8/29/14

1. Homework

Due **9/12/14** at the beginning of class

Remember, you are allowed to turn in homeworks in groups of two. One writeup, with two names.

1. **Propositions (3 points)**
   Consider the following propositions:
   r: It rains; b: I am wearing rain boots; f: I have wet feet
   Write the propositions below using r, b, f and logical operators.

   (a) It rains and you have wet feet, even though you are wearing rain boots.
   (b) I don't have wet feet whenever I wear rain boots.
   (c) If it rains and I am not wearing rain boots then I have wet feet.

2. **Equivalences (8 points)**
   Consider the following equivalence: $\neg p \rightarrow (q \rightarrow r) \equiv q \rightarrow (p \vee r)$

   (a) Show the equivalence using truth tables.
   (b) Show the equivalence by establishing a sequence of equivalences. You may use all equivalences in Tables 6, 7, 8. Show your work by annotating every step.

3. **Boolean Function (6 points)**
   A boolean function $y_1 \vee y_2 \vee \ldots \vee y_n$, where $y_i = x_i$ or $y_i = \neg x_i$ is called a *maxterm*.
   Show that a Boolean function can be represented as a conjunction ("and") of maxterms.

   Hint: Use the 0-rows in the truth table.

4. **Quantifiers (5 points)**
   Let $M(x) =$"likes Mardi Gras" and $P(x) =$ "plays an instrument", and let the domain consist of all people in New Orleans.

   (a) (2 points) Translate these statements into English.
       i. $\forall x : (M(x) \vee P(x))$
       ii. $\exists x : \neg M(x)$
   (b) (3 points) Express each of the following statements in terms of $M(x), P(x)$, quantifiers, and logical connectives.
       i. Noone in New Orleans plays an instrument.
       ii. Someone in New Orleans plays an instrument but does not like Mardi Gras.
       iii. Everyone in New Orleans who likes Mardi Gras also plays an instrument.

5. **Translation (4 points)**
   Translate each of these statements into logical expressions in three different ways by varying the domain and by using predicates with one and with two variables.

   (a) Someone at Tulane comes from the east coast.
   (b) Everyone in your class has studied calculus and owns a computer.