

CS 330 Formal Methods and Models

Quiz 3 (Spring 2011)

Instructor: Carlotta Domeniconi

February 17, 2011

Solutions

1. [50 points]

Using rules of inference with no substitution, prove that

$$(q \rightarrow r) \rightarrow (q \rightarrow (q \wedge r))$$

Use the notation introduced in class, and state, for each line, the rule of inference that justifies it.

$[q \rightarrow r]$	Assumption
$[q]$	Assumption
r	Modus ponens
$q \wedge r$	\wedge Introduction
$q \rightarrow (q \wedge r)$	\rightarrow Introduction
$\frac{q \rightarrow (q \wedge r)}{(q \rightarrow r) \rightarrow (q \rightarrow (q \wedge r))}$	\rightarrow Introduction

2. [50 points]

The following premises are given. Use rules of inference to derive the conclusion $(\neg t \vee w)$. Again, use the notation introduced in class, and state, for each line, the rule of inference that justifies it.

1. $\neg p \rightarrow (r \wedge \neg s)$	given
2. $t \rightarrow s$	given
3. $u \rightarrow \neg p$	given
4. $\neg w$	given
5. $u \vee w$	given
6. u	alternative elimination with 4 and 5
7. $\neg p$	modus ponens with 3 and 6
8. $r \wedge \neg s$	modus ponens with 1 and 7
9. $\neg s$	\wedge elimination with 8
10. $\neg s \rightarrow \neg t$	contrapositive law with 2
11. $\neg t$	modus ponens with 9 and 10
12. $\neg t \vee w$	\vee introduction with 11