Exam 1 **September 2023**
Discrete Mathematics II **Prof. Nollet**

First exam covers sections 10.1-10.11 in our zybook text, but (a) section 10.1 is subsumed by sections 10.3 and 10.11 and (b) sections 10.6, 10.10 and 10.12 are example/review sections, so there is not really new content (just practice). Looking at exercises in sections 10.10 and 10.12 should be a useful review for the exam.

10.2 The bijection rule and the $k-1$ rule for counting sets.

10.3 Generalized power rule is at the heart of most the other ideas below.

10.4 Permutation formula $P(n,r) = n!/(n-r)!$ counts the number of ordered lists of r distinct objects taken from a set of size n. When $r = n$, these are simply permutations of the set of size n (when $P(n,n) = n!$).

10.5 Combination formula $\binom{n}{r} = C(n,r) = n!/(r!(n-r)!)$ counts the number of subsets of size r taken from a set of size n. Note that the order doesn't matter for subsets.

10.7 Counting by complement: if $S \subset X$, then $|S| = |X| - |X - S|$.

10.8 If you are permuting $n = n_1 + n_2 + \ldots + n_k$ objects with n_k the number of each distinct type, the number of possibilities is $\frac{n!}{n_1! n_2! \ldots n_k!}$. It might be easier to remember as a product of combinations.

10.9 To count the number of ways to select n items from m varieties is $\binom{n+m-1}{m-1}$, because you can encode those choices with binary strings using $m-1$ 1s as dividers for the n items. An important idea!

10.11 Inclusion-exclusion principle for counting the size of unions. Should be fine if you can handle 4 sets or less.

Suggestions: Look over homework, quizzes, and examples from class. Checking book problems not assigned is a good idea (I will look at them when writing the exam). Understanding the ideas is more important than memorizing formulas. Look at problems in Sections 10.6, 10.10 and 10.12, as these require you to learn which counting ideas to use.