

Graduate Comprehensive Exam: Artificial Intelligence (Spring 2001)

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

1. (20 pts) Draw a semantic network that represents the following:

- (a) John is a student
- (b) Jane is a student
- (c) A student is a person
- (d) Every student has a GPA
- (e) John's GPA is 3.9
- (f) Each person has two eyes

2. (40 pts) Logical Reasoning

(a) Given the following sentence:

$$Person(x) \Rightarrow Understand(x, Computers)$$

explain what each of the following sentence can infer:

- i. $\neg Person(Micky)$
- ii. $Understand(Mary, Computers)$
- iii. $\neg Understand(Mary, Computers)$

(b) Given the following sentences:

- i. $On(B, A)$
- ii. $On(A, Table)$
- iii. $\forall x \forall y [On(x, y) \Rightarrow Above(x, y)]$
- iv. $\forall x \forall y \forall z [Above(x, y) \wedge Above(y, z) \Rightarrow Above(x, z)]$

convert them into clauses and prove $Above(B, Table)$ by **resolution**. Show all necessary substitutions.

3. (40 pts) Search algorithms

- (a) Discuss an advantage that iterative deepening search has over:
 - i. depth-first search
 - ii. breadth-first search
- (b) Devise a sample graph that illustrates depth-first and uniform-cost (branch and bound) searching algorithms can yield different solution paths from start node A to goal node G:
 - i. draw the graph with nodes A and G and at least five other nodes
 - ii. show the visiting order for depth-first search
 - iii. show the solution path and its cost found by depth-first search
 - iv. show the visiting order for uniform-cost (branch and bound) search
 - v. show the solution path and its cost found by uniform-cost search
- (c) State and explain two main problems of hill-climbing.