CS 638: Computer Game Technology

Sample Questions

Dec 14, 2001

The questions here are intended to be similar to those that will be asked on the final. However, the final will have fewer questions, and hence will take you less time to complete. Also, unlike the midterm, there is a greater range of questions that might be asked, so this is a less representative sample in terms of the material covered and the style of questions I might ask. Expect the unexpected for the final.

Question 1:

You wish to design an AI that responds to the player on roughly half of the occasions they meet, but should ignore the player on the other occasions. What techniques could you use to design such a character? (Hint: There are at least two options.)

Question 2:

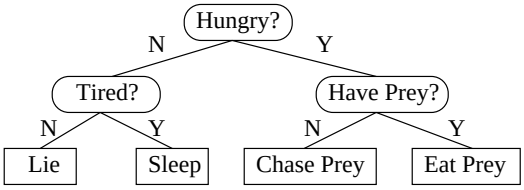
A sports spectator is to have the following behaviors:

- By default they sit and watch the game.
- If their team scores, they stand and cheer.
- If the opposing team scores, they stand and boo.
- After 15 seconds of standing, for any reason, they sit down again.
- If they are hungry at any time, they go to the food stand.
- If they have food, they sit a and eat it, and do not stand for any reason.
- It takes 5 minutes to eat food, after which they no longer have food.
- The spectator is never hungry while they have food.

Design a finite state machine that will demonstrate the behavior described.

Question 3:

Convert the decision tree below into a set of rules for use in a rule-based system. It is intended to model the behavior of a lion.



Question 4:

Imagine an environment with pairs of "teleport" waypoints that take you to their partners instantaneously at no cost.

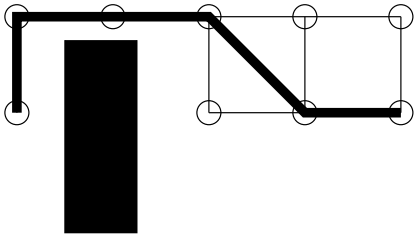
a. Why is Euclidian distance not an admissible heuristic in this situation?

b. How would you modify the waypoint graph and/or the heuristic to generate a new heuristic that is admissible.

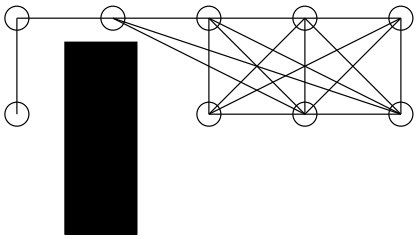
Question 5:

This question examines the effectiveness of the "Option 1" greedy path smoothing approach, in which points on the path are eliminated in a greedy fashion until the next point cannot be reached with a straight line, and the process repeats on the remainder of the path.

a. Show the result of greedy path straightening on the following path and obstacles. The light lines are the grid on which planning was done.



b. Show the optimal path found on the waypoint graph below, which has been augmented with links between any pair of nodes that can see each other.

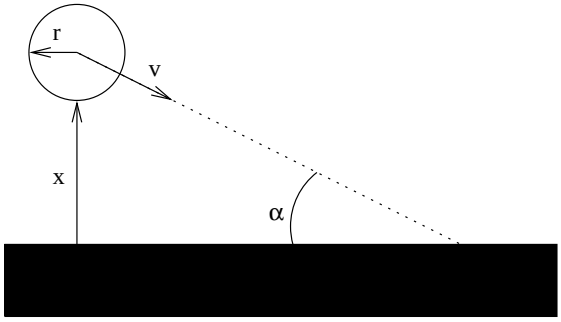


c. What are the advantages of planning on the augmented waypoint graph compared to greedy path straightening?

d. What are the disadvantages?

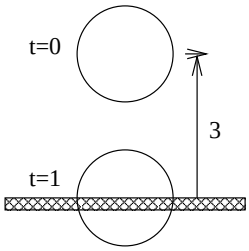
Question 6:

Consider the situation illustrated below, in which a sphere is approaching an infinite plane. The sphere has radius r and is moving with constant velocity v at an angle of α to the plane. Currently the distance between the ball and the plane is x. Write an expression for the time at which the ball will hit the plane, given that the current time is $t = 0$.



Question 7:

The state of a ball is shown at time $t = 0$, and again at time $t = 1$, when it is penetrating the plane. Use interval halving to find the collision time to 1 decimal place. (Assume the ball is moving with constant velocity).



Question 8:

Assume that you have two choices for broad-phase collision detection: bounding boxes and bounding spheres. You will perform tests between bounds for all n^2 object pairs and only do narrow-phase (accurate) collision detection between pairs whose bounds overlap.

Say that the bounding box overlap test costs 1 unit to perform, and eliminates %85 of the potentially colliding pairs. The sphere test costs 2 units to perform, but eliminates %90 of the pairs.

a. If the cost of the narrow-phase test is 100 units, which of the bounding options is best?

b. At what narrow-phase cost do the two bounding options result in the same overall cost?

Question 9:

You are considering using oriented bounding cubes for a bounding volume. These are cubes that are rotated and sized to best fit the object.

a. How many separating planes/axes must you test to be sure that two oriented cubes collide?

b. Will bounding cubes perform better overall than OBBs. Why or why not?

Question 10:

Which protocol, UDP or TCP/IP, would you prefer for each of the following types of game data?

a. Player state

b. AI position information

c. AI state machines transitions

d. Customized player geometry

e. AI orientation information

f. A player obtaining a power up

Question 11:

You decide to use packet compression in your multi-player game. With this technique, every outgoing packet is compressed using a standard compression algorithm, and every incoming packet is decompressed.

a. What impact does this technique have on bandwidth requirements for the game? Explain your answer.

b. Which sources of latency are affected by this technique, why, and in what way?

c. How is game security impacted by this technique?