

Homework 1: Getting Started with Probability

Instructions: Your answers are due at the beginning of class on the due date. You can either turn in a paper copy, or a pdf version through canvas. We highly recommend using latex (<http://www.cs.utah.edu/~jeffp/teaching/latex/>) for producing the assignment answers. If the answers are too hard to read (e.g. **do not create pdf using your phone's camera!**) you will lose points (entire questions may be given 0).

Please make sure your name appears at the top of the page.

You may discuss the concepts with your classmates, but write up the answers entirely on your own. **Be sure to show all the work involved in deriving your answers! If you just give a final answer without explanation, you may not receive credit for that question.**

1. Say two events A and B are disjoint and you know the probabilities $P(A)$ and $P(B)$. What is a simple expression for $P(A \cap B^c)$, using no more information than just $P(A)$ and $P(B)$? *Hint:* Think of a concrete example, like two disjoint events that could happen when you roll a die. Also, you may try drawing a Venn diagram. **Show your work by listing intermediate equations or by drawing a Venn diagram.**
2. Say 10% of the population is rich, 7% of the population is famous, and 3% of the population is both rich and famous. Define events $R =$ “person is rich” and $F =$ “person is famous” for some randomly selected person in the population. Write an expression for each of the following events using set operations involving the events R and F . **Here you can just give the answer, and do not need to show any work.**
 - (a) The person is not rich.
 - (b) The person is rich and famous.
 - (c) The person is either rich or famous (or both).
 - (d) The person is not rich or not famous (could be rich or famous, but not both).
3. Calculate the probabilities for each of the four events in the previous problem. **Be sure to show your intermediate steps and list any probability rules that you use.**
4. Exercise 2.9 from the book. **Here again, no explanation is needed for these answers.**
5. You have a deck of 16 cards, with:
 - 7 cards that are white on both sides;
 - 5 cards that are white on one side, black on the other;
 - 4 cards that are black on both sides.

The cards are shuffled and randomly flipped. You draw one card at random from the deck and look only at one side of it. *Hint:* Be careful! Each side of the card counts as a separate outcome. Think about it in terms of the 32 sides that are possible (not the 16 possible cards).

- (a) Draw a tree diagram with the probabilities of all possible card types. **Your tree should have two levels, one for the color of the top of the card, and one for the color of the bottom of the card. It should also include all of the joint probabilities (top color AND bottom color) at the ends.**

- (b) What is the probability that the top of your card is black?
- (c) If the top of your card is white, what is the probability that the bottom is black?
- (d) What is the probability that the bottom of your card is white? **Show how you got this.**