

Sample Second Midterm Exam

ECE 369

Coverage may vary from this semester **Name:** _____

Read all of the following information before starting the exam:

1. **NOTE:** Unanswered questions are worth 25% credit, rounded down. Writing any answer loses this “free” credit, which must be earned back by the quality of the answer. If you wish a question to be treated as unanswered, but you have written on it, clearly write “DO NOT GRADE” in the answer area. In a multi-part question, unanswered *parts* are worth 25%. This is an option only for parts that are numbered or lettered on the exam: you may not create your own “parts” for this purpose.
2. Show all work, clearly and in order, if you want to get full credit. I reserve the right to take off points if I cannot see how you arrived at your answer (even if your final answer is correct).
3. No calculators, or materials other than pen/pencil and blank paper are allowed except those we distribute during the exam. This is a closed book closed notes exam.
4. Please keep your written answers brief; be clear and to the point. Points will be deducted for rambling and for incorrect or irrelevant statements. Where algorithms are requested, you may be penalized for inefficient algorithms, and an exponential algorithm may be considered entirely incorrect on the basis of inefficiency alone.
5. Each of the problems is approximately equal in value, except where indicated. Multi-part problems divide the problem score approximately equally among the parts.
6. Good luck!

1. Consider a class of 14 students. Suppose 8 of these are juniors, 5 are seniors and 1 is a sophomore. Suppose I plan to draw a committee of four students. For each question below, explain how you get your result clearly.

a. How many different committees can be drawn from this class?

b. How many different class makeups are possible for the committee (e.g. all seniors, 2 juniors and 2 seniors, etc.)?

(continued on next page)

c. How many committees are there where the seniors outnumber the juniors?

d. How many committees have exactly one senior?

e. How many committees have exactly one freshman or exactly one senior?

2. Consider our class of 14 students. Suppose 8 of these are juniors, 5 are seniors and 1 is a sophomore. Suppose I plan to assign four different tasks, one to each of four different students. For each question below, explain how you get your result clearly.

a. How many different ways are there for me to assign the tasks to the class?

b. How many different class patterns can be assigned (e.g. sophomore to task 1, senior to task 2, and juniors to tasks 3 and 4)?

(continued on next page)

c. After I assign the tasks, will there be some class (sophomore, junior, or senior) that is responsible for more than one task? How do you know?

d. How many different ways are there for me to assign the tasks that have seniors performing tasks 1 and 4?

3. State and derive the binomial theorem.

4. Write and solve a recurrence for the Fibonacci numbers $0, 1, 1, 2, 3, 5, 8, \dots$

5.

Under what conditions do we say that two infinite sets have the same cardinality?

For each of the following pairs of infinite sets, state whether they have the same cardinality or not and prove your answer is correct.

a. The even natural numbers and the natural numbers.

b. The integers and the natural numbers.

(continued on next page)

c. The positive rationals and the natural numbers.