Format and topics for exam 3
Math 142

General information. Exam 2 will be a timed test of 50 minutes, covering sections 5.2–5.4, 6.1–6.2, and 7.1 of the text. No books, notes, calculators, etc., are allowed. Most of the exam will rely on understanding the problem sets (including problems to be done but not to be turned in) and the definitions and theorems that lie behind them. If you can do all of the homework, and you know and understand all of the definitions and the statements of all of the theorems we've studied, you should be in good shape.

You should not spend time memorizing proofs of theorems from the book, but you should defintely spend time memorizing the *statements* of the important theorems in the text. Exam 3 will feature the usual types of questions, though it is likely that all of the problems will be computations or problem-solving with explanation.

Definitions. The most important definitions and symbols we have covered are:

5.2	permutation	r-permutation
	r-combination	$P(n,r)$
	$C(n,r) = \binom{n}{r}$	
5.3	$P(n;a,b,\dots)$	
6.1	generating function	power series
	coefficient of x^r	
7.1	recurrence relations	initial conditions
	Fibonacci relation	Fibonacci numbers

Theorems, results, algorithms. The most important theorems, results, and algorithms we have covered are listed below. You should understand all of these results, and you should be able to cite them as needed.

Sect. 5.2: Set composition principle.

Sect. 5.3: Thm. 1 (MISSISSIPPI theorem); Thm. 2 (Divider theorem).

Sect. 5.4: Big board of balls in boxes (left 2 columns).

Sect. 6.2: Table of polynomial/power series expansions. Multiplication of generating functions (expansion (6), p. 248).

Types of computations. You should also know how to do the following general types of problems.

Sect. 5.3: Arranging MISSISSIPPI (and similar), with answer in $P(n;a,b,\dots)$ notation. Picking objects with repetition. Enumerating all partitions of an integer into a given number of parts ($9 = 7+1+1 = 6+2+1$, etc.).

Sect. 5.4: Translating between distribution and arrangement problems (ex. 27–28, p. 209). Translating among distribution, selection, and integer solution problems (ex. 29–30, p. 210). Numbers of integer solutions, using Divider theorem.

Sect. 6.1: Modelling with generating functions (possibly via integer solutions).

Sect. 6.2: Calculating coefficient of x^r, esp. using expansion (6), p. 248.

Sect. 7.1: Basic recurrence relations (e.g., Fibonacci). RR's with forbidden subsequences. Multivariable RR's (on last box, last ball).

As with the previous exam, since enumeration is the main focus of Sects. 5.2–5.4, you should also be able to do enumerations of the various types seen in the assigned homework (including the homework to be done but not turned in). Note that since one of the goals of Ch. 5 is to help you learn problem-solving skills to be used on unfamiliar problems, there may also be problems that do not closely resemble something from the homework. Nevertheless, it will definitely be helpful to know how to do all of the problems from the homework.

You may also find it useful to review the following important examples from the text:

Sect. 5.3: Ex. 5, p. 197: Sequences with varying repetitions. Ex. 7, pp. 197–198: Selection with lower bound. Ex. 8, p. 198: Arranging BANANA with restrictions.

Sect. 5.4: Ex. 2, p. 202: Bridge problems. Ex. 4, p. 203: Combining cases and $P(n; a, b, \dots)$. Ex. 9, pp. 206–207: VCV method.

Sect. 6.2: Exs. 2–4, pp. 250–252: Using expansion (6), p. 248 to calculate coefficients.

Sect. 7.1: Ex. 2, p. 274: Basic RR's. Ex. 7, p. 277: Forbidden subsequence. Exs. 9–10, p. 279: Multivariable examples.

Not on exam. Sect. 5.2: Stirling's approximation (p. 186). Sect. 5.5: all (except as required for generating functions). Sect. 7.1: Systems of recurrence relations, difference equations (pp. 280–281). Big board of balls in boxes: Bell numbers, Stirling numbers, partitions (except as required for 5.3 and 5.4), exponential generating functions.

Good luck.