

MATH 4510: Review for Exam 1 (Sections 1.1-3.2)

1 Topics to Review

You should be familiar with:

1. How to count using the basic principle of multiplication, permutations, combinations, and multinomial coefficients.
2. What the Kolmogorov axioms say and how to verify that a function satisfies them.
3. How to compute probabilities by counting in sample spaces with equally likely outcomes.
4. How to compute probabilities using our formulas for unions, intersections, and complements.
5. How to compute conditional probabilities from the definition and from using a reduced sample space.

2 Sample exam

The following questions are a sample exam similar to the content and length of the actual exam:

1. In how many different ways can a group of 12 people (6 men and 6 women) be divided into two groups of size 6 if each group has to have the same number of men and women?
2. Suppose that N raccoons live in Boulder. A scientist traps 100 raccoons, tags them, and releases them back into the wild. A month later, another 50 raccoons are trapped. What is the probability that exactly k of them will be tagged? (Assume that the raccoon population did not change during this period and that all raccoons are equally likely to be trapped.)
3. Let E , F , and G be events. Find (and prove) a formula for the probability that exactly one of the events E and F will occur and that G will not occur, in terms of $P(E)$, $P(F)$, $P(G)$, $P(EF)$, $P(EG)$, $P(FG)$, and $P(EFG)$. (You don't necessarily have to use all of these in the formula.)
4. You roll two dice. If the sum of the dice is at least 9, what is the conditional probability that the sum is odd?
5. An integer is chosen at random from the numbers $1, \dots, 1000$ with each integer equally likely to be chosen. What is the probability that the chosen integer is divisible by at least one of 2, 3, and 5? What is the probability that the chosen integer is divisible by none of 2, 3, and 5?
6. You are traveling from Denver to New York to Paris to London. You have one piece of luggage and at each stop it is transferred from one airplane to another. There is a 4% probability that a bag is lost at the Denver airport, a 12% probability that it is lost in New York, and a 6% probability that it is lost in Paris. What is the probability that your luggage will not reach London with you? If your luggage is lost, what is the conditional probability that it was lost in New York?