Math 235 - Dr. Miller - Topics List for Exam #3, Spring 2017 - Friday, Apr. 28, 2017

Non-Proof Tasks:

1. Formally state, including necessary universal hypotheses:
   (a) Definition of union, intersection, set difference, complement, Cartesian product
   (b) Definition of relation from A to B, relation on A, inverse of a relation, composition of relations
   (c) Definition of domain, range, equivalence class; disjoint, pairwise disjoint.
   (d) Definitions of reflexive, symmetric, transitive properties
   (e) Definition of partition, Fundamental Theorem of Equivalence Relations ("and" version)
2. Shade Venn diagrams (including intermediate) for mixed $\cup, \cap$, complement among 3 sets.
3. Create sets of ordered pairs, digraphs, or arrow diagrams that are/aren't or have/lack:
   (a) My choice of domain and range
   (b) Relations, functions, one-to-one, onto
   (c) Inverses, compositions, ON a set versus from one set to another
   (d) Reflexive/not, symmetric/not, transitive/not
   (e) Be aware of how false hypotheses affect symmetry or transitivity.
   (f) I may ask for sets of ordered pairs to have a given number of elements.
   (g) Prepare for combinations of the above, such as "has domain $\{1, 2, 3\}$ but isn't symmetric."
4. Given a formula/verbal description for a relation or function, list some/all ordered pairs.
5. Given an equivalence relation, find $\overline{x}$ for my choice of x, find ALL sets in A/R.
6. Given a set of ordered pairs, digraph, arrow diagram, formula, or verbal description of a relation, identify:
   (a) Domain, range, inverse, composition
   (b) Whether it is reflexive, symmetric, transitive - explain informally
   (c) Whether it is a function, one-to-one, onto - explain informally
7. Identify whether a collection of sets is a partition or not; create an example that is/is not; explain.

Proof Tasks:

1. Prove set identities using my/your choice of chain-style proof or two-directions.
2. **Precise** notation and math grammar will be required:
   (a) Logic words join STATEMENTS while set operations join SETS - example: "$x \in A$ and B" is wrong; "$x \in A$ and $x \in B$" is right, as is "$x \in A \cap B$."
   (b) We assume or show or conclude STATEMENTS, not SETS - example 1: "Assume $A \times B$" is wrong; "Assume $(x, y) \in A \times B$" is right, as is "Assume $A \times B \neq \emptyset$."
   (c) Example 2: "So $A \cap B$" is wrong; "So $A \cap B = B$" is correct, as is "So $x \in A \cap B$."
3. Prove results about sets involving $\emptyset$, $\subseteq$ or $=$, $\cup$, $\cap$, $\times$, $\setminus$, complement, etc.
4. Prove whether a given relation is/is not reflexive, symmetric, transitive. I may give you the initial relation via a formula or as verbal description.
5. Prove my choice of sub-part in the proof of the FTER. (You are NOT responsible for the $\Leftarrow$ half.)
6. You will NOT have to prove results about functions on this exam.

This exam will have more points for non-proof tasks than earlier exams have.