

MATH 2610
Discrete Mathematics for Computer Science
Thursday January, 13 2005

This is the last of the homework for this week. This week's homework will be due next Tuesday January 18, 2005 and it will include yesterday's assignment. Please be sure to write as neatly as you can and staple your work together. I'll be in my office most of today (Thursday) and I will be able to check my email tonight, tomorrow morning, tomorrow evening, and Monday. For the record, I will usually be able to check my email on weekends, just not this weekend.

- (1) Read the addendum for today which can be found on the course website.
- (2) Read examples 17 and 18 in the textbook on pages 36 and 37.
- (3) Let $P(x)$ be the statement " x spends more than five hours every day roleplaying," where the universe of discourse for x consists of all students. Express each of these quantifications in English.
 - (a) $\exists x P(x)$
 - (b) $\forall x P(x)$
 - (c) $\exists x \sim P(x)$
 - (d) $\forall x \sim P(x)$
- (4) Determine the truth value of each of these statements if the universe of discourse is \mathbb{R} (the real numbers).
 - (a) $\exists x(x^3 = -1)$
 - (b) $\exists x(x^4 < x^2)$
 - (c) $\forall x((-x)^2 = x^2)$
 - (d) $\forall x(2x > x)$
- (5) Suppose that the universe of discourse of the propositional function $P(x)$ consists of $-3, -1, 1,$ and 3 . Express these statements without using quantifiers, instead using only *negations*, *disjunctions* (ORs), and *conjunctions* (ANDs).
 - (a) $\exists x P(x)$
 - (b) $\forall x P(x)$
 - (c) $\forall x((x \neq 1) \rightarrow P(x))$
 - (d) $\exists x((x \geq 0) \wedge P(x))$
 - (e) $\exists x(\sim P(x)) \wedge \forall x((x < 0) \rightarrow P(x))$

- (6) Translate each of these statements into logical expressions using predicates, quantifiers, and logical connectives.
- (a) No one is perfect.
 - (b) Not everyone is perfect.
 - (c) All your friends are perfect.
 - (d) One of your friends is perfect.
 - (e) Everyone is your friend and is perfect.
 - (f) Not everybody is your friend or someone is not perfect.
- (7) Suppose that the universe of discourse of $Q(x, y, z)$ consists of triples x, y, z , where $x \in \{0, 1, 2\}$, $y \in \{0, 1\}$, and $z \in \{0, 1\}$. Write out these propositions using disjunctions and conjunctions.
- (a) $\forall y Q(0, y, 0)$
 - (b) $\exists x Q(x, 1, 1)$
 - (c) $\exists z \sim Q(0, 0, z)$
 - (d) $\exists x \sim Q(x, 0, 1)$