Homework 2

1. Compute the order in which states of the above graph are expanded and the returned path for each of these graph search algorithms:
2. Depth-first search:

Node Expansion: (Start, N, P, Goal)

Path found: Start → N → P → Goal

1. Breadth-first search:

Node Expansion: (Start, N, Q, M, P, Goal)

Path found: Start → Q → Goal

1. Uniform cost search:

Node Expansion: (Start, N(2), M(3), Q(4), P(6), Q(7), Goal(8))

Path found: Start → N → P → Goal

1. Greedy best first search (heuristic):

Node Expansion: (Start, Q(2), Goal)

Path found: Start → Q → Goal

1. A\* search (heuristic): It is admissible since the heuristic value for this path is 4, and is less than the total path traveled which is 8.

Node Expansion: (Start, N(5), P(5), Goal(2))

Path found: Start → N → P → Goal

Diagram

Description automatically generated

1. You are asked to compare different heuristics and to determine which, if any, dominate each other. You are executing search algorithms through this graph.

The shortest path length is 10 going through: S → B → D → F → G

1. Which heuristic functions are admissible among h1, h2, h3? (Heuristic ≤ Path)

H1: S, B, D, E, F, G

H2: S, B, C, D, E, F, G

H3: S, B, C, D, E, F, G

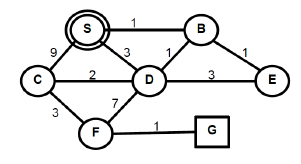
1. Which heuristic functions are consistent among h1, h2, h3? (Path ≥ Heuristic)

H1: S, B, D, E, F, G

H2: S, B, C, D, E, F, G

H3: S, B, C, D, E, F, G

Table

Description automatically generated

1. You are designing a menu for a special event. There are several choices, each represented as a variable: (A)ppetizer, (B)everage, main (C)ourse, and (D)essert. The domains of the variables are as follows:
2. (v)eggies, (e)scargot
3. (w)ater, (s)oda, (m)ilk
4. (f)ish, (b)eef, (p)asta
5. (a)pple pie, (i)ce cream, (ch)eese

Constraints:

1. Vegetarian options: The appetizer must be veggies or the main course must be pasta or fish (or both).
2. Total budget: If you serve the escargot, you cannot afford any beverage other than water.
3. Calcium requirement: You must serve at least one of milk, ice cream, or cheese.
4. Draw the constraint graph over the variables A, B, C, and D.
5. Imagine we first assign A=e. Cross out eliminated values to show the domains of the variables after forward checking.

Soda and Milk from variable B are eliminated because of constraint 2. Beef from variable C is eliminated as well because of constraint 1.

1. Again, imagine we first assign A=e. Cross out eliminated values to show the domains of the variables after arc consistency has been enforced.

Soda and Milk from variable B are eliminated because of constraint 2. Beef from variable C is eliminated as well because of constraint 1.

Apple pie from variable D is eliminated because of constraint 3.

1. Give a solution for this CSP or state that none exists.

A=v, B=s, C=p, D=i.

1. In your own words, explain why it is a good heuristic in a CSP search to choose the variable that is the most constrained but the value that is least constraining.

That way you can determine possible errors first, making sure the CSP search will be efficient and correct.

1. Programming Assignment Part I:

Text

Description automatically generatedIt returns the different values corresponding to three maps from Romania and Australia, using different search algorithms like BFS, DFS, etc. It uses these to get to whatever location the goal is in each map.

Text

Description automatically generated

This created an 8-puzzle board which then checks if its solvable with the configuration given. It then prints the movements needed to solve the puzzle.

1. Programming Assignment Part II: