Potential Final Exam Questions

1. Compare and contrast propositional logic and first order predicate calculus?
2. Formulate the game of chess as a search problem?
3. Translate the following sentence to first order logic:
   - If Sam loves everybody then Sam loves himself.
   - There are times when you may fool all the people.
   - All birds can fly.
4. Would it be rational for an agent to hold the three beliefs P(A)=0.4, P(B)=0.3 and P(A OR B)=0.5? If so what range of probabilities would be rational for the agent to hold for A AND B? Make up a probability table and show it supports your argument about rationality?
5. Describe the following briefly?
   - Probability theory
   - Utility theory
   - Decision theory.
6. What does Bayes' rule compute? What and full joint probability distribution?
7. Describe the differences and similarities between problem solving and planning?

8. What are the 4 categories of AI? Which category is viewed as true AI?
9. Define the following types of environments, and give an example for each:
10. What is the difference between breadth-first and depth-first search? Which ones, if either, are optimal and/or complete? What effect does limiting the depth of depth first search have?
11. Consider solving the 8 puzzle problem using A* search. Give three possible heuristics. Show that each is admissible.
12. Describe Minimax. When is it ideal?
13. Using First Order Logic, prove that the Bears are better than the Cubs. The following is given:
    - The Bears are a football team.
    - The Cubs are a baseball team.
    - Football teams are better than baseball teams.
14. Suppose a dog is trying to find a bone he buried in the ground, at either location A, B, C, or D. He can move from one location to another. He can dig in the ground, up to two feet, but only one foot at a time. He does not know where the bone is until he has uncovered it. If he is in the same location as the bone and he knows it is there, he can bite it. Describe the STRIPS language definitions for the actions that the dog can take.
15. In a decision tree, what effect does uncertainty have, both with regards to its construction and its use in predicting outcomes?
16. You make about $50,000 a year. Someone offers to invest an entire year of your salary in a very risky portfolio. There's about a 1/1000 chance you could be the next Bill Gates, but you would most likely lose all of it. You decide that this offer is BS, and tell them to go away and to read the sign about no solicitors next time they come to your door. The next day the same offer is made to another person, for $50,000, either billions or nothing. They decide to

take the investment. In terms of utility, explain why they may take such a seemingly bad investment

17. What is the difference between strong and weak AI? Which of them have been achieved at this point in time?
18. What makes a heuristic admissible? What makes a heuristic a good heuristic?
19. Represent the sentence "All Germans speak the same languages" in predicate calculus. Use Speaks(x,l), meaning that person x speaks l.
20. Is the sentence "Exists x,y x=y" valid?
21. Consider the following two sentences in the language of first-order logic:
    (A): VxEy (x>=y)
    (B): EyVx(x>=y).

    Does A logically entail B? Does B logically entail A?

22. Consider the problem of stacking blocks on a table in the order given by:

A
B
C

- Write a set of planning actions that allow for these blocks to be stacked in any manner. Only one block can be moved at a time and the table can only have two items placed on its surface at anytime.

23. Consider the domain of dealing 5-card poker hands from a standard 52 cards under the assumption that the dealer is fair.
    - How many 5 card hands are there?
    - What is the probability that each hand is dealt
24. Explain the difference between the weak AI and strong AI hypotheses.
25. Write a context free grammar for anbn
26. Enumerate the 4 components of the PEAS description of a rational agent and provide 2 examples for each component for the robot basketball player example.
27. Suppose a knowledge base contains the following sentence: Vx,y Pig(x) Λ Horse(y) => Faster(y,x).
    - Suppose the ground terms PIGLET and ED exist. Use universal instantiation to resolve all possible sentences.
28. We have some examples and we want to build a Decision Tree based on those examples. In the example we have two attributes: Patrons and Types. Patrons has three values 'None', 'Some', and 'Full'. Types has four values 'French', 'Italian', 'Thai' and 'Burger'.

	Yes	No		Yes	No
None	0	2	French	1	1
Some	4	0	Italian	1	1
Full	4	2	Thai	2	2
			Burger	2	2

- Our Target values are Yes and No. Determine which attribute will be chosen in Decision-Tree Learning algorithm.

29. What is Orderability, Transitivity, Continuity, Substitutability, Monotonicity, Decomposability?
30. Build a Simple Bayesian Network without Conditional Probability based on following story.
    - You have a burglar alarm installed at home. It is fairly reliable at detecting a burglary, but also respond on occasion to minor earthquakes. You also have two neighbors, John and mary, who have promised to call you at work when they hear the alarm. John always calls when he hears the alarm, but sometimes confuses the telephone ringing with the alarm and calls then, too. Mary, on the other hand, likes rather loud music and sometimes misses the alarm altogether.
31. Three Boolean variable toothache, catch and cavity. The full join distribution is a 2 x 2 x 2 table as shown. Notice that the probabilities in the joint distribution sum to 1.

	toothache		¬toothache	
	catch	¬catch	catch	¬catch
cavity	0.108	0.012	0.072	0.008
¬cavity	0.016	0.064	0.144	0.576

    - Calculate The following
        a. P(toothache)
        b. P(cavity)
        c. P(toothache|cavity)
        d. P(cavity|toothache V catch)

32. Consider a problem of changing a Flat tier. More precisely, the goal is to have a good spare tire properly mounted onto the car's axle. Where the initial state has a flat tire on the axle and a good spare tire in the trunk. To keep it simple, our version of the problem is a very abstract one, with no sticky lug nuts or other complications. There are just three action: removing the spare from the trunk, removing the flat tire from the axle, putting the spare on the axle. Write the STRIPS description with initial state and goal state and all action.
33. Let the basic vocabulary be:
    - Takes(x,c,s): student 'x' takes course 'c' in semester 's'
    - Passes(x,c,s): student 'x' passes course 'c' in semester 's'
    - Score(x,c,s): the score obtained by the student 'x' in course 'c' in semester 's'
    - 'F' and 'G' are object for French and Greek course.
    - X > Y represent X is greater then Y
    - Write down the First Order Logic for the following sentences, using a consistent vocabulary
        a. Some student take French in fall 2009
        b. Every student who takes French in fall 2009 passes it
        c. Only one student took Greek in Spring 2010
        d. The best Score in Greek is always higher than the best score in French

34. Write FOL for the following fact of the wumpus world
    - "A Square is Breezy if and only if there is a pit in the neighboring square"