Math 4370 **COMBINATORICS** Spring 2012
Dr. Duval **Homework**
Thursday, February 23

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.

Ferrers shapes and their applications

Subsection 2.3.2 (starting with Proposition 2.24)

A: Reading questions. Due by 3pm, Wed., 29 Feb.

1. Illustrate Proposition 2.24 by listing all partitions of 6 that have at least 3 parts; listing all partitions of 6 in which the largest part is at least 3; and the bijection between them given by Proposition 2.24. Use Ferrers shapes!
2. Illustrate Proposition 2.25 by listing the partitions of 7 in which the first two parts are equal; listing all partitions of 7 in which each part is at least 2; and the bijection between them given by Proposition 2.25. Use Ferrers shapes!
3. Demonstrate the bijection in the proof of Lemma 2.26 on the partition $(7, 5, 4, 3, 3)$. Use Ferrers shapes!

B: Warmup exercises. For you to present in class. Due by the end of class Thu., 1 Mar.

1. What does the largest part in the partition p correspond to in its conjugate p'?
2. What does the smallest part in the partition p correspond to in its conjugate p'?
3. Find a formula for the kth part of p' (in terms of parts of p).

Inclusion-exclusion: Two sets

Subsection 2.4.1

A: Reading questions. Due by 3pm, Mon., 5 Mar.

1. How is the question at the beginning of this section different from the question at the beginning of section 1.1? Why does this make it harder?
2. Draw a diagram like that of Figure 2.13 for an example like Example 2.33, except replace 2 and 3 by 4 and 5. Show how you can use your diagram to answer find the count the number of positive integers less than or equal to 300 that are divisible by at least one of 4 and 5.
3. The author invites the reader to solve Exercise 13 from section 2.8 before reading Example 2.34. Since you can find the solution to Exercise 13 in section 2.9, instead solve this slight variation: In how many different ways can you partition the set $[11]$ into three blocks so that two blocks are of size 4, and one block is of size 3? [Try to solve this **before** looking at the solution to Exercise 13.]
4. Use the technique from Exercise 13 to verify the author's claim of the value of $|B|$ in Example 2.34.
5. It may be too much to read through and comprehend all of Example 2.34 on your own (but please do so if you feel up to it). As an intermediate step, draw a diagram like Figure 2.13, and identify all the quantities that go into the diagram, and explain how we use it to find the answer to Example 2.34.

B: Warmup exercises. For you to present in class. Due by the end of class Tue., 6 Mar.

1. **2.10 Supplementary Exercise:** 31, 33