CSC 480: Artificial Intelligence I: 2026 Fall, Assignment #1

Last Modified 2026 January 16

Purpose:

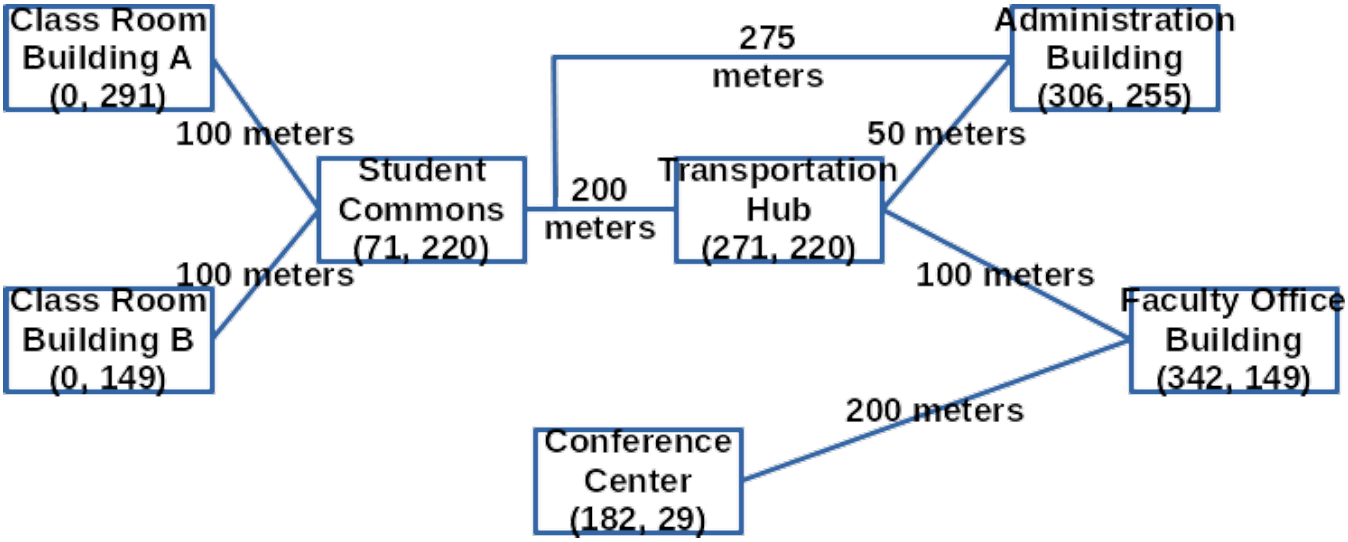
Due Jan 28

To consider:

- Uninformed search
- Informed search
- Adversarial search

Assignment:

1. 20 Points: *Question 3.21* Prove each of the following statements, or give a counterexample:
   a. Breadth-first search is a special case of uniform-cost search.
   b. Depth-first search is a special case of best-first tree search.
   c. Uniform-cost search is a special case of A* search.



2. **20 Points: Iterative Deepening Depth First Search**

   Consider *just the connectivity* of the locations in the graph above. Write an *iterative deepening depth first search* program to find the best path from *Class Room Building A* to the *Conference Center*.

3. **20 Points: A* Search**

   Consider both the *(X,Y) coordinates* and the *path costs* between the locations in the graph above. Write an *A* search* program to find the best path from *Class Room Building A* to the *Conference Center*.

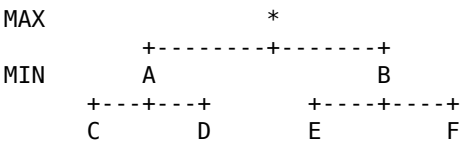
Note:

- For nodes that are connected together, assume the given path lengths are correct.
- For nodes that are *not* connected, use Euclidean given their distance coordinates.
  For example:

```
distance(Classroom Bldg B,Trans Hub) = sqrt((271-0)^2 + (220-149)^2)
                                     = 280 (okay to round to nearest integer)
```

4. **20 Points: Adversial search heuristics functions**

When he was in high school, your dear Prof Joe wrote a chess program (in Pascal). He *almost* re-invented the Minimax algorithm.



Minimax would have MIN compute:

```
value(A)=min(C,D)
```

and

```
value(B)=min(E,F)
```

Then MAX would compute

```
max(value(A),value(B))
```

However, your Prof Joe as a high school student tried to compute

```
max(min(A+C,A+D),min(B+E,B+F))
```

While Minimax only computes the heuristic function at C,D,E and F, the version that Prof Joe came up with computes it at A and B too. Then, the Prof Joe version chose the best path *sum*, not path *end*.

The high school aged Prof Joe reasoned that intermediates A and B should go into the calculation because if A was better than B (for example, in A we take the piece of an opponent, but in B we do not), then paths following A should be rewarded for this good initial move.

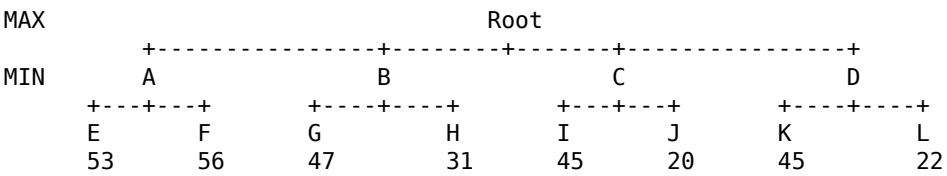
What was the flaw in the reasoning of the high school aged Prof Joe?

5. **20 Points: Adversial search heuristics**

Trace thru the alpha-beta search of the following tree. Show:

- the initial values of nodes
- the alpha and beta values sent to nodes recursively
- how nodes get their own values updated, as well as their alpha values (for the maximizer), or beta values (for the minimizer)

- the routes that can be ignored because of the values at the nodes, and of alpha or beta



You may, of course, check your work with a program. However, be sure you understand how it worked.