CPS 5310 Spring 2020
Homework and Lab Assignments

Homework 5 (Due Thursday, 2/27)

Refer to the *Introduction to Probability Models* book (10th Edition) by Sheldon Ross.

(a) Practice:
Chapter 5 # 1-5, 15, 31, 44, 50, 57

(b) Write up solutions for the following problems to be turned in on the due date:
Chapter 5, # 6, 9, 18, 19, 34

Homework 4 (Due Thursday, 2/20)

Refer to the *Introduction to Probability Models* book (10th Edition) by Sheldon Ross.

(a) Practice:
Chapter 2 # 54, 63, 69 (use R instead of tables), 74, 76, 79
Chapter 3 #3, 5, 6, 7

(b) Write up solutions for the following problems to be turned in on the due date:
Chapter 2, # 56, 73
Chapter 3, #2, 10, 21

Homework 3 (Due Thursday, 2/13)

Refer to the *Introduction to Probability Models* book (10th Edition) by Sheldon Ross.

(a) Practice:
Chapter 2 # 32, 35, 38, 49, 50, 51, 52, 53, 60, 62

(b) Write up solutions for the following problems to be turned in on the due date:
Chapter 2, # 33, 37, 42, and the two problems below:

Problem 1: Take a piece of one foot long wire, and break it at random (i.e., the break point is equally likely to be anywhere on the wire. What is the average length of the longer piece? First find the answer analytically using what you have learnt about random variables. Then verify your answer by a suitable simulation using R.

Problem 2: Consider rolling a fair die with the sample space $S = \{1, 2, 3, 4, 5, 6\}$.

(i) Show that the events $A = \{1, 3, 5\}$ and $B = \{1, 2, 3, 4\}$ are independent of each other.

(ii) Simulate $N = 10{,}000$ draws from the sample space using the "sample" function in R and verify that $\hat{P}(A)\hat{P}(B) = \hat{P}(A \cap B)$, where $\hat{P}(A)$ is the proportion of times A occurred in the simulation and similarly for $\hat{P}(A)$ and $\hat{P}(A \cap B)$.

Lab 2: Generating data from common probability distributions (Thursday, 2/6)

Exercise 1

Suppose we toss a coin *n* times and the probability of showing head at each flip is equal to *p*. Let *X* be the random variable that counts the number of heads observed.

(a) What kind of probability distribution would X have?
(b) Write down the mean and variance of X.
(c) Take $n = 3$ and $p = 0.8$. What are the value of the mean and variance for X?
(d) Using the rbinom function in *R*, generate m realizations of X, for $m = 10, 100, 1000, 10000$. Write down the sample means and variances you for each m. Organize your results in the table below.

Sample size	mean	variance	2nd moment	3rd moment
10				
100				
1000				
10000				

(e) You should already have the pmf and CDF tables for X from your class notes. Compare them to the values you get using the dbinom and pbinom functions.
(f) Try to find the 0.5 quantile for X using the qbinom function. Does the answer make sense?
(g) Using your sample data, estimate the second and 3rd moments of X. Also work out the theoretical values using the moment generating function. Are the sample estimates close to the theoretical values?

You can also do the above exercises with other common probability distributions like the Poisson, uniform, and normal.

Homework 2 (Due Thursday, 2/6)

Refer to the *Introduction to Probability Models* book (10th Edition) by Sheldon Ross.

(a) Practice:
Chapter 2 # 6, 10, 17, 18, 20, 21, 22, 23 29, 39
(b) Write up solutions for the following problems to be turned in on the due date:
Chapter 2, # 14, 19, 25, 29, 34

Homework 1 (Due Thursday, 1/30)

Refer to the *Introduction to Probability Models* book (10th Edition) by Sheldon Ross.

(a) Practice:
Chapter 1 #1, 2, 3, 4, 11
Chapter 2 # 1, 3, 5, 7, 10
(b) Write up solutions for the following problems to be turned in on the due date:
Chapter 1 #33
Chapter 2, # 2, 4, 12, 16

Lab 1: Introduction to R (Tuesday, 1/28)

(a) Learn a few basic commands in R to create a data vector or matrix, to read a data file, to perform basic arithmetic operations, to get descriptive summaries (mean, variance, standard

deviation, median, quartiles, interquartile range, and five number summary) and graphical visualizations like dot plots, stem and leaf plots, pie charts, box plots, and histograms.

Notes:

1. To prepare for the lab, please read Chapter 2 of the *Statistics* book by Agresti and Franklin. This starts on page 79 in the file "Custom Agresti and Franklin Stat 2480 Textbook.pdf" that you have a copy of.
2. Your TA, Ms. Sumi Dey, will cover the above during the lab. Please install R-Studio on your own laptop and bring it to the lab. Or you can use R-Studio on the lab computers.

(b) Work out problem #2.117 from the book using R and put your answers in a single document. The data is in the file central_park_yearly_temps.txt. Do NOT mix your answers with the R commands and outputs, which should be put in an appendix at the end of the document. Turn in a copy by email to Sumi (sdey2@miners.utep.edu) by 1:30 p.m. on Thursday, 1/30.