Homework 2

Due: 17 Sep 2018

REMEMBER:

- Include work in symbolic form (e.g. $p(X = \text{foo}|Y = 3)$). I should be able to tell where every number came from. You can abbreviate (e.g. $p(\text{foo}|3)$) as long as it's clear what is meant.

- Sanity-check your answers. If your answer seems crazy but you can't find the error, at least make it clear you know there's a problem.

Problem 2.1

A standard deck of playing cards has 52 cards in four suits (two red, two black), each suit with cards numbered 2–10 and "face cards" labelled jack, queen, king, and ace. A "pinochle deck" has 48 cards: each of the four suits has only 9 and 10 plus the face cards, and each card appears twice in the deck.[1]

Assuming in each case that the relevant deck is well-shuffled, identify the following probabilities. Show your work by making it clear where each number in your probability comes from.

a. p(R=ace | D=standard): In a standard deck, the probability of drawing any card whose rank is 'ace'

b. p(R=ace | D=pinochle): In a pinochle deck, the probability of drawing any card whose rank is 'ace'

c. p(F=true, C=red | D=pinochle): the probability of drawing a card whose rank is one of the face cards and whose suit is one of the red suits, from a pinochle deck

d. p(R=A, S=H | F=true): the probability of drawing the ace of hearts given that the card drawn is a face card

e. If there are 3 standard decks and 1 pinochle deck in a pile, and you pick one at random before drawing a card from that deck, what is p(F=true), i.e. the overall probability of drawing a face card?

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[1] I swear I am not making this up. It's pronounced "PEE-nuckle".

Problem 2.2

I have many decks of playing cards, most of which are standard, but some are pinochle decks—for the purposes of this problem, let's say I have two pinochle decks and ten standard decks. Without counting the cards, it's hard to tell at a glance whether you've accidentally grabbed a pinochle deck.

    a. If I grab a deck completely at random and draw a card from it, what is the probability that the card is a 5?

    b. If I grab a deck completely at random and draw a card from it, what is the probability that the card is a jack?

    c. If I grab a deck completely at random and draw a card, and the card is a jack, what is the likelihood that I've grabbed a pinochle deck?

    d. If I grab a deck completely at random and draw two cards from it, some pairs give me certainty: if either card is a 4, for instance, or if both cards are the jack of diamonds. But if one is a jack and the other is a king, does that give me any knowledge about the deck? Why or why not? (Note: I'm not looking for exact numbers on this part, because they're subtle and a bit gross. Focus on the analysis.)

Again, don't forget to show your work.