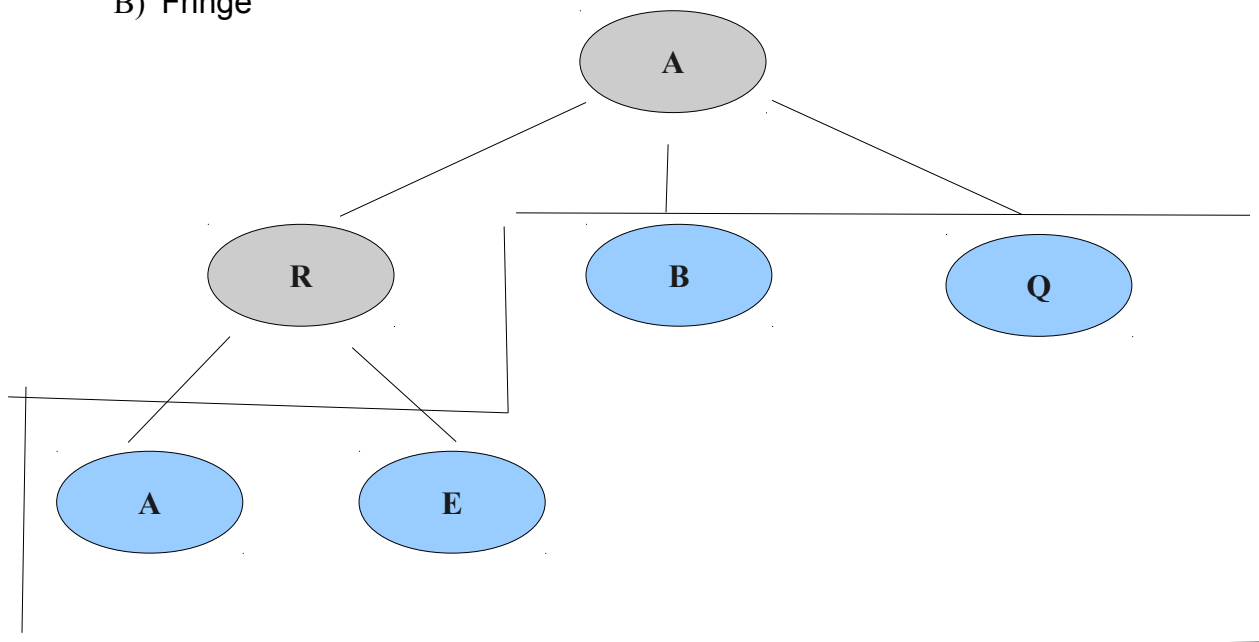
Goal Test: If the board is completely filled, we have reached our goal state. Since a completely filled board has no invalid states.

3.

A) Search Tree:



B) Fringe



C) In a Breadth first search: Node B will be expanded next.

D) In a Uniform Cost Search: Node Q will be expanded next (Because it has the lowest past cost of 4)

E) In a Depth first search: Node A will be expanded next.

4.

A) Breadth-first search is a special case of uniform-cost search :

When the path cost of every path is the same, the uniform-cost search will behave exactly like breadth first search.

B) Breadth-first search, depth-first search, and uniform-cost search are special cases of best-first search:

Best First search where the evaluation function/heuristic considered is the total path cost from the root to the current node would be equivalent to Uniform- cost search. Similarly, a breadth-first search is a best first search with the heuristic being the total path cost, but the path costs for all paths between nodes being equal.

A depth-first search can be considered a a special case of best-first search if the heuristic being considered is one where the node with the highest depth is chosen.

C) Uniform-cost search is a special case of A* search:

A* search considers both the total path cost so far as well as a heuristic function to reach the goal state. If this function would return a value of 0 for every possible node/state, the A* search would behave like a Uniform-cost search.

5. Knapsack Problem:

Objects weighing: 1,3,4,7,8,10,11 and 13
Capacity: 40

Coding for Individuals: would be an 8 bit string representing the 8 weights given. A 0 at the position indicating that the corresponding weight is not used, 1 indicating that it is not.

Fitness Function: We use the sum of the chosen weights for the fitness function. The closer the value of this is to 40, the greater the probability of being chosen for reproducing.