

## Math 1281 Christmas Exam Info Sheet

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

Exam Information. The exam will take place on

**Thursday, December 7, 2006, 1-4PM UC 2011.**

You *must* **bring your student ID**. You will *not* be allowed to bring in any notes, use the text book, or use a calculator. You may leave your answers in an unexpanded form. For example, you may simply write  $C(23, 4)$ .

**Material Covered.** All the material discussed in class up to the end of Chapter 5 may appear on the exam. For a description of the material that we covered in Chapter 1 and Chapter 2, see the handout for the last test (copies of this handout can be found on the web). I have given below a breakdown of what you will need to know from Chapters 2, 3, 4 and 5 covered since the last test.

1. Section 2.4. Know the difference between a sequence and a summation. Also, know the difference between an arithmetic and geometric progression. Know how to find a formula for a sequence, and how to do a summation over a set. You do not need to know the material on cardinality (pg. 158-160).
2. Section 3.1. Know how to write simple algorithms like the ones we did in class. You should also be able to write down the various steps of an algorithm, like some of the homework problems. As well, given an algorithm, you should be able to determine its output.
3. Section 3.2. Know the definition of “big-O” notation, and be able to apply Theorem 1 (page 184). You do not need to know the material from page 186-190.
4. Section 3.3. Know how we measure the time complexity of an algorithm, and be able to measure the time complexity of some simple algorithms.
5. Section 3.4. You will need to know the definitions of the following terms:  $a$  divides  $b$ , factor, multiple,  $a \bmod m$ ,  $a$  congruent modulo  $m$ . As well, you should be able to calculate  $a \bmod m$ , and know the Division Algorithm (Theorem 2). Also, know some applications of congruence.
6. Section 3.5. Know what a prime and composite number are. Know the Fundamental Theorem of Arithmetic. Also, know the definition of the gcd and lcm of two numbers, and how to use the prime factorization to find both.
7. Section 3.6. You will only need to know the material on the Euclidean Algorithm and how to use it.
8. Section 3.7. Know the material up to page 235. That is, know Theorem 1, and the subsection on solving linear congruence. As well, know Fermat’s Little Theorem (Theorem 5). You do not need to know the material on public-key systems.
9. Section 4.1. You will have to do one or two proofs that involve induction. You do not need to know the material of pages 275-277.
10. Section 4.2. Know the definition of Strong Induction (page 284) and be able to do examples like those done in class. Omit the material from page 288 to 291.

11. Section 4.3. Know the definition of a recursive definition. Be able to evaluate a function that is defined recursively. As well, you should be able to give a recursive definition for a sequence and for a set. You do not need to know the material on Recursively Defined Sets and Structures.
12. Section 4.4. From this section you will only need to know the definition of a recursive algorithm and some examples of a recursive algorithm.
13. Section 5.1. Know the Sum Rule and the Product Rule. You should be able to do problems using these two rules like those given in class and in the homework assignments. As well, know the principle of inclusion-exclusion, and the definition of a tree.
14. Section 5.2. Know both the Pigeonhole Principle and the Generalized Pigeonhole Principle. I expect you to be able to use these principles in problems similar to ones we did in class and in the homework.
15. Section 5.3. Make sure you understand the difference between a permutation and combination. I expect you to remember Theorem 1 and Theorem 2, and how to use them. You will be expected to do problems like those discussed in class and the homework.
16. Section 5.4. Know how to use the Binomial Theorem. As well, memorize Pascal's Identity. You should be able to show, via algebraic manipulation, identities involving binomial coefficients (similar to Question 20 of the homework.)
17. Section 5.5. Know how to count the number of permutations when repetition is allowed. Also, know how to count the number of combinations when repetition is allowed. I will expect you to be able to answer problems like Example 5. Also, know how to apply Theorem 3. The material on pages 376-379 can be omitted.
18. Section 5.6. Know how to put permutations in order according to the lexicographical ordering. As well, you should be able to find the next biggest permutation (see Example 2). You can skip the material on combinations.
19. Section 6.1-6.2. I will save this material for the next midterm.

Exam Format. The exam is out of 75 points. It will have three parts:

**Part A** Short Answer Questions - Do all the questions (15 questions worth 2 pts each + one matching question worth 10 pts = 40 pts)

**Part B** Long Answer Questions - Do all the questions (5 questions worth 5 pts each = 25 pts)

**Part C** Longer Answer Question - There will be three questions. You pick only *one* (1 question worth 10 pts)

**Important Note:** Before the exam, I will try to post all the homework marks on my office door and on the web. Make sure you check out your grade to check for errors.

Good Luck on your Exams! – Adam