# CS486: Artificial Intelligence

Homeworks 2 & 3 (30 pts)
Search
Due 28 September 2018 @ 1600

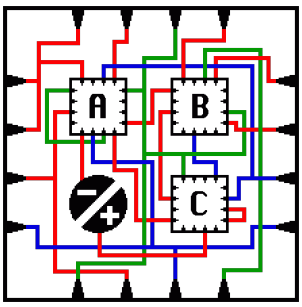
## Instructions

This is an individual assignment; however, *you may receive assistance and/or collaborate without penalty, so long as you properly document such assistance and/or collaboration in accordance with DAW.*

Answer the questions below and submit a hardcopy with DAW coversheet and acknowledgment statement to your instructor by the due date.

## Problem 1: Search Considerations

The picture below is a recursive maze—the A, B, and C boxes contain exact duplicates of the entire picture (and so on for the inner A/B/C's in those). The goal is to get between the top-level + and - (or vice versa); it is not sufficient to find a path from the top-level + to a - at some nested level.




a. (2 pts) At a minimum, what information does a state have to contain to formulate this as a search problem for our algorithms?

b. (1 pt) What is the state space size for this search graph?

c. (3 pts) What is an estimated branching factor for this search graph? (Note: Here, we are not looking for a "right" answer, *per se*. We'd just like you

to explain a reasonable way you might calculate this, and then give the result of your calculation. Show your work.)

d. (5 pts) Based on your answers above, identify which algorithm(s) we have covered in the course (depth-first, breadth-first, iterative deepening depth-first, uniform cost, greedy, and $A^*$) would be appropriate to use to find the shortest path to the goal and which one(s) would not. If you found more than one to be appropriate, discuss which one you would use. *Justify all answers*, discussing the relevant factors in the decisions.

## Problem 2: Constraint Satisfaction Problems

a. (1 pt) Is the Missionaries and Cannibals problem a CSP? Why or why not?

b. Learn about the *battleship puzzle* (`https://en.wikipedia.org/wiki/Battleship_(puzzle)`)—especially the "Rules" section.

   i. (5 pts) Define a possible set of variables and their domains for this CSP. (Note: While the examples in class all used explicit representation for variables and domains, you may use an implicit representation for these definitions, if you wish.)

   ii. (5 pts) Based on your choice above, choose *one* of the possible puzzle constraints to define using *either* implicit or explicit constraint representation.

   iii. (5 pts) Would you choose iterative improvement with min-conflicts heuristic or backtracking search with forward checking (constraint propagation) and MRV? Justify your answer.

## Problem 3: Adversarial Search (3 pts)

We saw in class that the effectiveness of $\alpha$-$\beta$ pruning is affected by the order in which moves are evaluated. All of our examples have been using "static ordering." Research and describe a "dynamic ordering" technique you could use to enhance the effectiveness of $\alpha$-$\beta$ pruning for chess. Cite your source(s) appropriately.