Math 311
Portfolio Proofs

The purpose of this document is to provide a list of proofs that are eligible to be added to your portfolio of proofs for the course. Each of you is expected to complete 50 points worth of portfolio proofs by the end of the course. When you submit a portfolio proof, I will grade it. If your proof is well written and essentially correct, I will award you points for the proof toward your portfolio total, and you will be able to add it to your portfolio. If the proof is incorrect or unclear, you will be expected to rewrite it and resubmit it for grading. Eventually, portfolio problems will expire (I will give a sunset date for each proof as the course progresses), but fear not, new proofs will be added so you will continue to have opportunities to earn portfolio points. Please note that some proofs will be grouped together in categories. When this happens, you will only be eligible to earn points for **one** proof in a given category.

1. Suppose $f : A \to \mathbb{R}$ and $g : A \to \mathbb{R}$ are both functions that map a set A **onto** the set of real numbers $\mathbb{R}$. Prove that the function $f + g$ is also onto. [This Problem is incorrect – see handout].

   Restatement: Suppose $f : A \to \mathbb{R}$ be a function that maps the set A **onto** the set or real numbers $\mathbb{R}$. Let $g : \mathbb{R} \to \mathbb{R}$ be the function $g(x) = -3x$ Prove that the function $g \circ f : A \to \mathbb{R}$ is onto.

2. Complete and turn in one of the direct proofs from the Direct Proofs Activity given in class on 10/30/2015.

3. Complete and turn in one of the proofs from the Direct Proofs Activity given in class on 10/30/2015 using *Proof by Contraposition*.

4. Complete and turn in one of the proofs from the Proof by Contradiction Activity given in class on 11/02/2015 using *Proof by Contradiction*.

5. Complete and turn in either Problem 2 or Problem 3 from the Proof by Cases Activity.

6. Complete and turn in Proposition 2 from the Uniqueness Proofs Activity.

7. Complete and turn in one of Proposition 3, Proposition 4, or Proposition 5 from the Set Proofs Handout and Activity.

8. Suppose that R and S are relations on a set B. Further suppose that R and S are both transitive. Prove **two** of the following:

   (a) Is $R \cup S$ transitive? Justify your answer.
   (b) Is $R \cap S$ transitive? Justify your answer.
   (c) Is $R - S$ transitive? Justify your answer.
   (d) Is $R \circ S$ transitive? Justify your answer.
   (e) Is $\overline{R}$ transitive? Justify your answer.