

Logical Foundations of CS – CS5303

Quiz 3

Important note: Please make sure that you justify your answers, and that your answers are readable. All non-justified answers will be graded half the points, all unreadable answers will be graded 0.

Exercise 1 (4 points) *Is the following formula a tautology? Justify your answer using the tableaux method: $[(a \wedge b) \vee c] \rightarrow d \leftrightarrow [\neg(\neg a \rightarrow c) \vee \neg(\neg b \rightarrow c) \vee d]$*

Exercise 2 (4 points) *Is the following formula a tautology? Justify your answer using the sequent method: $(a \rightarrow (b \wedge c)) \vee (c \rightarrow \neg b)$.*

Exercise 3 (4 points) *Is the following reasoning correct? Justify your answer using the resolution method: Here is the list of hypotheses: $\neg a \vee b, b \rightarrow (c \vee d), \neg d \vee f, f \rightarrow g, c \rightarrow (a \wedge b), b \rightarrow g, \neg a \vee e, a$. And the conclusion is $e \wedge g$.*

Exercise 4 (4 points) *Are these two formulas equivalent?*

1. $(a \rightarrow (b \wedge c)) \vee (c \rightarrow \neg d)$
2. $(a \wedge (b \rightarrow \neg c)) \rightarrow (\neg c \vee \neg d)$

Justify your answer.

Exercise 5 (4 points) *Translate the following English sentences in predicate logic.*

Tom is not happy when it is rainy or when there is someone he knows who is not happy.

Exercise 6 (4 points) *What statement can you deduce from the following two ones?*

1. *I never work when it snows*
2. *I am at UTEP when I work.*

Prove your deduction using Venn diagrams.

Exercise 7 (3 points) *Justify why: $\exists x, (\phi \vee \psi) \equiv (\exists x, \phi \vee \exists y, \psi)$.*

Exercise 8 (3 points) *Justify why: $\exists x, (\phi \wedge \psi) \not\equiv (\exists x, \phi \wedge \exists y, \psi)$.*

Exercise 9 (4 points) *Exercise to be given on the board.*