University of Lethbridge

# CPSC 3750 –Artificial Intelligence – Winter 2025

## Assignment 1 [140 points]

Due on February 6th, 2026

## Instructions

- Your written part should be uploaded to Moodle.
- Your programming part should run on the department's computer platforms in your course account.
- Your programming part should be uploaded to Moodle, including the source code, Makefile, and README file.

## Written Part

1. **[20 points]**

   For each of the following activities, give a description of the task (i.e., performance measure), the environment, the actions, and the sensors, and characterize the environment in terms of *fully observable vs. partially observable*, *single agent vs. multiagent*, *deterministic vs. stochastic* , *static vs. dynamic*, and *discrete vs. continuous*.

   - playing soccer
   - bidding on an item at an auction

2. **[20 points]**

   Give a complete problem formulation for each of the following:

   - You have three jugs measuring 12 liters, 8 liters and 3 liters, and a water faucet. You can fill a jug, empty it, pour water from one jug into another, or pour it onto the ground. Your goal is to measure exactly six liters.
   - Knuth conjectured that starting with the number 4, a sequence of square root, floor, and factorial operations can reach any desired positive integer. For example, we can reach 5 from 4 as follows:

$$\lfloor \sqrt{\sqrt{\sqrt{\sqrt{\sqrt{(4!)!}}}}} \rfloor = 5$$

3. **[40 points]**

   Consider the problem of finding a path in the grid shown on Figure 1 from the position *S* to the position *G*. The agent can move on the grid horizontally and vertically, one square at a time (each step has a cost of one). No step may be made into a forbidden crossed area.

   (a) What is a state? How many states are in this state space?

   (b) For each of the following searches, draw the search tree[1]:

      i. A depth-first search from *S* to *G*, given that the order of the operators you will test is: up, left, right, then down. Draw the search tree until you reach the solution.

      ii. A breadth-first search from *S* to *G*, given that the order of the operators you will test is: up, left, right, then down. Draw the search tree until the depth of 5.

# Programming Part

1. **[60 points]** Given a grid similar to the one in Figure 1. You may prompt the user to enter the width and the height of the grid, the start and the goal states, and the forbidden squares. Implement each of the following searches and show the solutions:

   (a) A depth-first search from *S* to *G*, given that the order of the operators you will test is: up, left, right, then down.

   (b) A breadth-first search from *S* to *G*, given that the order of the operators you will test is: up, left, right, then down.

   (c) An iterative deepening depth-first search from *S* to *G*, given that the order of the operators you will test is: up, left, right, then down. At what depth the solution is reached?

[1] You can number the squares from left to right from 1 to 8, and from bottom to up from 1 to 8.

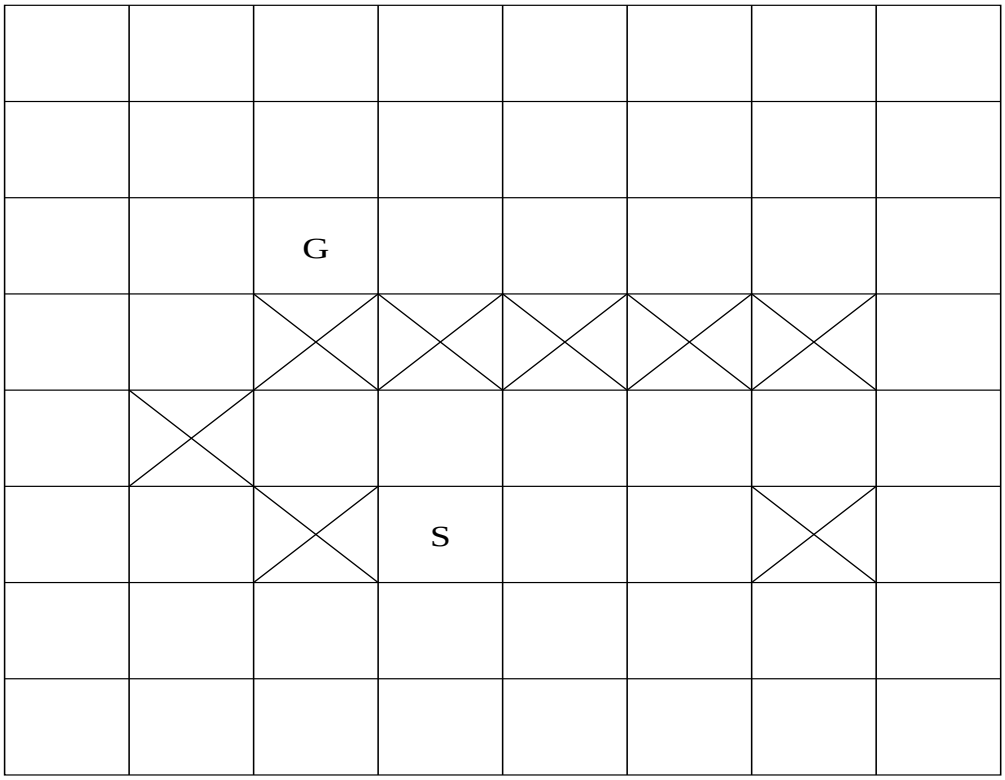


Figure 1: Search Grid