Lecture 0. Introduction.

Due to a necessary last minute schedule change I was assigned this class too late to change professional commitments for the first few days of the class, and so I must miss the first three days. In exchange, I'll do my best to provide printed "Lecture Notes" that will try to cover the same material that I would discuss in class if I were actually here. Copies of these notes (PDF versions) will be available on your Blackboard Account under "Course Materials". Fortunately, though, I will be here on Friday when we will have a real class! See you then.

But for now, let's learn

Counting.

Yes, indeed, this course begins with us learning how to count. Sounds pretty silly since you probably all learned how to "count" in first grade if not sooner. Well sort of. I'll bet that there are a lots of simple looking counting questions that you will find very challenging indeed. So for starters this term we are going to learn some techniques to deal with some of them. To try to convince you that there are some simple looking questions that are very tough to answer, let's look at just a few examples and then later turn to the task of learning ways to attack them.

Example 0.1. Professor Jones is teaching two courses this term, Math 251(Calculus I) and Math 231 (Discrete Math I). There are 32 students in his Calculus section and 21 in his Discrete Math section. So the first question is: How many students are taking a mathematics course from Professor Jones this term?

After a moment of thought we see that there is a wrinkle here and maybe it's not quite trivial. The answer depends on how many students are in **both** of the two classes. Once we settle that, this particular example is easy. Indeed, can you figure out the answer if there are **no** students in both classes, or if there are 7 in both? Well, if you're stuck, wait a minute; we'll find out how to answer this.

Example 0.2. Suppose that we have a set $S = \{a, b, c, d, e, f, g, h, i, j\}$ of ten letters including three vowels (a, e, i). Here are some simple enough counting questions to ask:

(a) How many three letter words are there using just letters from S? How many of these start with a vowel?

(b) How many three letter words are there with no letters repeated? How many of these start with a vowel? How many have at least one vowel?

(c) How many subsets does S have? How many of these have exactly three elements? How many have at least three elements?

(d) How many words are there that use exactly 5 a's and 3 b's?

(e) How may functions are there from S to S? How may are one-to-one?

Example 0.3. If we agree that a "poker hand" is any set of 5 cards from a standard 52 card deck,

(a) How many such poker hands are there?

(b) How many poker hands have exactly one pair? Exactly two pairs?

(c) How many are 5 card flushes (5 cards of the same suit)?