

COMP 4106 - ARTIFICIAL INTELLIGENCE  
WINTER 2019

ASSIGNMENT #1

DUE DATE: FEBRUARY 20, 2019

# A New Spider Game

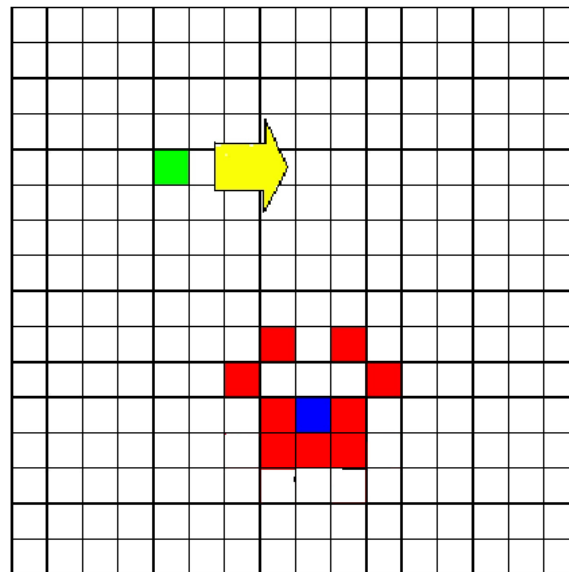
## Introduction

In this assignment you will be implementing a game that simulates a spider hunting for food. This game is inspired by many earlier games, such as the *snake game* available for mobile phones and many other platforms (video available at [http://www.youtube.com/watch?v=z\\_Ct-1KwSgo](http://www.youtube.com/watch?v=z_Ct-1KwSgo)).

The game is played on a varying size grid board. The player controls a spider. The spider, being a fast creature, moves in the pattern that emulates a Knight from the game of Chess when it moves forward. On the other hand, since it is not equipped with eyes to see behind, it emulates a King from the game of Chess when it moves backward. There is also an ant that slowly moves across the board, taking steps of one square in one of the eight directions. The spider's goal is to eat the ant by entering the square it currently occupies, at which point another ant begins moving across the board from a random starting location. The spider "knows" the location of the ant.

## Game Definition

Figure 1: The illustration of the "New Spider" game



The above figure illustrates the game. The blue box shows the location of the spider. The green box is the current location of the ant. The red boxes are the possible moves the spider could make. The yellow arrow shows the direction that the ant is moving - which, in this case, is the horizontal  $X$ -direction. When the ant is eaten, a new ant is randomly placed on one of the borders of the board and assigned a random direction to move across the screen, depending on where it starts.

To simplify the game, assume that the ant only takes a single step forward each time the spider moves. All your search algorithms should predict the motion of the ant along with the

spider, because the position to which it will move next is deterministic. If the ant makes a move that would take it off the board, the spider has failed to catch it, and a new ant is spawned as if it had been caught.

Similar to the *snake game*, the game only ends if the spider makes a move that causes it to step off the board.

## Assignment Objectives

- Implement the “*New Spider*” game.
- Implement a *Breadth\_First Search* for the spider to play the game.
- Implement *Depth\_First Search* for the spider to play the game.
- Implement *A\* search*.
  - Implement two (2) different heuristics for the spider to play the game.
  - Implement a third heuristic which takes the average of the first two heuristics.
- Write a short report (no more than two (2) pages) about the state space of the game, and about the choice of your heuristics.

## Questions

During the demo you should be prepared to discuss the following questions:

- Which search worked best?
- Which heuristics did you use?
- Why did you choose these heuristics?
- Does the combination of the two heuristics work better or worse than they do individually?
- How well do the searches work if you increase the size of the board to 30x30 or 50x50.
- Which of the searches works best if you increase the speed of the ant to two steps per turn? Three steps?

## Bonus

The following items are considered as bonus. You should work on these if you have completed the required objectives.

- Instead of a new ant appearing every time the old ant is eaten, they appear at a constant rate, allowing multiple ants to appear at the same time.
- Two, three, or even more spiders simultaneously compete for the same ant or the same set of ants.

## Tips

Don't spend too much time on the graphics. The search maybe slow. In this case, think about how you can optimize it. Command-line graphics are perfectly fine.

Your first priority should be to make sure that the search works.