Introduction to Computational Statistics INSH 5301

Midterm exam

02/24/2020

1.Write a function that checks if a number is a prime. The output of the function should be a logical value, TRUE if the number is prime and FALSE if not. A prime number is a positive integer greater than 1 that is divisible without remainder only by 1 and itself. Then, generate a 10 by 10 matrix of random integers and count how many prime numbers are in it. (10 pt)

2. Write a function that given an integer k and a sample size n generates k random vectors using the uniform distribution with bounds (0, 1) of length n and add them. Using this function, produce 5 vectors, each with sample size n = 1, 000, but with different values of k; in particular, use (k = 1, k = 2, k = 3, k = 4, and, k = 5). Make an histogram using ggplot2 of each vector. (10 pt)

3. You roll two 6-sided dies twice and add the result. a. What's the probability of getting a 12? (5 pt) b. What's the probability of getting a result less or equal to 6? (5 pt)

4. The average number of snow days in Boston in a year is 22. a. Assuming snow days follow a Poisson distribution, calculate (using R) the probability of getting 10 or less days of snow in a year. (5 pt) b. Knowing that in February the probability of a snow day is 20 percent. If it's snowing in Boston, what's the probability that the month is February? (5 pt)

5. You want to know how many hours of sleep the average college student gets. You survey 10 stuents and get the following data (in hours): 7,6,5,8,6,6,4,5,8,12. Conduct a one-sided statistical test to test if the population mean is less or equal to 7. (15 pts)

6. You survey the same 10 people during finals period, and get the following hours: 5,4,5,7,5,4,5,4,6,12 . Do college students get significantly less sleep than usual during finals? (15 pt)

7. You are a very bad gardener, and hypothesize that feeding houseplants with caffeine might help them grow better. You perform an experiment to test your hypothesis. To three separated groups of plants you gave them: (1) water spiked with diet coke, (2) water spiked with coffee, and, (3) water alone. The table below summarize the result for each group.

condition	mean days alive (life expectancy)	sd	n
Water	50	10	20
Diet Coke	42	7	15
Coffee	52	8	10

Test is there is any statistically significant difference among the groups' life expectancy. (15 pt)

8. You are a interested in knowing if knowing more than one language is related to memory. To test your hypothesis you run an experiment with 100 individuals, to each participant you asked if they speak at least two languagues and gave them a memory test. Using the test results you categorize each participant in a different groups: good memory, normal memory, and bad memory.

	Monolingual	At least Bilingual
Good	24	6
Average	40	5
Bad	23	2

Test if the number of languages an individual can speak is related to memory. (15 pt)