CISC 3665, Spring 2014
Lab 3-2: Chasing and Evading, Path Planning

Instructions

This is the second lab for unit-3, Game Physics, Motion and Perception, and should be submitted for a grade. The purpose of this lab is to give you a chance to demonstrate what you have learned in this unit about game physics and math, "chasing and evading" strategies and "wayfinding" algorithms. This assignment is worth **10 points**, or 10% of your term grade.

The assignment is due on March 27.

Preparation

- Read lecture notes (lec3-2.pdf and lec3-3.pdf). They are based on chapters 2, 6, and 7 from *AI for Game Developers*, by David M. Bourg and Glenn Seemann,
- Download the sample Processing code, **chaser0**, from: `http://www.sci.brooklyn.cuny.edu/~xiang/cisc3665/chaser0.zip`

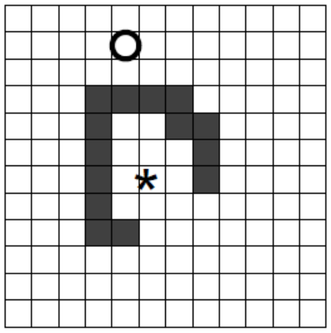
1 Written component

You need to hand in a print-out for this part.

1.1 Given two agents moving at constant speeds in a 2-D environment. The first agent, A_1, is at position (5, 2), moving at a velocity of (1, 1). The second agent, A_2, is at position (1, 3), moving at a velocity of (2, 1). Compute the **distance** between the two agents and the **angle** between the two agents' directions of motion. Note that the direction of an agent's motion is that of its velocity vector. *(1 point)*

1.2 Using the same information about agents A_1 and A_2, answer the following question. Assume that the agents move one unit of velocity per second—if A_1 is at (5, 2) at time $t = 1sec$ and moving at velocity (1, 1), then at time $t = 2sec$, A_1 will be at position (6, 3), etc. Suppose that A_2 is chasing A_1. Assume that neither agent changes course or speed. Will the paths of A_1 and A_2 ever cross? If yes, where (i.e., at what point)? Will they reach the point at the same time? *(1 point)*

1.3 Given the environment below, containing an agent (circle) and a piece of gold (*) hidden in a cave:



Explain how you would implement a *pathfinding* algorithm to help the agent locate the piece of gold. Describe any functionalities that you would need the agent to have (e.g., perception capabilities, etc). *(1 point)*

2 Programming Component: Chasing and Evading

You need to submit one program for this part: **chaser1**.

2.1 The sample code, **chaser0**, demonstrates a simple chasing/evading game where there are two agents: an avatar, which is controlled by a human, and an opponent, which is controlled by the computer. Try running the sample code. You can control the avatar (pink circle) by pressing on the arrow keys. Each key you press acts like giving the avatar a kick in the direction of the arrow. So if you start by pressing the up-arrow key, then the avatar moves up. If you press the up-arrow key again, the avatar moves up more quickly. You can press **S** to stop the avatar. You can press **R** to reset the game, and **Q** to quit the game.

2.2 The chaser code for the opponent is contained in the **chase()** function in the **Agent** class. This implements "line-of-sight" chasing.

2.3 Make a copy of the sample code and call it **chaser1**.

2.4 Modify the code so that the human player becomes the chaser and the computer player is the evader. To do this, you need to write an evasion function, **Agent.evade().** This should be called from the **draw()** function, instead of calling **opponent.chase().** (2 points)

3 Programming Component: Pathfinding

You need to submit one program for this part: **chaser2**.

3.1 The second part of the assignment is to modify the game so that the game environment contains obstacles, and the computer player has to implement a *pathfinding* algorithm in order to play the game.

3.2 Create a new version of the chaser game and call it **chaser2**.

3.3 Modify the code so that it contains some obstacles. Generate some black squares in the arena that are the same dimension as the agent (i.e., width and height are equal to **Agent.d**). Place these squares in random locations around the arena. *(1 point)*

3.4 Modify the code so that it will detect if an agent is going to collide with an obstacle. *Hint: look at collision detection in the sample programs from the class as posted on the class website. (1 point)*

3.5 Modify the code so that it will not allow an agent to move into a position where it collides with an obstacle. The agent should just stop if it is going to bump into an obstacle. *(1 point)*

3.6 Modify the code so that the computer agent uses one of the methods outlined in the lectures in order to avoid (go around) obstacles. *(2 points)*

Submission

- Submit the written component as a hardcopy.
- Submit your programming component electronically by emailing the zip file. Please zip the folder, and send ZIP only (no RARs)