Student ID: _____

Graduate Comprehensive Exam: Artificial Intelligence (Fall 2004)

Answer all questions on the exam. You may use the back for additional space. Total: 100 points. Good Luck.

1. (20 pts)
   (a) Which of the following are HORN clauses?
      i. $B \Rightarrow A$
      ii. $C \wedge D \Rightarrow B$
      iii. $B \vee \neg C \vee \neg D$
      iv. $B \vee \neg C \vee D$
   (b) When is an infernce technique refutation complete?
   (c) Which type of inference is known to be refutation complete for First Order Logic? Give the formula.

2. (20 pts) Compare A* and Iterative Deepening from the point of view of the properties that they offer (when applied to problems like finding the best path in a graph).

3. (20 pts) (CSPs) The stable matching problem consists of a set of employers $E_1, ..., E_n$ and a set of graduates $G_1, ..., G_m$ that want to be employed. Each graduate G_i has a preference for the employers (defined by an ordered list of employers $P_i[1..n]$, employer $P_i[a]$ is prefered by G_i to employer $P_i[b]$ if and only if $a < b$). Formalize this problem as a CSP.

4. (10 pts) While learning a decision tree, describe two criteria for not growing the tree further?

5. (30 pts) Consider the following pesudocode for state space search:

```
// search returns the cost of reaching the goal state from the initial state
// intialState is the starting/initial state
// goalState is the target/goal state
// operators is a list of possible operators, each operator (op) takes
//     a state and generates another state after applying op.
//     ie, op(state) returns a state
// cost is a function that returns the cost of applying an operator
//     ie, cost(op)

float search(initialState, goalState, operators, cost, heuristic)
{




}
```

(a) the last parameter of `search()` is `heuristic`, which is a function; describe `heuristic()` in terms of
   i. input parameter(s) and
   ii. the purpose (return value)

(b) Complete the pesudocode for implementing the best-first search algorithm.

(c) For breadth-first search, what are the `cost` and `heuristic` functions?

(d) Mark and describe changes you need to make in your pseudocode for implementing the breadth-first search algorithm.