CS 188 Midterm

11:15am–12:30pm March 22, 1990

Please try to be precise in your answers. The maximum possible score on this exam is 100 points. Good Luck!

1 Resolution Proof [20 pts]

Formulate as predicate-calculus expressions the facts given in the following puzzle. Use the resolution method to prove that Cafe-Stanford is criminal. Remember to convert to Conjunctive Normal Form before starting the proof!

1. It is a crime to sell a bad cappucino.
2. All the beverages that Tom drank were purchased by him from either Cafe-Stanford or Cafe-Berkeley.
3. One of the beverages that Tom drank was a bad cappucino.
4. Tom never bought anything from Cafe-Berkeley.

Use the following predicates: Bad (x), Cappucino (x), Criminal (x), Beverage (x), Drank (x, y) for "x drank y", Sells (x, y, z) for "x sells y to z".

2 Clause Form [20 pts]

Transform the *negation* of the following well–formed formula to clause form. Is the (original) formula valid?

$$[\exists x(p_1(x) \wedge q_1(x))] \Rightarrow [\exists x(p_1(x)) \wedge \exists x(q_1(x))]$$

3 Search [20 pts]

1. A knight on an infinite chessboard must be transferred from an initial position of $(0, 0)$ to a goal position (m, n) using the minimum number of legal knight moves. Find an admissible heuristic function h that you could use to solve the problem using the A^* algorithm.

2. Suppose that for some search problem for which you want to use A^* search you have found an evaluation function that never overestimates the cost to a goal state by more than K units. How can you get a guaranteed optimal solution from A* search?

4 Lisp [20 pts]

Define a LISP function ALLSUB (u, v) that returns a list of all occurences of a list of atoms u as a sublist of another list of atoms v. The occurence of a particular sublist is represented by a number n corresponding to the position in the list v of the beginning of that occurence. For example

ALLSUB ('(A A) , '(A A A B A A)) = (1 2 5)

5 Alpha–Beta Search [20 pts]

Explore the tree using the alpha-beta procedure. Assume that the top level is a maximizing level. Cross out all nodes where static evaluation need not occur. Indicate the winning path or paths.