Homework #2
due Friday, 2/21/2014, by 9am

Instructions: Complete all problems and turn in a set of answers either to me or under my door (office 335L) by the assigned due date. Do ask me questions via email or in my office hours. Do work together. Do not copy answers from another student or turn in answers that are substantively identical. To clarify, if you work with another student, I would expect that your numerical answers would be quite close, but that your verbal explanations would be similar, but not identical, reflecting that you wrote up your answers independently. Show your work, and write out explanations for your answers. If you use Excel or a similar tool, write "According to Excel, ..." in your answer.

Problem 1 Let X be an exponential random variable, with $\lambda = .5$. Find the following probabilities.

a. $P(X \geq 1)$

b. $P(X \geq .4)$

c. $P(X \leq .5)$

d. $P(1 \leq X \leq 2)$

Problem 2 Find the following probabilities.

a. X is a normal random variable, with mean 10 and standard deviation .5. Find $P(10 \leq X \leq 11)$.

b. X is a uniform random variable on the interval $[50, 100]$. Find $P(40 \leq X \leq 70)$.

c. X is a Poisson random variable, with expected value $\mu = 5$. Find $P(X \geq 3)$.

Problem 3 The weight of luggage carried onto a plane by passengers is normally distributed with a mean of 20 KG and a standard deviation of 6 KG.

a. What is the probability that a passenger's luggage weighs 25 KG?

b.   Passengers are "fast-tracked" if they have luggage weighing less than 10 KG. What percentage of passengers are fast tracked?

   c. The airline wants to set the maximum weight limit so that only 2.5% of passengers have to pay an overweight luggage fee. What limit should it set?

   d. If the plane has 100 passengers, what is the probability that the average weight of their luggage is less than 23 KG?

Problem 4 Every day a bakery prepares its famous marble rye. A statistically savvy customer determines that daily demand is normally distributed with a mean of 850 loaves and a standard deviation of 90. How many loaves should the bakery make each day if:

a. It wants the probability of running short on any day to be no more than 30%

b. it wants the probability of running short on any day to be no more than 10%

Problem 5 The amount of time spent by American adults watching TV per day is normally distributed with a mean of 6 hours and a standard deviation of 1.5 hours.

a. What is the probability that a randomly selected American adult watches television for more than 7 hours per day?

b. What is the probability that the average time spent watching TV in a random sample of 5 American adults is more than 7 hours?

c. What is the probability that the average time spent watching TV in a random sample of 30 American adults is more than 7 hours?

Problem 6 In class, we discussed what fraction of 7-foot or taller males of an appropriate age play in the NBA. This exercise demonstrates the sensitivity of such calculations to underlying assumptions.

a. There are 20 US-born 7-footers who have played at least one game in the NBA in the current 2013-2014 season. There are X total 7-footers between the ages of 20 and 35 living in the US. Estimate X under the following assumptions:

- There are 316,710,000 total people living in the US

- 49.22% of people living in the US are male.

- $\frac{1}{4}$ of all males are between the ages of 20 and 35.

- The average height of a male is 5 feet, 10 inches.

- The standard deviation of male height is 3 inches

b. Repeat part a, but now assume that the standard deviation of male height is 3.2 inches. How does this change your estimate of the fraction of all 7-footers who currently play in the NBA ($\frac{20}{X}$)?

b. Repeat part a, but now assume that the standard deviation of male height is 3.4 inches. How does this change your estimate of the fraction of all 7-footers who play in the NBA?

Problem 7 During Eco 391's exams, you will be given a photocopy of certain probability tables from the back of your textbook. To practice using these tables, calculate the following probabilities first in Excel, and then using table 3 in Appendix B. Note that the probability tables give cumulative probabilities, that is $P(X \leq x)$. Use two decimal places in all calculations.

a. Suppose X is a normal random variable with mean -2 and standard deviation 10. Find $P(X < -5)$, $P(X \geq 0)$, and $P(X \geq 10)$.

b. Suppose that X is a normal random variable with mean 100 and standard deviation 6. Find $P(X \leq 110)$, $P(X \geq 85)$, and $P(X \leq 100)$.

c. Suppose that X is a normal random variable with mean 30 and standard deviation 2. Find $P(X \geq 28)$, $P(27 \leq X \leq 34)$, and $P(X \leq 35)$