Name _____

SS# _____

1   Search (15 points)

We are given a sliding-tile puzzle with three tiles and are given a problem with the following initial and final states:

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INITIAL    FINAL

  o 1        1 2
  3 2        o 3
```

Where a "o" represents a blank spot. Assume that we always try moving the blank first right, then left, then up and then down.

1. Draw the search space for this problem.

2. If we treated the search space as a tree, what would the result of a breadth-first search be? Of a depth-first search?

3. If we treat the search space as a graph, what would the result of a breadth-first search be? Of a depth-first search?

2   Adversarial Search (15 points)

Simple game-playing programs often search a game-tree to a fixed depth. One problem that can arise is the *horizon effect*. Assuming the use of the alpha-beta algorithm,

1. define the *horizon effect*,

2. give a concrete example using any common game you know (e.g., chess, checkers, etc.), and

3. briefly describe how to deal with it.

3   Symbolization (10 points)

1. Translate the following statements into a FOPC sentence, choosing appropriate predicates and functions:

    - "Good food is not cheap and cheap food is not good."
    - "If a computer can beat Kasparov in chess, then a computer can beat anyone"

2. Rewrite your FOPC sentence as a set of sentences in normal form, using either the scheme used in our textbook or the one used in class.

4 Probability in MYCIN? (10 points)

What would be the advantages and disadvantages of using probability theory in a rule-based expert system like MYCIN to represent and reason about uncertain data and knowledge instead of the more ad hoc system actually used in MYCIN.

5 Bayesian Reasoning (10 points)

What role do influence diagrams play in modelling a problem for baysean reasoning? What does the following influence diagram say about the conditional dependence or independence of the nodes P, Q, R, S, T and U?

6   Reasoning with uncertain knowledge (15 points)

Recall the *Nixon diamond* which involves the knowledge that Republicans are typically not pacifists, that Quakers are typically pacifists and that Nixon was both a Republican and a Quaker.

Describe how this knowledge would be encoded using non-monotonic reasoning, using probabilities and using an ATMS. Use diagrams and formal notation as appropriate.

7   Knowledge Representation in KL-ONE (15 points)

Draw a KL-ONE diagram which represents the following concepts:

A *person* is a kind of *thing* which has exactly one *name* and at most one *department*. A *department* is also a kind of thing and has two instances – *CMSC* and *Mathematics*. There are two subclasses of *person* – *employee* and *student*. A *TA* is **defined** to be any thing which is both a kind of *student* and a kind of *employee*. A *CMSC-TA* is **defined** to be any thing which is a kind of *TA* whose department is *CMSC*.

8 Failure as Negation (10 points)

Describe the relationship between Prolog's *failure as negation* and non-monotonic reasoning.