Stochastic Processes, Mid-term, 2025 Spring

- Duration: 90 minutes
- Closed material, No calculator.

- Name: _____
- Student ID: _____
- E-mail: _____ @seoultech.ac.kr

- Write legibly.
- Justification is necessary unless stated otherwise.

1	10
2	10
3	10
4	10
5	10
Total	50

#1. Clearly explain the meaning of each component in Kendall's queuing notation $M/D/2/3$. [10pts]

- M:
- D:
- 2:
- 3:

#2. Consider a queuing system with a single server and infinite waiting space. If the arrival rate and the service rate are equal, state the conditions under which the system can be stable. [10pts]

#3. A free legal clinic has a single lawyer who provides one-on-one consultations. Clients arrive at an average rate of 2 per hour, and the interarrival time is known to follow an exponential distribution. Each consultation takes an average of 25 minutes, with a standard deviation of 10 minutes.

(a) What is the expected waiting time in a queue? `[5pts]`

(b) What is the expected number of customers in the system? `[5pts]`

#4. Consider a queuing system with two servers, X and Y. (Customers can receive service from either server.) Server X provides service at an average rate of 1 customer every 20 minutes, and Server Y provides service at an average rate of 1 customer every 30 minutes. Service times follow an exponential distribution. Each arriving customer is assigned to the first available server.

There are currently four customers, A, B, C, and D. A is currently being served by server X, and B is being served by server Y. When either A or B finishes service, the next customer, C, will be assigned to the available server. After C, the next customer is D.

(a) What is the probability that A will be the last to leave the system? `[5pts]`

(b) What is the probability that C will be the last to leave the system? `[5pts]`

#5. A travel agency can pre-purchase airline tickets for a Hawaii route at $600 each. Unsold tickets has a salvage value of $400 each. The customer demand varies according to the retail price that the agency offers. The following is the demand information.

- If the retail price for a ticket is offered at $1,000, then customer demand is estimated to follow a discrete uniform distribution between 71 and 75. (i.e. 71, 72, 73, 74, or 75, each with probability of 20%)
- If the retail price for a ticket is offered at $900, then customer demand is estimated to follow a discrete uniform distribution between 81 and 85. (i.e. 81, 82, 83, 84, or 85, each with probability of 20%)

How many tickets should the travel agency purchase, and what should be the retail price? `[10pts]`

(intended blank page)