Assignment 1
CS232/NetSys201/EECS248A Fall 2021

October 19, 2021

Deadline: October 26th on Canvas (upload your answers in PDF under Assignment 1 and please mark each problem accordingly).

Turn in: A *pdf* file of your answers to each question.

Note: You can leave fractions/equations in your answers without calculating the exact numbers.

1   Problem 1:

Consider two, independent, Exponentially distributed random variables X_1 and X_2, with rate $\lambda_1=4$ and $\lambda_2=1$, respectively.
a) Compute the probability $P(X_2>3)$.
b) Compute the probability $P(\min(X_1, X_2)>5)$.
c) Compute the probability that X_2 is smaller than X_1.

2   Problem 2:

A router sends out 60 packets every 3 seconds on average. Suppose that the time in between two packets sent out can be modeled as an exponential r.v.
a) What is the probability that a packet will be sent out in less than 4 seconds?
b) Suppose that at time $t = 0$ a packet was sent out, what is the probability that at time $t = 4$ no further packets were sent out?
c) Assume now 120 packets are sent out every 3 seconds on average. Is the probability of point (a) larger or smaller now?

3   Problem 3:

A router is receiving packets from two different clients. Assume the time between the generation of two consecutive packets at each client is exponentially distributed with parameters $\lambda_1=1$ packets/second for node 1, and at $\lambda_2=2$ packets/second for node 2.
a) What is the probability that the next packet will come from node 2?

b) What is the probability that the router will not receive any packet in the next 2 second?

4 Problem 4:

Consider a router with service rate μ pkt/s, and arrival rate λ pkt/s. At time $t = 0$ a packet (packet A) is being served. The next packet that arrives (according to the exponential distribution describing the arrival time) in the buffer is called packet B.
a) What is the probability that Packet A leaves the router before Packet B arrives?
b) What is the average time packet B waits in the buffer before being served?
c) What is the average time packet B spends in the system?