Math 361: Introduction to Topology
Asst. 1, due F., 1/27

• read sections 1.1-1.3 of Messer/Straffin

Below are 11 problems. The first 5 are required; the next 5 are optional. We will discuss the last one in class this week. You should submit at least one of the optional problems. We will present some of these problems in class the week after they are due.

Required

1. Find three examples of equivalence relations not mentioned in class or the book. At least one should be mathematical; at least one should be non-mathematical. Show that they are equivalence relations. You should be prepared to talk about these in class on Monday, 1/23.

2. Find the flaw in the following proof:
   (False) Claim: If a relation $\square$ on set X satisfies the symmetry and transitive properties, then it must also satisfy the reflexive property.
   Incorrect Proof: We need to show $x \square x$ for all $x \in X$. By symmetry, we know $x \square y$ implies $y \square x$, for all $x, y \in X$. Now, by transitivity, $x \square y$ and $y \square x$ imply that $x \square x$, for all $x, y \in X$. Thus relation $\square$ on X is reflexive.
   Come up with an example where symmetry and transitivity hold, but reflexivity does not.

3. 1.1.9 (that is, section 1.1, problem 9 in Messer/Straffin)

4. 1.2.10

5. 1.2.11

Optional Problems

1.1.4, 1.1.5, 1.1.11
1.2.1, 1.2.2

For Discussion

For each possibility of reflexive, symmetry, and transitive being individually true or false, find a relation on a set which precisely satisfies that possibility. (There are $2^3 = 8$ possibilities.) Say why each property does or does not hold. Make sure you specify the set.