

2nd Midterm Exam

Wednesday April 15

75 minutes == 75 points

Open book and notes - no computer

1. *15 points*

The game of *nim* is played as follows. There is a stack of 5 pennies. Two players alternate removing 1, 2, or 3 pennies from the stack. The player who picks up the last penny loses.

Show by drawing the game graph that the player who plays the second move can always win.

2. *15 points*

1. Represent the following set of facts in a semantic network:

Apes and monkeys are primates.

All primates eat fruits.

Chimpanzees are apes.

Baboons are monkeys.

Chimpanzees eat insects.

Bananas are fruits.

Termites are insects.

2. What procedure could you use to answer the following kind of question: "Does A eat B?". Describe it informally in terms of how the arcs in the networks will be traversed.

3. Answer the following questions and explain briefly your reasoning:

Does a baboon eat bananas?

Does a baboon eat termites?

3. *15 points*

All people who are not poor and are smart are happy. Those people who read are smart. John can read and is not poor. Happy people have exciting lives. Can anyone be found with an exciting life?

1. Write the sentences in predicate calculus, using appropriate predicates.
2. Convert them to Conjunctive Normal Form.
3. Who has an exciting life? Answer by using resolution with refutation.

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4. *15 points*

Write the following sentences in predicate calculus, using appropriate predicates:

1. All big houses are expensive.
2. A house is prestigious only if it is big.
3. Any small apartment costs less than any big house.
4. There is a house which is bigger than any apartment.
5. All apartments have at least one bathroom.
6. There is only one red house.

5. *15 points*

Answer the following questions briefly but precisely. Justify your answers.

1. Suppose you use resolution to prove that $KB \models \alpha$. Does it mean that α is valid?
2. Is it true that in first-order logic, if a sentence is entailed, it can always be proven using resolution with refutation?
3. Is it true that it is always possible to prove that a sentence in propositional logic is entailed or not entailed by a knowledge base? Is this also true if the sentence is in predicate calculus?