Homework
Elementary Statistics & Inference (STAT:1020; Bognar)

1. It is known that 20% of all credit applicants have poor credit ratings. Suppose mortgages are repeatedly selected at random (assume independence).
   (a) Suppose the random variable X is the mortgage that is the first to be under water. What is the distribution of X? *Be sure to state the parameter.*
   (b) Find the probability that the 10th selected mortgage is the first that is under water.
   (c) Find the probability that the first under water mortgage occurs on or before the 3rd selected, i.e. find $P(X \leq 3)$.
   (d) Find the probability that the first under water mortgage occurs after the 2nd selected, i.e. find $P(X > 2)$.
   (e) On average, how many mortgages must be selected to get the first under water?
   (f) Find $SD(X)$.

2. An egg manufacturer knows that 9.6% of its eggs are cracked. The eggs are packed in cartons containing 12 eggs. *Assume eggs are independent.*
   (a) If the random variable X counts the total number of cracked eggs in a carton, determine the distribution of X.
   (b) Suppose a carton of eggs is randomly selected. Find the probability that exactly 2 eggs are cracked.
   (c) Suppose eggs are repeatedly selected at random. If the random variable X records the egg that is first cracked, determine the distribution of X.
   (d) Suppose eggs are repeatedly selected at random. Find the probability that the 10^{th} selected egg is the 1^{st} cracked egg.
   (e) On average, how many eggs must be selected to get the first cracked egg?
   (f) Suppose eggs are repeatedly selected at random. Find the probability that the 10^{th} selected egg is the 2^{nd} cracked egg. *This one is a little more challenging — we can not use a Geometric distribution — compute this the old-fashioned way.*

3. Scores on the ACT exam have a $N(\mu = 18, \sigma = 6)$ distribution, while scores on the SAT exam have a $N(\mu = 500, \sigma = 100)$ distribution. Suppose Xiaoyu got a 27 on the ACT exam, while Emily got a 720 on the SAT exam. Who has the higher relative score? Why?

4. A *nit* is a measure of brightness (one nit is equal to one candela per square meter). The LCD screens from a manufacturer have brightness, X, that follows a normal distribution with mean $\mu = 250$ nits and standard deviation $\sigma = 15$ nits, i.e. $X \sim N(250, 15)$.
   (a) Find the probability that a randomly selected screen has brightness between 250 and 270 nits.
   (b) Suppose screens with brightness levels in the highest 25% are sold as "premium" panels. How many nits must a screen produce to be sold as premium?

5. Suppose the length of time an iPad battery lasts, X, can be modeled by a normal distribution with mean $\mu = 8.2$ hours and standard deviation $\sigma = 1.2$ hours, i.e. $X \sim N(\mu = 8.2, \sigma = 1.2)$.
   (a) Find the probability that a randomly selected iPad lasts longer than 10 hours.
   (b) Find the probability that a randomly selected iPad lasts between 7 and 10 hours.
   (c) What is the 3rd percentile of the battery times?

6. A chocolate manufacturer produces boxes of chocolates whose weights, X, follow a normal distribution with mean $\mu = 16.2$ ounces and standard deviation $\sigma = 0.1$ ounces, i.e. $X \sim N(\mu = 16.2, \sigma = 0.1)$.
   (a) Find the probability that a randomly selected box contains less than 16 ounces of chocolate.
   (b) Suppose the lightest 38.21% of boxes are sent to discount retailers. To be sent to a discounter, what is the most a box of chocolates can weigh?