Format and topics for exam 2
Math 142

General information. Exam 2 will be a timed test of 50 minutes, covering sections 2.3, 3.1–3.4, and 5.1–5.2 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.

With one exception, 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, especially any result with a name (e.g., Euler's Formula). The exception is that you should understand the proof of the theorem in Sect. 3.4.

The four types of questions on exam 1 (statements of definitions and theorems, computations, problem-solving with explanation, proofs) are the same types that will appear on exam 2.

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

2.3	k-coloring	chromatic number
	wheel	
3.1	tree	root
	rooted tree	directed tree
	level	parent
	child	siblings
	leaves	internal vertices
	m-ary tree	binary tree
	height (of a tree)	balanced tree
3.2	spanning tree	depth-first
	breadth-first	
3.3	traveling salesperson problem	assignment problem
5.2	permutation	r-permutation
	r-combination	$P(n,r)$
	$C(n,r) = \binom{n}{r}$	

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. 3.1: Tree with n vertices has $n-1$ edges; determining number of vertices, leaves, and internal vertices from knowing only 1 of those; max leaves for given height, min height for given number of leaves.

Sect. 3.3: Branch-and-bound algorithms for TSP, assignment problems.

Sect. 3.4: Sorting requires $O(n \log n)$ binary comparisions (also proof); merge sort, QUIK sort.

Sect. 5.1: Multiplication principle, addition principle.

Sect. 5.2: Set composition principle.

Types of computations. You should also know how to do the following general types of problems, some of which are straight computations, and some of which require explanation.

Sect. 2.3: Determining (with explanation) the chromatic number of a graph. Subgraphs requiring k colors (complete graphs, wheels). Applications of chromatic numbers.

Sect. 3.2: Doing depth-first and breadth-first search in a given situation.

Of course, since enumeration is the main focus of Sect. 5.1–5.2, 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.

Not on exam. Sect. 2.3: Chromatic polynomials. Sect. 3.1: Theorem 4 (Cayley). Sect. 3.2: Traversal of trees. Sect. 3.3: Approximate traveling salesperson tour construction. Sect. 3.4: Bubble sort, heap sort. Sect. 5.2: Stirling's approximation (p. 186).

Good luck.