

Math 220—Homework #1

due at the beginning of class Wednesday, January 12, 2005

- I. D'Angelo and West, p. 44, #2.4
- II. D'Angelo and West, p. 45, #2.9
- III. D'Angelo and West, p. 45, #2.10(a)–(d), (g)–(h)
- IV. D'Angelo and West, p. 46, #2.19. (Hint: let $P(A, B)$ be the statement “you can fool person A at time B ”. Also, there might be more than one reasonable interpretation; just choose one you think is right and go with it.)
- V. Write the negative of each of the following statements. All of your answers should end with “he/she does not vote for that candidate.”
 - (a) There is a candidate such that, for every person, he/she votes for that candidate.
 - (b) For every person, there is a candidate such that he/she votes for that candidate.
 - (c) There is a person such that, for every candidate, he/she votes for that candidate.
 - (d) For every candidate, there is a person such that he/she votes for that candidate.
- VI. Which of the four statements (a)–(d) in the previous problem imply which of the others? In other words, list all the pairs of statements for which, whenever the first one is true, the second one is automatically true.
- VII. Consider the following statement about how to keep your goldfish happy: “You must either feed it every day, or else sing to it and feed it every other day, or else feed it once a week and turn on the television or radio.” Convert this into an equivalent statement about how to not keep your goldfish happy.
- VIII. Consider the following four statements that might be found in a recipe for chocolate cake.
 - (a) If the flour is sifted, then whenever the butter is at room temperature, the batter is easy to mix.
 - (b) If whenever the flour is sifted, the butter is at room temperature, then the batter is easy to mix.
 - (c) The flour is sifted, and either the butter is not at room temperature or the batter is easy to mix.
 - (d) Either the flour is sifted and the butter is not at room temperature, or the batter is easy to mix.

Two of these statements are logically equivalent. Decide which two, write them in logical notation, and prove that they are logically equivalent. (Using truth tables is one way; Examples 2.14 and 2.19-2.20 might suggest an alternative.) Use R to stand for the statement “The flour is sifted”, S to stand for “The butter is at room temperature”, and T to stand for “The batter is easy to mix”.