CS 671 Finals

Due - December 10 11:59:59 PM EST

Answer all 4 questions. Each question is worth 10 points. You are allowed to look at the book or the class slides. You are <u>*NOT*</u> allowed to use any resource outside of the study guide, home work solutions, book and the slides I used. IF I determine that you have used any other source for any part of any question, you will automatically get a 0 for this exam. You are also forbidden to discuss with each other. That will also entail a 0 in the exam for everyone involved.

Your answers must be submitted as a pdf or word document through email. Please email your answers to nataras@wfu.edu

1. Problem Formulation The goal is to navigate a robot out of a maze. The robot starts at the center of the maze facing north. You can turn the robot to face north, east, south, or west. You can direct the robot to move forward a certain distance, although it will stop before hitting the wall.

a. Formulate this problem. How large is the state space?

b. In navigating a maze, the only place we need to turn is at the intersection of two or more corridors. Reformulate the problem using this observation. How large is the state space now.

c. From each point in the maze, we can move in any of the four directions until we reach a turning point, and this is the only action we need to do. Reformulate the problem using these actions. Do we need to keep track of the orientation now?

d. In our initial description of the problem we already abstracted from the real world, restricting actions and removing details. List three such simplifications we made.

2. Adversarial Search Describe how the minimax and alpha-beta algorithms change for two-player, non-zero-sum games in which each player has a distinct utility function and both utility functions are known to the players. If there are no constraints on he two's terminal utilities, is it possible for any node to be pruned by alpha-beta? What if the player's utility functions on any state differ by at most a constant k, making the game more cooperative?

3. Logic Decide which of the following sentences is valid, unsatisfiable or neither. You can use the truth tables or the equivalence rules shown in Figure 7.11 of the book (page 249).

1. $Smoke \rightarrow Smoke$
2. $Smoke \rightarrow Fire$
3. $(Smoke \rightarrow Fire) \rightarrow (\neg Smoke \rightarrow \neg Fire)$
4. $Smoke \vee Fire \vee \neg Fire$
5. $((Smoke \wedge Heat) \rightarrow Fire) \leftrightarrow ((Smoke \rightarrow Fire) \vee (Heat \rightarrow Fire))$
6. $(Smoke \rightarrow Fire) \rightarrow ((Smoke \wedge Heat) \rightarrow Fire)$
7. $Big \vee Dumb \vee (Big \rightarrow Dumb)$

4. Uncertain Reasoning Suppose you are a witness to nighttime hit and run accident involving a taxi at Athens. All taxis in Athens are blue or green. You swear under oath, that the taxi was blue. Extensive testing show that under dim lighting conditions, discrimination between blue and green is 75% reliable.

1. Is it possible to calculate the most likely color of the taxi? How would you do it? (Hint: Distinguish between the proposition that the taxi *is* blue and that the taxi *appears* blue).
2. What if you know that 9 out of 10 taxis are green? How does you belief change?