Math 131 - Dr. Miller - Topics List for Final Exam - Thursday, Dec. 11, 2014, 1:00-3:00 pm

Logic with STATEMENT FORMS: (i.e., using ONLY p, q, r, etc. and the symbols below)

1. Memorize and understand the symbols $\vee$, $\wedge$, $\sim$, $\rightarrow$, $\leftrightarrow$.
2. Construct truth tables or just individual truth values for given statement forms.
3. Individual values may be asked about in terms of other statement forms, as in p.48, #21.
4. Use the Order of Operations to evaluate truth values for longer expressions.
5. Use truth tables to determine logical equivalence, tautology, or contradiction.
6. Convert between verbal statements and statement forms, as in p.37 #8 and HW handout.

Logic with STATEMENTS:

1. Use and understand statements that are entirely verbal, entirely symbolic, or a mix.
2. Be able to use $\vee$, $\wedge$, $\sim$, $\rightarrow$, $\forall$, $\exists$, as well as basic symbols such as $=$, $<$, etc.
3. Use the variations "if...then," "only ...if," "necessary," "sufficient" in conditional statements.
4. Given a conditional statement using any of the above variation, rewrite it or give its hypothesis, conclusion, converse, inverse, or contrapositive using my choice of the other variations above.
5. Given a conditional statement using any of the above variations, write its negation.
6. Convert between verbal statements written as conditionals versus as universal statements.
7. Be able to recognize universal or existential statements, including the many verbal synonyms.
8. Classify a given conditional, universal, or existential statement as true or false, and justify.
9. Negate verbal, symbolic, or mixed statements, including conditional, universal, and existential.
10. Answer questions about a given Tarski's World diagram, and justify, as in HW.

Sets:

1. Memorize and understand the notations $\mathbf{Z}$, $\mathbf{Z}^+$, $\mathbf{Q}$, $\mathbf{Q}^+$, $\mathbf{R}$, $\mathbf{R}^+$.
2. Understand, use the $\in$, $\notin$, $\subseteq$, $\not\subseteq$ symbols, including in true/false or fill-in-the-blank questions.
3. Especially prepare for questions involving $\emptyset$ or power sets.
4. List all subsets of a given set S; use correct roster notation to specify $\mathcal{P}(S)$.
5. List all subsets with certain qualities, as in "contain $*$ and \$ but neither ♡♣ nor *Ohio*" from HW.
6. Predict how many subsets or proper subsets a given set should have.
7. Given two sets, determine whether either is a subset of the other, and justify, as in HW.
8. Know the notation n(S) for cardinality. Predict the cardinality of $A \times B$ or $\mathcal{P}(S)$ for given sets.
9. Determine the $\cup$, $\cap$, $\setminus$, $\times$, or complement of sets, including mixes of 3 or more of these.
10. Make up sets whose $\cup$, $\cap$, $\setminus$, $\times$, or complement have certain features, as in HW.
11. Find the union or intersection of an indexed family of sets (may be rosters, intervals, or graphs).

Sequences

1. List terms for a sequence given by an explicit formula or a recurrence relation.
2. Find an explicit formula for a given list of numbers, including when signs alternate.
3. Evaluate sums or products expressed in either sigma, pi, or expanded form.
4. Convert between expanded form and sigma or pi notation.
5. Rewrite a given sigma or pi expression via a change of variables, as in p. 184 #48-53.
6. Use and understand factorial notation for numbers or variables (5! vs. $n!$).
7. Expand factorials to simplify expressions involving them.

Induction

1. Your induction proofs MUST follow correct course style (5 sections, sentences).
2. Write induction proofs about sums or products using sigma or pi notation or ellipsis.
3. Use the formula for $\sum_{i=1}^{k} i$ and $1 + r + r^2 + \ldots r^n$ in problems like p.198 #20-28.
4. Use exponent and factorial rules correctly, especially in expressions like that in p.208 #26.

Recursion

1. Use substitution to determine *whether* a given explicit formula satisfies a given RR.
2. Use PMI to prove that a given RR satisfies a certain (correct) explicit formula, as in p.207 #24-27.
3. Don't confuse these two tasks; they have the same "ingredients," but one is much harder.
4. Use iteration to guess an explicit formula for a RR, including piecewise-defined functions.

Counting:

1. Apply Multiplication, Addition, Subtraction Principles in counting problems.
2. Be prepared for situations where the "blanks" aren't simply spaces in a word or code.
3. **Be able to separate outcomes by cases (inspired by interpretations that involve "or").**
4. Comprehend and solve questions using the phrases "at least" or "at most."
5. Recognize whether a situation is a combination or permutation situation, or neither.
6. List permutations or combinations of n things taken r at a time.
7. Simplify expressions involving $P(n, r)$, $C(n, r)$, and n-choose-r notation, showing steps.
8. Count rearrangements, committees, etc. for simple combination or permutation situations.
9. Count rearrangements involving duplicate letters.

Bring a calculator!