Department of Electrical Engineering, University of Hawaii

EE 342: Probability and Statistics **Fall 2016**

Homerwork Set 6

Due date: Oct. 12, 2016

(1) a) Chapter 5, problem 1
b) Chapter 5, problem 4
c) Chapter 5, problem 6
d) Chapter 5, problem 11
e) Chapter 5, problem 16
f) Chapter 5, problem 21
g) Chapter 5, theoretical exercise 8
h) Chapter 5, theoretical exercise 9

(2) Matlab exercise:
a) Use Matlab to make plots of the PDF and CDF of a uniform [-1,3] random variable. Compute the mean and variance of this random variable.
b) Use Matlab to generate random numbers according to the PDF in part a). From these numbers, generate plots of the sample PDF and CDF. Also, find the sample mean and sample variance.

(3) Matlab exercise:
Repeat Problem (2) for a Gaussian (normal) random variable with mean 3 and variance 4.

5.1. Let X be a random variable with probability density function

$$f(x) = \begin{cases} c(1 - x^2) & -1 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$

(a) What is the value of c?
(b) What is the cumulative distribution function of X?

5.4. The probability density function of X, the lifetime of a certain type of electronic device (measured in hours), is given by

$$f(x) = \begin{cases} \frac{10}{x^2} & x > 10 \\ 0 & x \le 10 \end{cases}$$

(a) Find $P\{X > 20\}$.
(b) What is the cumulative distribution function of X?
(c) What is the probability that, of 6 such types of devices, at least 3 will function for at least 15 hours? What assumptions are you making?

5.11. A point is chosen at random on a line segment of length L. Interpret this statement, and find the probability that the ratio of the shorter to the longer segment is less than $\frac{1}{4}$.

5.16. The annual rainfall (in inches) in a certain region is normally distributed with $\mu = 40$ and $\sigma = 4$. What is the probability that, starting with this year, it will take over 10 years before a year occurs having a rainfall of over 50 inches? What assumptions are you making?

5.21. Suppose that the height, in inches, of a 25-year-old man is a normal random variable with parameters $\mu = 71$ and $\sigma^2 = 6.25$. What percentage of 25-year-old men are over 6 feet, 2 inches tall? What percentage of men in the 6-footer club are over 6 feet, 5 inches?

5.8. Let X be a random variable that takes on values between 0 and c. That is, $P\{0 \le X \le c\} = 1$. Show that

$$\mathrm{Var}(X) \le \frac{c^2}{4}$$

Hint: One approach is to first argue that

$$E[X^2] \le cE[X]$$

and then use this inequality to show that

$$\mathrm{Var}(X) \le c^2[\alpha(1 - \alpha)] \quad \text{where } \alpha = \frac{E[X]}{c}$$

5.9. Show that Z is a standard normal random variable, then, for $x > 0$,

(a) $P\{Z > x\} = P\{Z < -x\}$;
(b) $P\{|Z| > x\} = 2P\{Z > x\}$;
(c) $P\{|Z| < x\} = 2P\{Z < x\} - 1$.