CS3130/ECE3530: Probability and Statistics for Engineers **Due Tu 10/7**

Homework 3: Random Variables

Instructions: Your answers are due at the beginning of class on the due date. You can either turn in a paper copy, or a pdf version through canvas. We highly recommend using latex (`http://www.cs.utah.edu/~jeffp/teaching/latex/`) for producing the assignment answers. If the answers are too hard to read (e.g. **do not create pdf using your phone's camera!**) you will lose points (entire questions may be given 0).

Please make sure your name appears at the top of the page.

You may discuss the concepts with your classmates, but write up the answers entirely on your own. **Be sure to show all the work involved in deriving your answers! If you just give a final answer without explanation, you may not receive credit for that question.**

1. Exercise 4.2. (Recall when the book says "distribution function" it refers to the "cumulative distribution function (cdf)").

2. Utah Jazz guard Trey Burke makes 90% of his free throws attempts (and misses 10%). Lets say he will shoot 100 free throws next season. For each of the questions below, please give ALL of the following information: (1) the formula to compute the answer, and (2) the final number for the probability. (You will want to use a calculator or R to compute these.)

   (a) What is the probability that Burke will miss exactly 12 free throws next season?

   (b) What is the probability that Burke will make 90 or more free throws next season?

   (c) What is the probability that Burke will make all of his free throws next season?

3. I bought a cheap toaster. Every time I use it there is a 1/4 probability that it will catch on fire, burn my toast, and destroy itself. But with 3/4 probability it makes perfect toast!

   (a) How would you model my toaster with a random variable?

   (b) Give the formula for the probability I get exactly k perfect toasts out of my cheap toaster before it destroys itself.

   (c) What is the probability I will get *at most* 5 perfect toasts before my cheap toaster destroys itself.

4. Exercise 5.7. Show your steps (i.e., what you are integrating or differentiating).

5. You write a new app that can take a picture of someone and automatically draw a funny mustache on them. It takes 3 seconds of time on your server to perform this process. You expect that the time between user requests will follow an exponential distribution with rate λ (requests per second).

   (a) What is the maximum request rate λ that you can handle if you want the probability that a user will have to wait to be no more than 5%?

   (b) How does it change if you improve your funny mustache algorithm to only take 2 seconds?