Prob & Stats
Final Exam

Name: _____

December 11, 2017

Instructions

Answer all of the following questions using R. Show your work by including any R code in your responses. You will find this easiest using an R-Markdown notebook. Give a mathematical expression when possible to show your work.

This is a Class A assignment. You may not receive help from others. You may consult books, your notes, previous assignments, and the R Help System. You must number your responses corresponding to the questions in the exam.

Deliverables: A PDF document entitled `lastname.PDF` and your `exam2_sim.Rmd` notebook should be placed on the MSBA server, under `/5032Prob/final`.

Drugs

The annual demand for Wozac, a prescription drug manufactured and marketed by the NuFeel Company, is normally distributed with mean 50,000 and standard deviation 12,000. We assume that demand during each of the next 10 years is an independent random draw from this distribution. NuFeel needs to determine how large a Wozac plant to build to maximize its expected profit over the next 10 years. If the company builds a plant that can produce x units of Wozac per year, it will cost \$16 for each of these x units. NuFeel will produce only the amount demanded each year, and each unit of Wozac produced will sell for \$3.70. Each unit of Wozac produced incurs a variable production cost of \$0.20. It costs \$0.40 per year to operate a unit of capacity.

1. Among the capacity levels of 30K, 35K, 40K, 45K, 50K, 55K, and 60K units per year, which level maximizes expected profit? Use simulation to answer the question.

2. Using the capacity from your answer to the previous question, NuFeel can be 95% certain that expected profit for the 10-year period will be between what two values?

Warranty

Suppose you buy an electronic device that you operate continuously. The device costs you \$100 and carries a 1-year warranty. The warranty states that if the device fails during its first year of use, you get a new device for no cost, and this new device carries exactly the

same warranty. However, if it fails after the first year of use, the warranty is of no value. You need this device for the next 6 years. Therefore, any time the device fails outside its warranty period, you must pay $100 for another device of the same kind. (We assume the price does not increase during the 6-year period.) The time until failure for a device is gamma distributed with parameters $\alpha = 2$ and $\beta = 0.5$. (This implies a mean of 1 year.) Use simulation to simulate the 6-year period. Include as outputs:

3. (a.) your total cost

4. (b.) the number of failures during the warranty period

5. (c.) the number of devices owned during the 6-year period.

Clearance

Washington Town Furnishings (WTF) is currently having its year-end appliance clearance sale. The store has twelve washing machines on sale; 5 are top-loaders, 4 are regular capacity front-loaders, and 3 are extra-capacity front-loaders. Each day, the company expects between 0 and 4 customers interested in buying a refrigerator to arrive at the store according to the following probability distribution:

PMF	
P(0 arrivals)	.15
P(1 arrival)	.25
P(2 arrivals)	.30
P(3 arrivals)	.20
P(4 arrivals)	.10

For each customer, there is a 60% chance that the person will want to purchase one of the 12 sale-priced items. Of those who are interested in washers, WTF knows that 40% desire a top-loader, 25% desire the extra-capacity front-loaders, and 35% desire a regular capacity front-loader. If the store is sold out of a particular washer, the customer will leave without making a purchase.

6. Set up a simulation on the number of customers arriving and their purchases. How many days will it take for WTF to sell all 12 washers?