Math 4370 **COMBINATORICS** Spring 2012
Dr. Duval **Homework**

Tuesday, January 17

Follow the separate general guidelines for Parts A,B,C. Be sure to include and label *all four* standard parts (a), (b), (c), (d) of Part A in what you hand in.

When we add, subtract, and multiply

Sections 1.1, 1.2

A: Reading questions. Hand in Thu. 19 Jan., or earlier.

1. Why does the hypothesis of Theorem 1.2 specify that the sets are *pairwise* disjoint? Why not disjoint? What is the difference between "disjoint" and "pairwise disjoint"? Give an example of three finite sets that are disjoint, but not pairwise disjoint, and show how they do not satisfy the conclusion of Theorem 1.2. [Note the author's comment after the proof of Theorem 1.2.]
2. Near the bottom of p. 5, the author says, "The reader should go back to our proof of the Subtraction Principle [Theorem 1.4] and see why the proof fails if B is not a subset of A." Do this, and explain why the proof fails in this case.
3. After Example 1.13, near the bottom of p. 9, the author claims that "we would count the integer 83885 three times". Explain carefully why this is so, why we *shouldn't* count 83885 three times in this case, and how the author gets around this problem.
4. In subsection 1.2.3, when deriving the formula for permutations, the author uses the Generalized Product Principle at the bottom of p. 10 and top of p. 11. At first glance, this does not seem like a legal use of the Product Principle, since the choices are not independent. Why isn't this a problem?
5. (Based on an actual question from a student.) In Theorem 1.17, we are choosing k elements. So why does the product in the formula for that theorem end $(n-k+1)$ instead of $(n-k)$?

B: Warmup exercises. For you to present in class. Due by end of class Thu., 19 Jan.

1. **1.10 Supplementary Exercise:** 1
2. Generalize Examples 1.9 and 1.10 by finding the number of k-digit positive integers that both start and end in even digits.
3. Rework Example 1.13, except now assume the password has either four or five digits. (The password still does not start with 0, and it still contains the digit 8.)

When we divide
Section 1.3

A: Reading questions. Due by 3pm, Mon., 23 Jan.

1. Draw a diagram like that of Figure 1.2, except make it match the story of the children's party at the beginning of subsection 1.3.1. Relate the solution of the children's party problem to your diagram.
2. Explain why the first two tables in Figure 1.3 are marked "same", and the last table is marked "different".
3. Draw a diagram like that of Figure 1.2, applied to Example 1.22, with $n = 3$. (In class, we'll do this with $n = 4$.)
4. Why is the superficial argument in the second paragraph of subsection 1.3.2, near the bottom of p. 17, wrong? How do we fix it?

B: Warmup exercises. For you to present in class. Due by the end of class Tue., 24 Jan.

1. The example at the beginning of subsection 1.3.2, but with 27 faculty, sending four members to commencement.
2. **1.10 Supplementary Exercise:** 2(a)
3. The pizza restaurant has 9 different kinds of toppings. How many different pizzas can be ordered with either 3 or 4 different toppings?