Statisatics 6861/4861 Fall 2014

Assignment 3 100 points

Due: Monday, November 10

Problem 1.

Suppose n people have a $5 bill, and n people have a $10 bill. They line up single file one night to buy a ticket that costs $5. The agent selling tickets has no change at the beginning of the night. No one ever changes place in line. If the agent does not have change for the next customer, the ticket booth shuts down. Ignore the fact this would not happen with real human beings. Each possible ordering of the customers is equally likely.

What is the probability that every customer who lined up at the beginning of the process will be able to purchase a ticket? Remember, there are 2n customers, so the answer will depend on n.

Use R to simulate the problem by writing a function. **Do not give an analytic solution**.

The function prototype is:

ticket.line <- function(n,sim.length)

Here n is the number of people in line who have a $5 bill (and this equals the number of people who have a $10 bill). You should check that n is a positive integer.

sim.length should also be a positive integer. It is the number of times a ticket line will be simulated.

Your simulation will create a randomly selected ticket line. Then you determine if everyone gets to purchase a ticket. You repeat this process sim.length times. You keep count of how many of these randomly selected ticket lines allow the last customer to purchase a ticket.

The function returns the number of times the last customer was able to purchase a ticket divided by sim.length

This is the simulated probability.

2. Write a function that computes the same probability as the previous problem. This time compute the exact probability by generating all possible permutations of the ticket line. The function prototype is:

ticket.line.perm <- function(n)

Here n is the number of customers with a $5 bill. For this case n MUST be in the set {1,2,3,4,5}. We regard 10! as the most permutations we want to compute. You may use any R function to generate the permutations, or you may use the gen.perm function under the Code Examples.

The function then returns the exact probability.

3. For your own education, run the simulated and exact functions for the same n value. See how large sim.length must be to give an accurate estimate of the probability. You should also run the simulated probability for the same n several times to see how much variance there is in the simulated probability.

You do not have to turn in the results of your work under #3.

Do email me one file containing your two functions using the usual conventions for your filename, and do include name = “your name” as the first executable statement.