CSI 35 LECTURE NOTES (Ojakian)

Topic 4: Formal Logic (Review!)

OUTLINE

(References: Wells 11 - 14, 25, 29, 71, 72, 75, 79)

1. Predicates
2. Propositions
3. Quantifiers
4. Logical Connectives

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1. Predicates and Propositions
   (a) Proposition (our usage! - as a "logician")
   (b)

   PROBLEM 1. *$P(m)$ is the predicate "$m|9$". Determine if the following are true or false: $P(3), P(9), P(6), P(0)$.*

   PROBLEM 2. *If $Q(n)$ is the predicate "$n^3 < n$", find the integers (if any), where the predicate is true.*

   PROBLEM 3. *Find a predicate with one variable with is always false.*

2. Universal and Existential Quantifiers

   PROBLEM 4. *Do Wells Exercise 13.2.7*

3. Bringing in Connectives

   Connectives: AND, OR, NOT, IMPLY, EQUIVALENCE

   PROBLEM 5.

   (a) Use a truth table to show that $(P \wedge Q) \rightarrow P$ is a tautology.

   (b) Use a truth table to show that $(A \rightarrow B) \wedge A \wedge \neg B$ is a contradiction.

   PROBLEM 6. *Wells, Exercise 14.2.3*

   PROBLEM 7. *Wells, Exercise 14.2.4 and consider what happens 1) when a universal quantify is put in from, and 2) when an existential quantifier is put in front.* **Use some programs to test these by creating functions the evaluate the predicate**.

   PROBLEM 8. *Do Wells, Exercise 25.1.4.*

   PROBLEM 9. *Find examples of true implications ("material implication") which seem odd because the antecedent and consequent are not related.*

   PROBLEM 10. *For each proposition, is it True or False (if False, how many counter-examples does it have?)*

   (a) $\forall n : N \ (n < 2019 \vee n > 2019)$

   (b) $\forall n : N \ (n \leq 2019 \vee n > 2019)$

   PROBLEM 11. *Do Wells, Exercise 75.3.4 (p.113)*

   PROBLEM 12. *Do Wells, Exercise 79.1.5 (p. 118)*