

# CS 2802: Homework 8

March 24, 2019

Handed out March 25, due Tuesday, April 9 at 5 PM. (No possibility of handing it in late, though.) Note that this is a somewhat long assignment, which is why I'm giving as much time as I can. The reason that it's long is that includes problems on all the probability material that will be covered in the prelim. I plan to post the solutions to the homework on April 9 (after the homework has been handed in, of course!), so you can use them to help in studying for the prelim.

- Read Chapters 18 and 19, except for 19.4.6 and 19.5.4-19.5.8. (The material not covered is still interesting. We just don't have the time to do everything.)
- Do the following problems:
  - 18.7 (make sure that your answer explains Sauron's mistake as well as calculating the correct probability)
  - 18.10 (for (b), state clearly which event we want the conditional probability of)
  - 18.12
  - 18.17
  - 18.24 (Give a concrete counterexample to the step that you think is incorrect.)
  - 18.25(a),(b). (Again, make sure you clearly specify the events that you are taking the probability of.)
  - 18.31(b)
  - 19.1
  - 19.9. (For full credit, you must clearly specify a sample space and random variable on this space that you're taking the expectation of in part (c), use this random variable to define the probabilities of interest in parts (a) and (b).)
  - 19.11

- 19.21 (Again, make clear what the sample space is, and what random variables you’re using. Hint: There’s a really elegant approach that gives a 5-line solution.)
- 19.22 (Hint: the sample space should consist of all the possible truth assignments to the primitive propositions that appear in  $G$ .)
- Additional problem: In the second-ace puzzle, come up with a protocol for Alice that is consistent with the story told in class. Specifically, if Alice says “I have an ace” at the first step, the probability (according to Bob) that she has both aces is  $1/5$ ; if she says “I have the ace of spades” at the second step, the probability that she has both aces is  $1/3$ ; and if she says “I have the ace of hearts” at the second step, the probability that she has both aces is also  $1/3$ . How does your protocol address the concern that Bob can say (after the first step, when Alice says she has an ace) “no matter Alice tells me she has at the second step, I’ll think that she has both aces with probability  $1/3$ , so I should ascribe probability  $1/3$  to her having both aces now (after the first step).” (Hint: the protocol is quite simple. The easiest way to come up with it is perhaps to think about what you’d want the probability tree to look like, and then construct a protocol with that probability tree.)

Think about (but don’t hand in) 18.11, 18.16.