

## COT 3100 Recitation #1: Logic Practice 1/17-20/2017

### Warm-Up Problems

- 1) Al gets the disease algebritis and must take one green pill and one pink pill each day for two weeks. A green pill costs \$1 more than a pink pill and Al's pills cost a total of \$546 for the two weeks. How much does one green pill cost?
- 2) The second and fourth terms of a geometric sequence are 2 and 6, respectively. What are the possible values of the first term in the sequence?
- 3) Let  $s(x)$  denote the sum of the digits of the positive integer  $x$ . For example  $s(8) = 8$  and  $s(123) = 1 + 2 + 3 = 6$ . For how many two-digit values of  $x$  is  $s(s(x)) = 3$ ?
- 4) Cassandra sets her watch to the correct time at noon. At the actual time of 1:00 PM, she notices that her watch reads 12:57 and 36 seconds. Assuming that her watch loses time at a constant rate, what will be the actual time when her watch first reads 10:00 PM?
- 5) If  $\log(xy^3) = 1$  and  $\log(x^2y) = 1$  what is  $\log(xy)$ ?

### Logic Problems

- 6) Using the following premises:

$$(p \wedge t) \rightarrow (r \vee s)$$

$$q \rightarrow (u \wedge t)$$

$$u \rightarrow p$$

$$\bar{s}$$

Derive the conclusion  $q \rightarrow r$ .

- 7) In class, Modus Ponens was proved using just the laws of logic. Prove Modus Tollens in the same manner.
- 8) Simplify the following logical expression as much as possible using the laws of logic only. Show each step and state which rule is being used. (Note: You may combine both associative and commutative in a single step, so long as you do so properly.)

$$p \vee [p \wedge [\neg(\neg r \vee \neg q) \vee (\neg r \wedge q)]]$$

- 9) Show that  $(p \rightarrow r) \wedge (q \rightarrow r)$  and  $(p \vee q) \rightarrow r$  are logically equivalent using the laws of logic equivalence and the definition of the conditional statement only. Show each step and state which rule is being used.
- 10) Use the Rules of Inference and the Law of Contraposition to validate the conclusion drawn below. (Each of the items above the dotted line is a premise, while the conclusion to draw is below the dotted line.) Show each step and state which rule is being used.

$$q \rightarrow (u \wedge t)$$

$$u \rightarrow p$$

$$q$$

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$$p \wedge t$$