CAP 4621 Artificial Intelligence

Assignment 1

Due date: January 29 (Sunday at 11:59 pm)

Problem 1 (3 points)

Answer the following questions:

(a) Give your own definition of Artificial Intelligence

Answer:

Artificial intelligence is the study and making of machines that appear to be intelligent, that is they carry out various tasks, without the help of a human user, that would give the impression of intelligence.

(b) Is AI a science, or is it engineering? Or neither or both? Explain.

Answer:

AI is both a science and engineering because in order to simulate intelligence it has to utilize various areas of science specifically those that deal with the human brain and this simulation is implemented using engineering techniques and skills.

(c) Imagine that the speed and memory of computers became 1000 larger. Which AI problems become trivial due to this increase, and which would not get any easier?

Answer: Complex mathematical problems and problems that utilize large datasets would become trivial for AIs. However, problems closer related to the mimicking of human actions/interactions would still be dominated by AIs.

Problem 2 (2 points)
Answer the following questions:

(a) Define in your own words the following terms: state, state space, search tree, search node, goal, action, transition model, and branching factor

Answer:

State – this is the representation of an instance/aspect of a problem
State Space- This is how the states of the problem are represented in the computer
Search Tree- This is a list of all possible paths resulting from a tree-search
Search Node – these are objects with their own paths that are used in the search algorithm to find path to goal.
Goal- This is the desired state set for the problem
Action- These are steps that can be taken to move between states
Transition Model- This model depicts the action done to move from each state.
Branching factor – This is the number of children the nodes of the tree has

(b) What is the difference between a world state, a state description, and a search node? Why is this distinction useful

Answer: The world state represents reality and thus will also contain information that may be useless to the problem thus making it a more complex representation of the problem than the state description's representation. The state description is the agent's representation of the world state, and it negates additionally information which the agent may deem to be irrelevant. Search nodes contain both state description and the actions taken to get there thus it contains more information than the state description. This distinction is useful because it is important to understand that with world state and state description there's information that can get lost within the translation from one state to another. Additionally with search nodes, there can be nodes with the same state but different actions were taken to arrive at that particular state thus the additional information is needed.

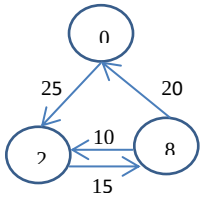
Problem 3 (15 points) (Do not use the library function)

Implement a program that inputs a weighted directed graph, and finds the shortest path between two given vertices of this graph. Use the programing language of your choice. Your program must read a graph from a given file, prompt the user to specify two vertices, and output the shortest path between them. The format of the graph encoding is as follows:

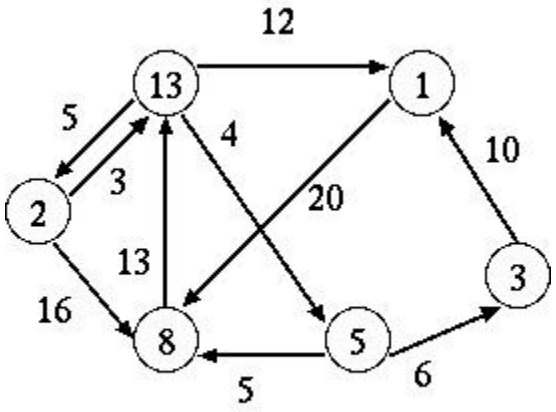
<vertex> <vertex> <weight>
<vertex> <vertex> <weight>
<vertex> <vertex> <weight>
…

Each line encodes an edge, which points from the first to the second vertex, and the weight of this edge. The vertices of the graph are denoted by natural numbers, which may not be consecutive; for example, the vertex numbers may be 0, 2, and 8. All edge weights are positive, and they are also encoded by natural numbers. For example, the following graph consists of three vertices (denoted 0, 2, and 8) and four edges:

0 2 25
2 8 15
8 0 10
8 2 20



Problem 3 on Assignment 1 involves writing a program to solve the shortest path problem on a graph. In order to illustrate this problem further, sample graph and a shortest path through this graph are given below.



Solutions:

This graph contains six vertices and ten edges. An example of a shortest path through this graph is that from vertex 2 to vertex 8.

Starting vertex: 2
Ending vertex: 8
The shortest path is:

Vertex 2 to vertex 13 (edge weight of 3)
Vertex 13 to vertex 5 (edge weight of 4)
Vertex 5 to vertex 8 (edge weight of 5)

Note that the shortest path in this case was not the path with the fewest edges, but the least total edge weight. For instance, there is an edge that directly connects vertices 2 and 8, but this edge has a weight of 16, which means it is *not* the shortest path. There is also another path (from 2-13-1-8), but this has an even greater total weight of 35.

Total weight: 12

Submitting your assignment

- Submission via Canvas Assignment.
    - It is your responsibility to submit these assignments in a timely fashion.
- All files should be zipped together.
- The name of your zipped folder should include your last name and ID
- There should be a readme file explaining in detail the exact steps to be taken to compile and execute the code files and the title page
- In case of any code errors, partial credit may be offered based on the code and documentation.

Late Submission Policy

- Late work will be not accepted.

Rubric for Assignment 1

Problem 1 (3 points)

a. [1/]
b. [1/]
c. [1/]

Don't copy others' work. You can google and read tutorials to understand the concepts, and can provide reference.

Problem 2 (2 points)

a. [1/]
b. [1/]

Don't copy others' work. You can google and read tutorials to understand the concepts, and can provide reference.

Problem 3 (15 points)

- Compile, run and test (15 points)

  [5/] code compile
  [6/] Run the program
  [Test case - 2/] Vertex 2 to Vertex 3
  [Another Test case - 2/] On the fly (any vertex to any e.g. boundary case, initial case etc.)