Midterm Exam

ARTIFICIAL INTELLIGENCE

Class: KSTN 2003
Questions: 3 – Total mark: 10 – Time: 60 minutes
Open book

Question 1 (*4 marks*):
Consider the water jug problem: "You are given two jugs, a 4-litre one and a 3-litre one. Neither has any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 litres of water into one of the two jugs".

This problem could be solved using a modified Simple Hill Climbing method as follows:
- A goal state is one where the amount of water in either jug is exactly 2. So one can apply the heuristic function $f((x, y)) = |x - 2| + |y - 2|$, where x and y represent the amounts of water in the 4-litre and the 3-litre jugs, respectively. The idea is that the closer to 2 the amount of water in either of the two jugs is, the closer to the goal it would be.
- Keep moving for a few steps when getting in the plateau situation.

Illustrate how the method works via search tree expansion.

Question 2 (*4 marks*):
Represent the following sentences in predicate logic, using your defined vocabulary:
- Every student who takes AI passes it.
- No student likes a boring course.
- There was a student who took Philosophy but failed it.
- All students like courses instructed by a PhD holder.
- The birthplace of a person is where he/she was born.
- A person whose mother or father is a Vietnamese citizen is also Vietnamese citizen.
- A Vietnamese citizen cannot hold another citizenship.
- No one working for the United Nations can hold a citizenship.

Question 3 (*2 marks*):
Express the meanings of the following predicate logic formulas in English naturally:
- $\forall x$: student(x) $\rightarrow$ $\exists y$: course(y) $\wedge$ ¬likes(x, y).
- $\forall x \forall y$: student(x) $\wedge$ course(y) $\wedge$ takes(x, y) $\rightarrow$ interesting(y) $\vee$ easy(y).

where student(x) ≡ x is a student, course(y) ≡ y is a course, likes(x, y) ≡ x likes y, takes(x, y) ≡ x takes y, interesting(y) ≡ y is interesting, easy(y) ≡ y is easy.

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