Laboratory Session 02 : March 31, 2022

Exercises due on : April 17, 2022

Exercise 1

- a set of measurements have been performed on the concentration of a contaminant in tap water. The following tables reports a set of values (x), with the corresponding probabilities given by the two methods (p_1 and p_2)

x	15.58	15.9	16	16.1	16.2
p_1	0.15	0.21	0.35	0.15	0.14
p_2	0.14	0.05	0.64	0.08	0.09

- Evaluate the expected values, $E[X]$, and the variance, $Var(X)$, for both methods

Exercise 2

- the waiting time, in minutes, at the doctor's is about 30 minutes, and the distribution follows an exponential pdf with rate 1/30

A) simulate the waiting time for 50 people at the doctor's office and plot the relative histogram

B) what is the probability that a person will wait for less than 10 minutes ?

C) evaluate the average waiting time from the simulated data and compare it with the expected value (calculated from theory and by manipulating the probability distributions using R)

B) what is the probability for waiting more than one hour before being received ?

Exercise 3

- let's suppose that on a book, on average, there is one typo error every three pages. If the number of errors follows a Poisson distribution, plot the pdf and cdf, and calculate the probability that there is at least one error on a specific page of the book

Exercise 4

- we randomly draw cards from a deck of 52 cards, with replacement, until one ace is drawn. Calculate the probability that at least 10 draws are needed.

Exercise 5

- the time it takes a student to complete a TOLC-I University orientation and evaluation test follows a density function of the form

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

where t is the time in hours.

a) using the `integrate()` R function, determine the constant c (and verify it analytically)

b) write the set of four R functions and plot the pdf and cdf, respectively

c) evaluate the probability that the student will finish the aptitude test in more than 75 minutes. And that it will take 90 and 120 minutes.

Exercise 6

- the lifetime of tires sold by an used tires shop is $10^4 \cdot x$ km, where x is a random variable following the distribution funcion

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

a) write the set of four R functions and plot the pdf and cdf, respectively

b) determine the probability that tires will last less than 15000 km

c) sample 3000 random variables from the distribution and determine the mean value and the variance, using the expression $Var(X) = E[X^2] - E[X]^2$