

## Examination 1

## CS 313H

1. The important issue is the logic you used to arrive at your answer.
2. Use extra paper to determine your solutions then neatly transcribe them onto these sheets.
3. Do not submit the scratch sheets. However, all of the logic necessary to obtain the solution should be on these sheets.
4. Comment on all logical flaws and omissions and enclose the comments in boxes

1. [10] Using a truth table prove that  $((p \Rightarrow q) \wedge (q \Rightarrow r)) \Rightarrow (p \Rightarrow r)$  is a tautology.
2. [20] Using sentential calculus (with a four column format), prove  $((p \Leftrightarrow (q \vee r)) \wedge r) \Rightarrow p$  holds without premises.
3. [20] Prove the tautology  $(p \Rightarrow q) \vee (p \wedge \sim q)$  using resolution.
4. [20] Using sentential calculus (with a four column format), prove that the conclusion “Either Rachel or Sarah has no cat” follows from these premises:  
 If Mike has no cat then Pat has no cat and if Tom has no cat then Zack has no cat.  
 If either Mike has a cat or Pat has no cat then Zack has a cat.  
 If Tom has a cat then it is not true that both Rachel and Sarah have cats.

**Begin by giving them symbolic values to certain sentences and expressing the premises and conclusion in terms of those symbols.**

Let  $m$  = “Mike has a cat”  
 $p$  = “Pat has a cat”  
 $t$  = “Tom has a cat”  
 $z$  = “Zack has a cat”  
 $r$  = “Rachel has a cat”  
 $s$  = “Sarah has a cat”

5. [20] Using the predicates defined on the set of UT students:

$Exy$   $x$  is equal to  $y$ ,

$CSx$   $x$  is a CS major,

$Mx$   $x$  is a math major,

Express in the syntax of Predicate Calculus:

a. *“There is exactly one CS major.”*

b. *“There are at least three students who are both Math majors and CS majors.”*

c. *“No one is both a Math major and a CS major.”*

d. *“There are at most two Math majors.”*