Math 6d: Homework 21

HW#21 is due March 24; submit to Google classroom 15 minutes before the class time.

Please, write clearly which problem you are solving and show all steps of your solution.

Dependent probability

When the probability of one event depends on the probability of the previous event, the events are called dependent. To find the probability for the two events to occur, we use the independent probability for the first even and the dependent probability for the second:
$P(A \cap B) = P(A)\, P(B|A)$, where $P(B|A)$ is the probability of B given that A has happened.

Homework questions

1. You have a bag with 6 red, 3 green, and 4 blue marbles. You take a marble out of the bag and you do not return it. Find the probability for:
   (a) The first marble to be red and the second to be blue
   (b) To pick 3 red marbles in a row
   (c) To pick one blue and the second not green.

2. In a bag of 20 coins, 5 are unfair and the rest are fair coins in the sense that they have an equal probability for head or tail when flipped. If the probability for a tail for the unfair coin is 0.8, what is the probability to pick a coin and get three heads in a row?

3. Suppose you have four coins (a penny, a nickel, a dime, and a quarter).
   (a) How many possible results are there for a flip of just one of these coins?
   (b) How many total possible results are there for flipping two distinguishable coins, say the penny and the nickel? (*Hint: For each result of the first coin, how many are there for the second? If you are not sure, write all of the possible results out and count them.)*
   (c) How many possible results are there for three distinguishable coins? For four?
   (d) Summarize your responses above by writing an expression for the number of possible results when flipping *N* distinguishable coins.

4. In a sequence of DNA, each monomer has four 'outcomes': it can be one of the 4 nucleotides called A, C, G, or T. *(Hint: in this problem, think of a monomer as a coin or a die with 4 sides. Every slot in the DNA sequence is a roll of that 4 sided die)*
   (a) How many total outcomes are there for a sequence that is 2 monomers long (has 2 slots for nucleotides)? 3 monomers long? 4 monomers long?
   (b) Suppose you picked a 3-monomer sequence at random, and you wanted to know the probability of a particular event, namely that the sequence has no A's in it. How many outcomes would correspond to this event? (*Hint: You could simply write down all the possibilities, but instead think about how many non-A options there are* ***per slot*** *or, when you roll a die with 3 sides only, how many possibilities are per roll.*)
   (c) What is the probability that a random 3-monomer sequence would have no A's in it, assuming all sequences (outcomes) are equally likely?

A sequence with 2 monomers(slots), each one could be A, C, G, T