Homework 4p

EE/TE 4367: Telecommunications Networks

NOTE: **Please, complete the following table and keep record of your assignment number.**

First Name	
Last Name	
Student ID	
Assignment #	0

Exercise 1. Two servers (S_1 and S_2) with exponential service time and same service rate μ are busy completing service of two jobs at time $t = 0$. The server that completes service first is referred to as the winning server (S_w), the other is referred to as the losing server (S_l). Jobs must complete their service before departing from the queue.

A) Compute the probability of S_1 to be the winning server, i.e., $P(S_w = S_1) = P(S_l = S_2)$. Compute the probability of S_2 to be the winning server, i.e., $P(S_w = S_2) = P(S_l = S_1)$ [pt. 10].

B) Compute the expected departure time of the winning server, defined as $t_w > 0$ [pt. 10].

C) Compute the expected departure time of the losing server, defined as $t_l > t_w$ [pt. 10].

Exercise 2. Consider a $M/M/1$ queue with job arrival rate λ and service rate μ. There is a single job (J_1) in the queue and in service at time $t = 0$. Jobs must complete their service before departing from the queue.

A) Compute the probability that the job in service (J_1) completes service and departs from the queue before the next job (J_2) enters the queue [pt. 10].

B) Compute the probability that the next job (J_2) enters the queue before the job in service (J_1) completes service and departs from the queue [pt. 10].

C) Assuming that the queue is First-Come First-Serve, which means J_2 can go into service only once J_1 completes service, compute the expected departure time of J_1 and J_2, i.e., $t_1 > 0$ and $t_2 > t_1$, respectively [pt. 10]. [Hint: two possibile and mutually exclusive sequences must be accounted for when computing t_2: J_1 departs before J_2 arrives, and J_1 departs after J_2 arrives.]

Exercise 3. Four servers (S_1, S_2, S_3, and S_4) with exponential service time and same service rate μ are busy completing service of four jobs at time $t = 0$. Jobs depart from their respective server as soon as their service completes.

A) Compute the expected departure time of the winning job (the job that completes service first), i.e., $t_1 > 0$ [pt. 10].

B) Compute the expected departure time of the job that completes service second , i.e., $t_2 > t_1$ [pt. 10].

C) Compute the expected departure time of the job that completes service third , i.e., $t_3 > t_2$ [pt. 10].

D) Compute the expected departure time of the job that completes service last , i.e., $t_4 > t_3$ [pt. 10].