COT 3420
Section U1
FALL 2006

EXAM # 1

INSTRUCTIONS

1. This test is open book, open notebook.
2. There are 5 questions on the test, for a total of 100 points.
3. For the multiple choice questions, there is no penalty for wrong guessing. For proofs, every word counts.
4. Circle the answers to question 1 on the exam paper. Write the answers to the other questions on blank sheets of paper.
5. If you do not understand the meaning of a question ask me during the test.
6. You have 1 hour to work on the test.
7. Write your name below.

NAME: _

QUESTIONS

Question 1. (28 points)

For each of the following 14 statements select the string that not only makes the assertion true, but also states the strongest possible result. There is no penalty for wrong guessing, but choose only one answer.

1. If 2.3.2 is an address in the tree, then ... is also an address in the same tree.
   a. 2.3.2.0
   b. 2.3.2.1
   c. 2.4
   d. 2.2

2. $n[(, ((P_0 \vee P_1) \longleftrightarrow \neg(P_2 \wedge P_3))] = \ldots$

a. 0
b. 1
c. 2
d. 3

3. $n[con, ((P_0 \wedge P_1) \longleftrightarrow \neg(P_3 \vee P_4))] = \ldots$
a. 1
b. 2
c. 3
4. 4

4. ...is not a suffix of **Marquito**.
a. **Marq**
b. **Marquito**
c. **ito**
d. λ

5. In the CNF $F = ((((P_0 \vee P_1) \vee P_2) \wedge ((P_3 \wedge P_4) \vee P_5)) \wedge (P_6 \vee P_7))$, $L_{2,1} \ldots$
a. $= P_1$.
b. $= P_2$.
c. $= P_3$.
d. $= P_4$.

6. If $F \longrightarrow G$ is satisfiable, then ...is also satisfiable. ...
a. $G \longrightarrow F$
b. $\neg G \longrightarrow \neg F$
c. $\neg F \longrightarrow \neg G$

7. If $F \models (G \wedge H)$ then ...
a. $F \models G$.
b. $G \models F$.
c. $G, H \models F$.

8. $F \models \neg F$ is ...
a. always true.
b. always false.
c. sometimes true and sometimes false.

9. The relation *agreeing on* F is defined on ...

a. the set of formulas.

b. the set of truth values.

c. the set of truth assignments.

10. If $F \equiv G \wedge H$, then ...

a. $Mod(F) \subseteq Mod(H)$.

b. $Mod(H) \subseteq Mod(F)$.

c. for some F, G, and H, neither $Mod(F) \subseteq Mod(H)$, nor $Mod(H) \subseteq Mod(F)$ are true.

11. Let S be an infinite set of clauses. If S is unsatisfiable, then it has ... number of unsatisfiable subsets.

a. a finite

b. a countable

c. an uncountable

12. Let S be a set of clauses and $C \in Res^*[S]$. Then, ...

a. $S \models C$.

b. $C \models S$.

c. sometimes neither $S \models C$ nor $C \models S$ holds.

13. If C_1 and C_2 have more than 1 resolvent, then ...

a. at least one of C_1, C_2 must be a tautology.

b. both C_1, C_2 must be tautologies.

c. at least one of the resolvents must be a tautology.

d. all resolvents must be tautologies.

14. If $Res^*[S] = Res^*[T]$, then ...

a. $S = T$.

b. $S \neq T$.

c. $S \equiv T$.

Question 2. (25 points)

Do parts a and b.

a. (12 points) Prove that the set of connectives $S_1 = \{(F \vee \neg G) \wedge H\}$ is not adequate.

b. (13 points) Show that the set of connectives $S_2 = \{(F \vee \neg G) \wedge \neg H\}$ is adequate. You may use the fact that the sets $\{\neg F, F \wedge G\}$ and $\{\neg F, F \vee G\}$ are adequate.

Write your answer on a blank sheet of paper.

Question 3. (15 points)

Prove or disprove: If $F \longrightarrow G$ is a tautology, and F and G have no atoms in common, then at least one of $\neg F$ and G is a tautology.

First you must write Proof or Disproof and then provide the proof or the counter-example.

Write your answer on a blank sheet of paper.

Question 4. (14 points)

Construct a derivation tree of $\Box$ from $S = \{\{A, B, C\}, \{A, B, \neg C\}, \{A, \neg B, D\}, \{A, \neg B, \neg D\}, \{\neg A, D\}, \{\neg A, \neg D, E\}, \{\neg A, \neg D, \neg E\}\}$.

Draw the derivation tree on a blank sheet of paper.

Question 5. (19 points)

Apply the algorithm given in the book to find a CNF for
$F = \{\neg[A \vee \neg(B \wedge C)] \longrightarrow [B \wedge \neg(C \wedge \neg D)]\}$.
Show your work on a blank sheet of paper.