Math 183 HW3, Name: _____, PID: _____

2.2 Roulette wheel. The game of roulette involves spinning a wheel with 38 slots: 18 red, 18 black, and 2 green. A ball is spun onto the wheel and will eventually land in a slot, where each slot has an equal chance of capturing the ball.

(a) You watch a roulette wheel spin 3 consecutive times and the ball lands on a red slot each time. What is the probability that the ball will land on a red slot on the next spin?

(b) You watch a roulette wheel spin 300 consecutive times and the ball lands on a red slot each time. What is the probability that the ball will land on a red slot on the next spin?

(c) Are you equally confident of your answers to parts (a) and (b)? Why or why not?

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2.6 Dice rolls. If you roll a pair of fair dice, what is the probability of

(a) getting a sum of 1?

(b) getting a sum of 5?

(c) getting a sum of 12?

2.10 Guessing on an exam. In a multiple choice exam, there are 5 questions and 4 choices for each question (a, b, c, d). Nancy has not studied for the exam at all and decides to randomly guess the answers. What is the probability that:

(a) the first question she gets right is the 5^{th} question?

(b) she gets all of the questions right?

(c) she gets at least one question right?

2.16 PB & J. Suppose 80% of people like peanut butter, 89% like jelly, and 78% like both. Given that a randomly sampled person likes peanut butter, what's the probability that he also likes jelly?

In addition to answering the above question, you should display the given setup in both a Venn diagram and a contingency table (with margins).

2.18 Health coverage, relative frequencies. The Behavioral Risk Factor Surveillance System (BRFSS) is an annual telephone survey designed to identify risk factors in the adult population and report emerging health trends. The following table displays the distribution of health status of respondents to this survey (excellent, very good, good, fair, poor) and whether or not they have health insurance.

		Health Status					
		Excellent	Very good	Good	Fair	Poor	Total
Health Coverage	No	0.0230	0.0364	0.0427	0.0192	0.0050	0.1262
	Yes	0.2099	0.3123	0.2410	0.0817	0.0289	0.8738
	Total	0.2329	0.3486	0.2838	0.1009	0.0338	1.0000

(a) Are being in excellent health and having health coverage mutually exclusive?

(b) What is the probability that a randomly chosen individual has excellent health?

(c) What is the probability that a randomly chosen individual has excellent health given that he has health coverage?

(d) What is the probability that a randomly chosen individual has excellent health given that he doesn't have health coverage?

(e) Do having excellent health and having health coverage appear to be independent?

2.20 Assortative mating. Assortative mating is a nonrandom mating pattern where individuals with similar genotypes and/or phenotypes mate with one another more frequently than what would be expected under a random mating pattern. Researchers studying this topic collected data on eye colors of 204 Scandinavian men and their female partners. The table below summarizes the results. For simplicity, we only include heterosexual relationships in this exercise.[65]

		Partner (female)			
		Blue	Brown	Green	Total
Self (male)	Blue	78	23	13	114
	Brown	19	23	12	54
	Green	11	9	16	36
	Total	108	55	41	204

(a) What is the probability that a randomly chosen male respondent or his partner has blue eyes?

(b) What is the probability that a randomly chosen male respondent with blue eyes has a partner with blue eyes?

(c) What is the probability that a randomly chosen male respondent with brown eyes has a partner with blue eyes? What about the probability of a randomly chosen male respondent with green eyes having a partner with blue eyes?

(d) Does it appear that the eye colors of male respondents and their partners are independent? Explain your reasoning.

R Questions

This HW, you will explore the first 100,000 digits of pi (3.1415….).

R1. Using an internet search, locate a text file that contains the first 100,000 digits of pi. If this file includes the decimal point, remove this in a text editor. [List website where you got the file]

https://www.angio.net/pi/digits.html

R2. Read the file into R and break it into an array of 100,000 elements. The below code should be helpful. [code]

```
piisfun = readLines("file location", warn=FALSE)
digits = as.numeric(unlist(strsplit(piisfun,"")))
```

```
> pir = readLines("100000.txt", warn = FALSE)
> digits = as.numeric(unlist(strsplit(pir,"")))
```

R3. What percent of the first 100,000 digits of pi are 7s? [code, answer]

```
> a <- table(digits)
> a['7']
   7
10025
> percentageOfSevens = (a['7']/100000) * 100
> percentageOfSevens
    7
10.025
```

R4. Do a search for how to write a for-loop in R. Practice some simple examples from the internet. Then use a for-loop to calculate the alternating sum of the first 100,000 digits of pi. That is, calculate the sum 3 – 1 + 4 – 1 + 5 – … – (100,000th digit of pi). [code, answer]

```
> pir = readLines("100000.txt", warn = FALSE)
> digits = as.numeric(unlist(strsplit(pir,"")))
> sum <- 0
> count <- 0
> for (d in digits) { if ( count %% 2 == 0 ) { sum <- sum + d } else { sum <- sum - d } }
> print(sum)
[1] 449330
```

R5. The digits 0 through 9 appear about the same number of times among the first 100,000 digits. You probably expected this. But, do all the two-digit strings (00, 01, 02, 03, … 98, 99) appear about the same number of times? (To be clear, pi begins with the two-digit strings 31, 14, 41, 15, etc.) Using a for-loop, move through the digits array looking at two-digit strings (there will be 99,999 of these), and count up how many of each there are. You might want make your own R-script (File >> New File >> R Script), since this will likely take a few lines of code to do. What does your analysis reveal? [code, answer with some justification – do not write out the counts for all two-digit strings!] (If your code is correct, you should have 998 “00”s, 1027 “01”s, ….)

```
pir = readLines("100000.txt", warn = FALSE)
digits = as.numeric(unlist(strsplit(pir,"")))

bis <- vector("list", 99999)
i <- 1
while (i < length(digits)) {
  bis[[i]] <- paste(digits[[i]], digits[[i+1]], sep = "")
  i <- i + 1
}

bis <- as.numeric(unlist(bis))

biTable <- table(bis)
print(biTable)
```