Math 3215: Homework 4

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due March 1

subject to additional problems until Feb. 24

1 Variance

1. You place a bet at the horse race. If your horse wins you make \$100, if he loses you lose \$5. Let's say the probability of him winning is .1.

   - What is your expected winngings? (in dollars)
   - What is the variance of your winnings?

2. You toss a fair coin 10 times. Let X be the number of times the coin came up differently than the last flip.

   - What is $\mathbb{E}X$?
   - What is $var(X)$?

3. In a room of 40 people, what is the expected number of pairs of people with the same birthday?

4. What is the variance of the number of people with the same birthday?

5. do the above question for n people in the room.

2 Statistics

1. Come up with an experiment, a null hypothesis, and an alternate hypothesis to answer the following questions with statistics:

   - Do more people prefer Pepsi or Coke?
   - Are there more blue-eyed people in Georgia or brown-eyed people?
   - Are younger people more likely than older people to not have landlines?

2. Burger King claims that the average weight of their hamburgers is 3.2 oz after cooking.

   - If you measure 100 of them and the average is 2.8 oz, what can you conclude using statisitcs?
   - If you measure 10,000 of them and the average weight is 2.9 oz what can you conclude?

3 Continuous RV's

1. Let X and Y be independent random variables, each with a uniform distribution on $[0, 2]$.

   - What is the probability that both X and Y are larger ($>$) than 1.5?
   - Both larger than or equal to 1.5?
   - What's the probability $X + Y \geq 3$?
   - What $\mathbb{E}(X + Y)$?
   - What's the variance of $(X + Y)$?
   - What's $\Pr[X > 1.5 | X > 1]$?

2. Let X have an exponential distribution: $f(x) = e^{-x}$, $x \geq 0$.

   - What's $\mathbb{E}X$?
   - What's $var(X)$?
   - What's the probability that $X > 5$?
   - What's the probability that $X > 10$?
   - What's $\Pr[X > 5 | X > 10]$?

3. Let X have an exponential distribution as above, and Y be uniform on $[-1, 1]$. Let X and Y be independent.

   - What's $\Pr[X + Y \geq 0]$?
   - What's $\mathbb{E}[X + Y]$?
   - What's $\Pr[X + Y > 1 | X + Y > 0]$?