TMATH 390 Spring 2015 **Homework Set 2**

Chapter 1 questions

1. On his way to work, a friend of ours must pass through ten traffic signals. Suppose that in the long run, she encounters a red light at 40% of these signals and that whether any particular signal is red is independent of whether any other one is red. (Note: what distribution could you model this using? Is there an analogy of the red/green outcome with another variable with a binary outcome?)
   (a) On what proportion of days will our friend encounter at most two red lights?
   (b) On what proportion of days will our friend encounter at least five red lights?
   (c) On what proportion of days will our friend encounter between three and five (inclusive) red lights?

2. Suppose that the number of drivers who travel between a particular origin and destination during a designated time period has a Poisson distribution with parameter $\lambda = 8$. In the long run, in what proportion of time periods will the number of drivers
   (a) Be at most 4?
   (b) Exceed 8?
   (c) Between 6 and 10 (inclusive)?

3. Let x denote the distance (m) that an animal moves from its birth site to the first territorial vacancy it encounters. Suppose that for banner-tailed kangaroo rats, x has an exponential distribution with parameter $\lambda = 0.01386$.
   (a) What proportion of distances are at most 80 m?
   (b) What proportion of distances are at least 60 m?
   (c) What is the median distance?

4. Suppose that 10% of all bits transmitted through a digital communication channel are erroneously received and that whether any particular bit is erroneously received is independent of whether any other bit is erroneously received. Consider sending a very large number of messages, each consisting of 20 bits.
   (a) What proportion of these messages will have at most 2 erroneously received bits?
   (b) What proportion of these messages will have at least 5 erroneously received bits?

5. Consider writing onto a computer disk and then sending it through a certifier that counts the number of missing pulses. Suppose this number x has a Poisson distribution with parameter $\lambda = 0.2$.
   (a) What proportion of disks have exactly one missing pulse?
   (b) What proportion of disks have at least two missing pulses?

6. The bursting strength of wine bottles of a certain type is noramlly distributed with paraeters $\mu = 250$ psi and $\sigma = 30$ psi. If these bottles are shiped 12 to a carton, in what proportion of cartons will at least one of the bottles have a bursting strength exceeding 300 psi? Hint: think of a bottle as a success, or "heads" H if its bursting strength exceeds 300 psi.

Chapter 2 questions

7. Here are some data: $115.8,\ 115.2,\ 114.6,\ 115.9,\ 116.4.$
   (a) Compute the mean of the deviations from the sample mean. (Note: the deviation of observation x_i from the mean $\bar{x}$ is $(x_i - \bar{x})$.)
   (b) Compute the sample standard deviation using the defining formula.
   (c) Compute it using the computational formula.

   Setting up tables like this will help:

   For parts (a) and (b):

i	x_i	$x_i - \bar{x}$	$(x_i - \bar{x})^2$
1	115.8		
2	115.2		
3	114.6		
4	115.9		
5	116.4		
$n = 5$	$\sum_{i=1}^{5} x_i =$ $\bar{x} =$	$\sum_{i=1}^{5}(x_i - \bar{x}) =$ divide the above by n for (a)	$\sum_{i=1}^{5}(x_i - \bar{x})^2 =$ divide the above by $n-1$ for (b)

   For part (c):

i	x_i	$(x_i)^2$
1	115.8	
2	115.2	
3	114.6	
4	115.9	
5	116.4	
	$\sum_{i=1}^{5} x_i =$ $\left(\sum_{i=1}^{5} x_i\right)^2 =$	$\sum_{i=1}^{5}(x_i)^2 =$

   Combine the two sums you computed using the "computation" formula to get (c).

8. Recall the uniform distribution, with the the density function

$$f(x) = \begin{cases} \dfrac{1}{b-a}, & \text{if } a < x < b, \\ 0, & \text{otherwise.} \end{cases}$$

   The corresponding density "curve" has constant height over the interval from a to b.

   Compute the mean of the uniform distribution in terms of a and b.

9. Find the mean and the variance of the number of underinflated tires, if the mass density is the one specified in exercise 1.26 a (ii) on page 35 of text. For what proportion of such cars will the number of underinflated tires be within 1 standard deviation of the mean?

10. Problem 2.40 on page 89. Use R.

11. Find the expected value and variance of the exponential distribution with parameter λ. Show work.

12. Problem 2.45 on page 95 of the text (this should be done after class on 4/14).