Math 235 - Dr. Miller - Topics List for Exam #3, Spring 2018 - Monday, Apr. 30, 2018

Prepare for the exam by reviewing your notes, homework, reading, and handouts.

Non-Proof Tasks:

1. Formally state these definitions, including necessary universal hypotheses:
   (a) Union, intersection, set difference, complement, Cartesian product, power set
   (b) Relation from A to B, relation on A
   (c) Reflexive, symmetric, transitive, anti-symmetric properties
2. Create digraphs or sets of ordered pairs that are/aren't: reflexive, symmetric, transitive, anti-symmetric.
   (a) Prepare for combinations of these, such as "is reflexive but not symmetric."
   (b) Be aware of how false hypotheses affect symmetry, anti-symmetry, transitivity.
   (c) I may require or forbid specific ordered pairs/xRy relationships, such as "$3R5$" or "$(1,1) \notin R$".
3. Given a digraph, set of ordered pairs, or verbal description of a relation, identify:
   (a) Whether it is reflexive, symmetric, transitive, anti-symmetric; explain informally.
   (b) Whether it is an equivalence relation, a partial order (reflexivity required); explain informally.

Proof Tasks: (Some are "rehearsed" proofs: we did them in class, so just rehearse your own write-up!)

1. Prove that something is/is not unique.
2. Prove that $\emptyset \subseteq A$ for all sets A.
3. Prove my choice of direction in "$A \subseteq B$ iff $\mathcal{P}(A) \subseteq \mathcal{P}(B)$.
   (a) Pay close attention to the wording I give; points off for wrong direction.
   (b) It may be helpful to review all the different variations (Exam #1) for stating a conditional.
4. Prove "subsetness," set equality, or "not a subset."
   (a) Prepare for creative arithmetic, as in the $1 - \frac{2+a}{b-7}$ or $14x + 9y$ HW problems.
5. Prove set identities using chain-style proof, with only definitions and rules of logic.
6. Especially on set proofs, **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.
   (c) Example 2: "So $A \cap B$" is wrong; "So $A \cap B = B$" is correct, as is "So $x \in A \cap B$."
7. Prove whether a given relation is/is not reflexive, symmetric, transitive, anti-symmetric.
8. Counterexamples should be rigorous: give your candidate, and show it meets all conditions.
   (a) I will not OPENLY ask for counterexamples; that is, instructions won't say "Give a cex to the following statement ...."
   (b) However, most of the "not" proof tasks listed above require the creation of a cex.
9. **Take-home problem:** Prove a result by PMI.