TELECOMMUNICATIONS ENGINEERING

STATISTICS

2022-2023

ASSIGNMENT 3. PROBABILITY MODELS

Exercise 1 (3 points)

From a study on the number of friends request received *weekly* in the social network's account of UC3M School of Engineering undergraduate students, it is known that the number of *undesired* friends request (i.e. people that the student actually does not know) received by a student is distributed according to a Poisson with variance 7.

a) Compute by simulation in MATLAB/Octave the probability that two students would receive more than 15 *undesired* friends requests. **(1.5 points)**

b) Compute by simulation in MATLAB/Octave the probability that in a particular week, 180 or more students from a selection of 250 of the campus, had received between 5 and 10 (both included) *undesired* friends requests each. **(1.5 points)**

Remark: Do not use the approximation to the Normal distribution. The analytical solution is optional and thus would not have any mark.

Exercise 2 (2 points)

a) The waiting time (in seconds) that a student takes to login to a PC in a computer lab, is a random variable X with density function given by:

$$f(x) = \begin{cases} \frac{1}{5}e^{-\frac{1}{5}x} & \text{if } x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Compute by simulation in MATLAB/Octave the probability that a student do not take more than 3 seconds to login. Compare the result obtained in the simulation with the theoretical result. **(1 point)**

b) Let Y be the r.v. that represents the duration (in hours) of the connection time from a PC of the computer lab to a social network is given by the density function:

$$f(y) = \begin{cases} 3e^{-3y} & \text{if } y \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Compute by simulation in MATLAB/Octave the probability that a student is connected to the social network between half an hour and three quarters of hour in the computer lab. Compare the result obtained in the simulation with the theoretical result. **(1 point)**

Exercise 3 (5 points)

A computational study is based in three processes running in series. Let T_1, T_2 and T_3 be the execution time for processes 1, 2 and 3 respectively, and let T be the total execution time of the computational study. Assume that T_1, T_2 and T_3 are independent random variables and identically distributed by an Exponential distribution with parameter $\lambda = 35$ milisecs^{-1}.

a) Compute by simulation using MATLAB/Octave the average time of execution of the computational study. **(1.5 points)**

b) Assume that the three processes can be parallelized, i.e. processes 1, 2 and 3 can be run in parallel to complete the computation study. How much time would be saved to perform the computational study as opposed to what would be the case if the process must be executed in series? **(1.5 points)**

c) If you could choose between a system running in series but where each process has parameter $\lambda = 40$ milisecs^{-1} (i.e. each one runs faster) or the old system (each process with $\lambda = 35$ milisecs^{-1}) but parallelized, which one would you select and why? **(2 points)**

Remark: The analytical solution is optional, and thus would not have any mark.