

**Fall 2018 COT 3100 Homework 9**  
**Please Consult WebCourses for the due date/time**

**Note: Please justify your answers and why you use each formula.**

- 1) In a tennis league, there are six teams of 5 players each. A set of 7 players is selected randomly out of the 30 players in the league. What is the probability that at least one player from each team will be selected?
- 2) 30 tickets are sold in a raffle where 4 prizes will be given. Terri buys 3 of the tickets. What is the probability that Terri wins 0 prizes? 1 prize? 2 prizes? 3 prizes?
- 3) The integers from 1 to 10, inclusive, are partitioned at random into two sets of five elements each. What is the probability that 1 and 2 are in the same set?
- 4) Sam's probability of getting an A on an individual test is 80%. If he takes ten tests, what is the probability he gets As on exactly 7 of those tests?
- 5) You roll a pair of standard fair six-sided dice three times, and record the sum of the two faces showing each time. Let these three sums be  $s_1$ ,  $s_2$ , and  $s_3$ . What is the probability that  $s_2$  is strictly bigger than both  $s_1$  and  $s_3$ ?
- 6) Suppose we roll a fair 6 sided die with the numbers [1,6] written on them. After the first die roll we roll the die  $k$  times where  $k$  is the number on the first die roll. The number of points you score is the sum of the face-values on all die rolls (including the first). What is the expected number of points you will score?
- 7) Suppose that one person in 1,000 people has a rare genetic disease. There is an excellent test for the disease; 99% of the people with the disease test positive and only 3% of the people who don't have it test positive. What is the probability that someone who tests positive has the disease? What is the probability that someone who tests negative does not have the disease?
- 8) Suppose E and F are events in a sample space and  $p(E) = 2/3$ ,  $p(F) = 3/4$ , and  $p(F | E) = 9/10$ . Find  $p(E | F)$ .
- 9) Balls are randomly removed from a bag without replacement. If the probability that the first five balls withdrawn are all green is one-half, what is the fewest possible number of balls in the bag at the start?
- 10) A Bubble Sort is a common algorithm taught to students that sorts a list of numbers ([https://en.wikipedia.org/wiki/Bubble\\_sort](https://en.wikipedia.org/wiki/Bubble_sort)). Given a random permutation of the integers 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, what is the probability that the permutation will be sorted **just one pass** of Bubble Sort? (For example, the permutation 3, 1, 2, 7, 4, 5, 6, 10, 8, 9 would get sorted in a single pass. 3 would swap with 1 and 2. Then 7 would swap with 4, 5 and 6, followed by 10 being swapped by 8 and 9. But, the permutation 3, 1, 2, 7, 4, 5, 8, 6, 10, 9 would not get sorted by one pass of the algorithm. After one pass, the array would be 1, 2, 3, 4, 5, 7, 6, 8, 9, 10.)
- 11) Give a summary of the life and mathematical contributions of Andrew Wiles. Please aim for a length of roughly 200 - 400 words. **Your summary must be typed.** Please state the sources you used in writing your summary.