Sample Exam 1
Math 42, Fall 2014

This is most of the first exam I gave in Math 42 in Spring 2014. Our exam may be more difficult than this one, but it should at least be comparable, and cover similar (though not the same) material. Exception: There is one topic we covered in the spring that we did not cover this semester. That topic has been replaced by the material on logic gates, so you might expect a question on logic gates instead.

1. (12 points) Let $f : A \to B$ be a function.

  (a) Define what it means for f to be one-to-one.

  (b) Define what it means for f to be onto.

2. (10 points) JT is making a bead necklace that will have the form of a "J" bead, then 4 colored beads, and then a "T" bead. Suppose there are 5 colors of beads to choose from, and the order of the beads matters (e.g., J-red-red-blue-red-T is different from J-red-blue-red-red-T). How many different necklaces can she make? Briefly (1–2 sentences) **EXPLAIN** your answer. If your numerical answer involves arithmetic operations, you do not need to do them out. (E.g., $7 \cdot 6 \cdot 5 + \dfrac{8(9)}{2}$ is a correctly formatted final answer.)

3. (10 points) Write the negation of the following statement: "Every plan has a flaw in it somewhere." No explanation necessary.

4. (10 points) Draw a (shaded) Venn diagram that indicates $(A \backslash B) \cup (B \backslash A)$. No explanation necessary.

5. (10 points) Suppose P, Q, and R are logical statements, and the statement

$$P \vee (Q \Rightarrow R)$$

is FALSE. What (if anything) can you deduce about the truth or falsity of P, Q, and R? Briefly (2–3 sentences) **EXPLAIN** your answer.

6. (12 points) Lady Googoo is performing in Las Vegas, doing 2 shows per night on each weekday (Mon–Fri) and 3 shows on each weekend day (Sat and Sun). When she performs, she wears an outfit that consists of a jumpsuit and a top hat, and she has 5 jumpsuits and 3 hats to choose from. Briefly (2–3 sentences) **EXPLAIN** why every week, there must be at least two shows where she wears exactly the same outfit.

7. (12 points) Let $A = \{5, 6, 7\}$ and $B = \{6, 7\}$. List the elements of $(A \times B) \cap (B \times A)$. No explanation necessary, but show all your work.

8. (12 points) Prove that if n and k are both even numbers, then $n + k$ is even. (As usual, your proof should be written out in complete sentences and equations.)