Name:

SA402 · Dynamic and Stochastic Models Fall 2022 · Uhan

Quiz 4 – 10/5/2022

Instructions. You have 15 minutes to complete this quiz. You may use your plebe-issue calculator. You may not use any other materials (e.g., notes, homework, website).

Show all your work. To receive full credit, your solutions must be completely correct, sufficiently justified, and easy to follow.

Problem	Weight	Score
1	1	
2	1	
3	1	
4	1	
Total		/ 40

For Problems 1-4, consider the following setting.

Erlang's Eatery serves passengers driving down Route 314 from 6 a.m. to 3 p.m. During this time period, cars pass Erlang's Eatery according to a Poisson process with an arrival rate of 10 per hour.

Problem 1. If exactly 75 cars have passed the restaurant by 12 p.m., what is the probability that the 100th car passes the restaurant before it closes?

Problem 2. If exactly 25 cars have passed the restaurant by 9 a.m., what is the expected number of cars that pass the restaurant before it closes?

Problem 3. Suppose 25% of the cars passing Erlang's Eatery stop at the restaurant. What is the expected number of cars that stop at the restaurant between 11 a.m. and 1 p.m.?

Problem 4. Suppose trucks pass Erlang's Eatery according to a Poisson process with an arrival rate of 5 per hour. What is the probability that 20 or fewer vehicles (cars and trucks) pass the restaurant between 11 a.m. and 1 p.m.?

Exponential random variable with parameter λ:	cdf $F(a) = \begin{cases} 1 - e^{-\lambda a} & \text{if } a \geq 0 \\ 0 & \text{if } a < 0 \end{cases}$	expected value = $1/\lambda$
Erlang random variable with parameter λ and n phases:	cdf $F(a) = \begin{cases} 1 - \sum_{j=0}^{n-1} \frac{e^{-\lambda a}(\lambda a)^j}{j!} & \text{if } a \geq 0 \\ 0 & \text{if } a < 0 \end{cases}$	expected value = n/λ
Poisson random variable with parameter λt:	pmf $p(n) = \frac{e^{-\lambda t}(\lambda t)^n}{n!}$ for $n = 0, 1, 2, \ldots$	expected value = λt