

Math 188, Fall 2022

Study guide for Midterm 2

- The exam is in-class on December 7 during 11:30AM – 2:30PM.
- There are no notes or books allowed.
- I will provide paper, so do not bring a blue book.
- Content: everything (but see exceptions at the end), the final exam is cumulative.

The format will be similar to the midterms, just longer. Here is what I expect you to know for the exam.

- All items from study guides 1 and 2.
- All homework problems from Homeworks 5, 6, and 7 (ignore optional problems) whether they were graded or not. You might see them in the exact same form, either partially or in whole. You might also see them with slight modifications.
- Computations
 - (1) Using graphs to solve enumerative problems, relation between counting walks and eigenvalues of adjacency matrix
 - (2) Using exponential generating functions: how to interpret sums, products, compositions
 - (3) Computing Möbius functions of posets (both general formulas like Lemma 6.13 or explicit examples like Example 6.9) and using Möbius inversion (and specifically inclusion-exclusion and on the divisor poset)
 - (4) Using Burnside's lemma and Redfield–Pólya theorem on specific examples
- Statements of theorems: you may be asked to state a formula or to complete or fully give the statement of a theorem. You don't need to memorize them word for word how I wrote them, but you should be able to give a statement that is logically equivalent.
 - (1) Counting walks in graphs using adjacency matrix (powers and also eigenvalues)
 - (2) Möbius function for boolean poset and divisor poset
 - (3) Burnside's lemma and consequences
- Derivations and proofs: it will help to internalize the main ideas from the derivations and proofs that we discuss in class. I don't plan to ask you to repeat them (unless it falls under one of the above categories), but they will help you with all of the above.

1. EXEMPTIONS

Here are a few things you don't have to worry about:

- Lagrange inversion – we didn't have time to really do much with it and there were no homework problems
- Remark 6.15: calculus used to study derangements
- Section 7.4: proving congruences is interesting but I don't usually like to test on things covered in the last lecture