Math 2300, Spring 2013 – Discrete Structures
Sample Problems
Material Covered Since Quiz 2

1. Let $A = \{1,2,3\}$ and $B = \{x, y\}$.
   a. List the elements of $A \times B$.
   b. List the elements of the power set of A: $\mathscr{P}(A)$.

2. Let *A, B*, and *C* be sets. Prove that $(A \times B) \cup (A \times C) \subseteq A \times (B \cup C)$.

3. Let *A, B*, and *C* be sets. Use set identities to prove that $(A - B) - C = A - (B \cup C)$.

4. Assume that all sets are subsets of a universal set *U* and prove that for all sets *A* and *B*, if $A \subseteq B$, then $A \cap B^c = \varnothing$.

5. Let $A = \{1,2,3,4\}$, draw a directed graph of a relation on *A* that is:
   a. Reflexive, but not symmetric and not transitive.
   b. Symmetric and transitive, but not reflexive.

6. Let $A = \{2,3,5\}$ and $B = \{2,6,15\}$ and let *R* be the "divides" relation from *A* to *B*:

$$\forall (x, y) \in A \times B, xRy \Leftrightarrow x \mid y$$

   a. Explicitly state which ordered pairs are in *R*.
   b. Explicitly state which ordered pairs are in R^{-1}.

7. Let R be the relation defined on Z as follows:

$$\forall m,n \in Z, mRn \Leftrightarrow 5 \mid (m - n)$$

   a. Prove that R is an equivalence relation.
   b. List (no proof required) the distinct equivalence classes of R.

8. How many integers from 1 through 100 must you pick to be sure of getting one that is divisible by 5?