Name: _____

CSCI 561: Final Solution
Spring 2010

Circle the correct answer(s) for each question. All answers are worth 5 points.

1. *Search*:

   a. **Completeness** and/or **Consistency** and/or **Efficiency**: The order in which the children of a node in alpha-beta are searched can impact which properties of the search? Circle all that apply.

   b. **True** or **False**: Iterative broadening is complete in the presence of infinite branching factors as long as there is a solution at a finite depth.

   c. **Solution Optimality** and/or **Time to Solve** and/or **Space to Solve**: The temperature *schedule* in simulated annealing impacts which of these aspects? Circle all that apply.

   d. **True** or **False**: For a small extra cost in space complexity, iterative deepening depth-first search yields a substantial improvement in time complexity over breadth-first search.

2. *Knowledge representation and reasoning*:

   a. **Forward Chaining** or **Backward Chaining**: Does the set of support strategy used in project 2 make resolution behave more like forward chaining or backward chaining?

   b. **Yes** or **No**: For variables *x* and *y* and constant C, if we unify (after standardizing apart) P(*x,y,x*) with P(*y,x*,C) does the variable that is the first argument of the second predicate (*y*, before standardizing apart) get constrained to a constant value in the substitution (rather than remaining a variable)?

   c. **1T** or **1F** or **1C**, **2T** or **2F** or **2C**: Consider two variants of the closed world assumption: (1) all atomic sentences not explicitly listed in the knowledge base as true are false: and (2) all atomic

sentences not entailed by the knowledge base are false. Assume that the knowledge base only explicitly lists the sentences A and A⇒B. For each of the two variants of the assumption, is B true (T), false (F) or contradictory (C).

d. **Independence** and/or **Mutual Exclusion** and/or **Exhaustive Decomposition**: Which of these relationships must hold between A and B for P(A ∨ B) to equal P(A) + P(B)? Circle all that apply.

3. *Learning*: Consider the following computer scientists (assume that Alan and Allen are the same name for the purposes of this question):

First Name	Last Name	Nationality	AI	Theory
Allen	Newell	American	True	False
Donald	Knuth	American	False	True
Alan	Turing	British	True	True
Donald	Michie	British	True	False

a. **Yes** or **No**: If the task is to predict Nationality from AI and Theory, is there a consistent decision tree for these four training examples?

b. **AI** or **Theory**: Given the task of predicting Nationality, which of the two attributes AI or Theory yields a higher information gain over these four training examples?

c. **First Name** and/or **Last Name**: Given the task of predicting Nationality, circle the attribute(s) of these two that have higher information gain than the best choice in 1b.

d. **Yes** or **No**: Given just the first three examples (Newell, Knuth and Turing) is it possible to learn a single layer perceptron model that correctly predicts Nationality from AI and Theory? You can assume that the values *British* and *True* can be represented as *1* and that *American* and *False* can be represented as *0*.

e. **S1** or **SM**, **G1** or **GM**: Given the desire to predict whether the First Name is Alan/Allen from Nationality, AI and Theory; after learning just the first two examples (Newell and Knuth) does the S set have 1 (S1) or multiple (SM) elements and does the G set have

1 (G1) or multiple (GM) elements? Circle one answer for S and one for G.

f. **Yes** or **No**: Consider Alan Mackworth, who works in AI but not theory. Do 1-nearest neighbor and 3-nearest neighbor, when applied to these four training examples, yield the same prediction for his nationality if the distance metric is the number of mismatched attributes among First Name, AI and Theory?

g. **ML** or **MAP**: Assume you are to learn a naïve Bayes model of AI (*True* or *False*) given the attributes First Name, Nationality and Theory, with these four training examples. Which of Maximum Likelihood (ML) or Maximum A Priori (MAP) will yield a higher probability of *True* for AI when given Alan Bundy (A British AI researcher who doesn't do theory) as a test case?

h. **First Name** and/or **AI** and/or **Theory**: Is there some combination of the attributes First Name, AI and Theory that determines Nationality given these four training examples? If so, circle just the (minimal set of) attributes involved in the determination. If not, circle none of the attributes.

i. **TP** or **TN** or **FP** or **FN**: If we are learning to predict whether someone is an AI researcher, and our current hypothesis for this is that people are AI researchers if and only if they are American, is Donald Michie a True Positive (TP) a True Negative (TN) a False Positive (FP) or a False Negative (FN) for this hypothesis?

j. **Supervised** and/or **Unsupervised**: Learning probabilities for a Bayesian network with latent variables involves which of these forms of learning? Circle all that apply.

4. *Philosophy*:

a. **True** or **False**: Biological naturalism is a monist theory of mind.

b. **True** or **False**: Strong AI necessarily implies that computers are capable of superhuman levels of intelligence.