

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 function

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

- 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 $Var(X) = E[X^2] - E[X]^2$