**Math 1271/3071 Final Exam Info Sheet**

The purpose of this handout is to help you study by listing the concepts, definitions, and results you will need to know for the final exam.

**Final Exam Information.** The final exam will be on Thursday, Dec. 15 from 9AM to 12PM. The exam will take place in **Ryan Building 1042**. You will *not* be allowed to bring in any notes, use the text book, or use a calculator. Please bring your **Student Card**.

**Material Covered.** All the material discussed in class, unless stated otherwise, will appear on the final exam. For the material you need to know from Chapters 1 through 6, please see the review sheets for Midterms 1 and 2. For the material on Chapters 7 and 9, please see below for the breakdown of what you will need to know from each section.

> **Section 7.1** Know the terminology associated to graphs: directed graph, multigraph, edge ,vertex, loops, subgraph. Know the special families of graphs, like complete graph, the complete bipartite graph, and how to construct the complement of a graph. Know what it means for a graph to be bipartite, connected, and know what we mean by connected components. Know how the degree of a vertex is defined, what it means for a graph to be regular, and know the Handshaking Theorem (Theorem 7.1). Know what it means for a sequence of integers to be graphical.
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> **Section 7.2** Know how to determine if a graph has an Euler circuit or an Euler walk. Know how to compute the Eulerization of a graph.
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> **Section 7.3** Know terms like walk, circuit, the length of a walk, a cycle, simple walk, and a path. Know what it means for a graph to be connected, and be able to determine the cut-edges and cut-vertices of a graph. Know how to compute $\kappa(G)$ and $\kappa'(G)$.
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> **Section 7.4** Know how to compute the distance between any two vertices in a graph. Know how to compute its eccentricity, diameter, and radius. Be able to compute the shortest distance between two vertices using Dijkstra's algorithm.
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> **Section 7.5** Know what a tree and a rooted tree are. Be able to find spanning trees in a graph, and how to use Prim's algorithm to find the minimal spanning tree.
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> **Section 7.6** Know what a Hamilton circuit and path are. Be able to determine if a graph has a Hamilton circuit/path. Know how to use Ore's theorem to determine if a graph has a Hamilton circuit/path.
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> **Section 7.7** Know what the Traveling Salesman Problem is, and be able to use the nearest neighbour method to find an approximate solution to the Traveling Salesman Problem.
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> **Section 9.1** Know what a prime number is and some of their properties. Be able to compute the GCD of two numbers using the Euclidean Algorithm.
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> **Section 9.2** Know how to do computations using modular arithmetic. Be able to find the inverse of a number modulo an integer. Be able to use the Chinese Remainder Theorem to solve a system of congruences.
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> **Section 9.3** Know the following encryption methods: scytale, the Caesar cipher, the Vigenère method. Know how to both encrypt and decrypt a message using these methods.
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> **Section 9.4** Know how to generate substitution ciphers using a keyword. You will not have to decrypt a message using the methods of letter frequencies.
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> **Section 9.5** There will be no RSA questions (simply because of the computations involved). However, you will still need to know how to compute expressions of the form $a^b \pmod{m}$ (see page 312-313).

**The Weighting of the Exam.** Please note that in calculating your final mark, I will be using the following scheme. I will calculate your mark in two ways: (1) The first way is the way described on the course handout, i.e., each midterm test will be worth 25% of your final mark, and the final exam will be

worth 40%. (2) The second way is to drop your lowest midterm, and add its weight to the final exam. So your final exam will be worth 65% of your mark. I will then take the highest number of the two methods.

**Note.** I will be out of town December 7-11. Although I will be in town on December 12 and 13, I will be in meetings all day, so I will only be able to reply to email in the evening. I will be in my office from 10AM to 4:30PM on Dec 14, the day before the exam (except for lunch). Please feel free to drop by to ask me a question, or send me a question via email (`avantuyl@lakeheadu.ca`) or by phone (343-8228).

Good luck! Adam VT