Topics for Exam 2
Math 42, Fall 2014

General information. Exam 1 will be a timed test of 75 minutes, covering 3.3–3.7, 4.1–4.4, 5.3–5.4, and 6.1–6.7 of the text, as well as the notes on induction outlines and the notes on algorithms, recursion, and induction. No books, notes, calculators, etc., are allowed. Most of the exam will be based on the homework and quizzes from the above sections. If you can do all of those problems, and you know and understand all of the ideas behind them, you should be in good shape.

As mentioned above, your first priority should be to understand the homework and quizzes and the ideas behind them. Besides the list of topics you should know, below, you should also be familiar with everything specially emphasized in the text. You should also study the Check Yourself problems in 3.2, 3.5, 3.6, 3.7, 4.2, 4.4, 5.3, 5.4, 6.2, 6.4, and 6.7. These are practice problems with answers in the back of the book, and similar problems may well appear on the exam. Finally, you should also look at the additional Try This problems in 3.8 and 5.5; these do not have answers in the back of the book, but you are welcome to ask about them in class and at office hours.

Statements of definitions. On at least one question, you will be asked to recite one of the definitions listed below (the italicized words under the **Definitions:** headings). This is meant to force you to learn the mathematical terms that you need to learn for the rest of this course and for future courses.

Section 3.3 Definitions: *graph, vertices, edges, adjacent, incident, neighbors, loop, multiple edge, degree.*

Section 3.4. Number of functions $f : A \to B$; number of injective functions $f : A \to B$.

Section 3.5. Definitions: *walk, path, cycle, length, distance, connected, forest, tree, leaf, simple graph, complete graph, bipartite graph, complete bipartite graph, P_n, C_n, K_n, $K_{m,n}$, regular graph, degree sequence, Petersen graph.*

Section 3.6. Definitions: *isomorphic graphs, nonisomorphic graphs.* Examples of isomorphic graphs.

Section 3.7. Definitions: *subgraph, component, $G \setminus H$, graph complement $\overline{G}$.*

Section 4.2. Definitions: *base case, inductive hypothesis, inductive step.* How to do a proof by induction. How to do an **induction outline**. "Strong"/fancy induction (p. 97). Examples (DeMorgan, Vogelplex, subsets of $\{1, \ldots, n\}$, trees formula). Summation notation.

Section 4.3–4.4. More examples of induction.

Algorithms, recursion, and induction. Idea of algorithms as functions. Idea of recursive algorithms. Using induction to prove that a recursive algorithm works. Examples: multiplication, exponentiation, sorting.

Section 5.3. Definitions: *divide, congruent mod n, integers mod n.* Examples of modular arithmetic.

Section 5.4. Definitions: *encryption, decryption, substitution ciphers, plaintext, cipertext, wacktext, shift cipher, ROT13, atbash cipher, standard Vignère cipher, original Vignère cipher.* How to encrypt and decrypt various ciphers.

(cont. on next page)

Section 6.2. Definitions: $\binom{n}{k}$, *n choose k, recursion.* Choice notation identity (p. 156).

Section 6.3–6.4. Pascal's Triangle; computing $\binom{n}{k}$ using triangle/choice notation identity.

Section 6.5. Definitions: *k-to-one correspondence,* $n!$ *(n factorial).*

Section 6.7. Definitions: *Binomial, binomial coefficients, binomial identity.* Binomial Theorem, Factorial formula for $\binom{n}{k}$.

Not on exam: Sections 3.9–3.12, 4.5–4.10, 5.6–5.8. (3.6) Generalized idea of isomorphism (Defn. 3.6.3). (3.7) Subsection 3.7.2 (weights, directed graphs, computer storage, adjacency matrix). (5.3) **Definitions:** *equivalence relation, equivalence classes, partition.* Abstract version of mod n (pp. 128–129).