Queuing Theory and DES

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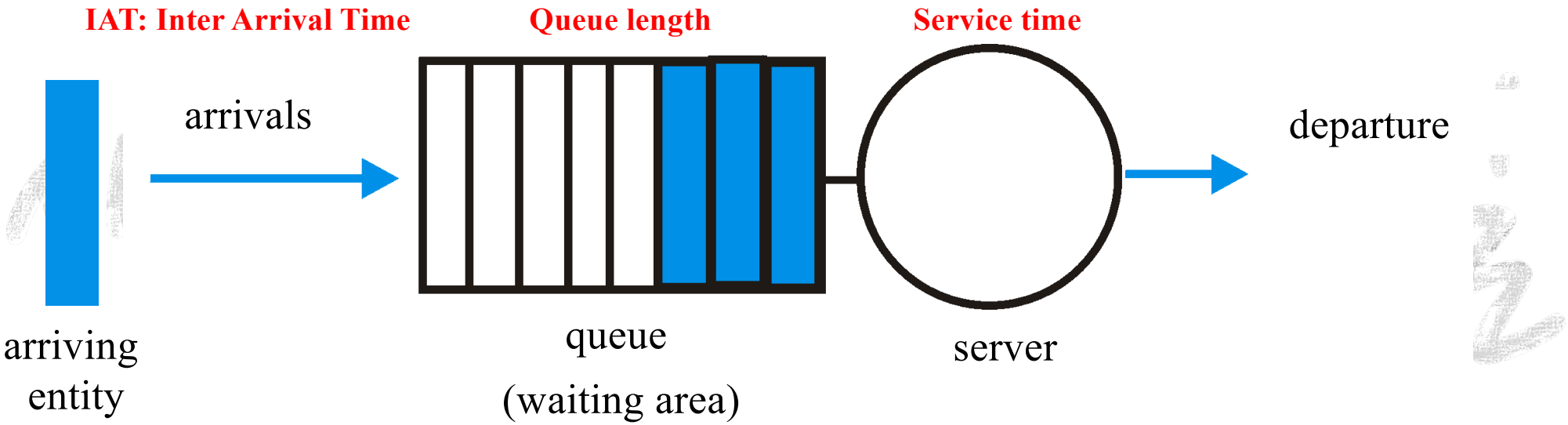
Jong Hun Woo

Basic Queuing Model



Kendall notation for queuing model

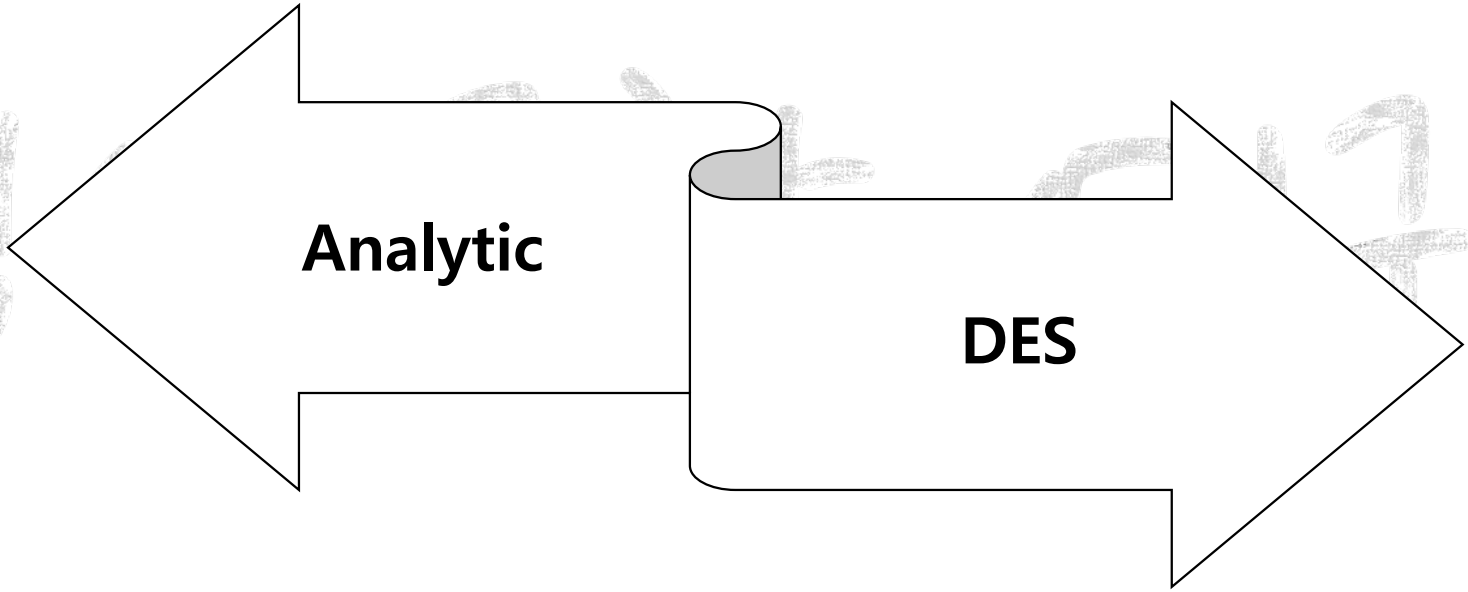
- Kendall's Notation is a system of notation according to which the various characteristics of a queuing model are identified.
- Kendall (Kendall, 1951) has introduced a set of notations which have become standard in the literature of queuing models.
- A general queuing system is denoted by (a/b/c): (d/e/f) where
  - a : probability distribution of the interarrival time.
  - b : probability distribution of the service time.
  - c : number of servers in the system.
  - d : maximum number of customers allowed in the system (or in the queue).
  - e : calling population
  - f : queue discipline
- https://en.wikipedia.org/wiki/Kendall%27s_notation

Various Queuing Models

- $M/M/1$
- $M/G/1$
- $M/M/1$
- $M/M/c$
- $M/G/c$
- $M/G/\infty$
- $M/M/c/N$

Assignments

- Construct a queuing model for the listed problems, and compare the analytic calculation result with the DES result.



Problem 1

- Customers arrive at a walk-in shoe repair shop apparently at random.
- It is assumed that arrivals occur according to a Poisson process at the rate $\lambda = 1.5$ per hour.
- Observation over several months has found that shoe repair times by the single worker take an average time of 30 minutes, with a standard deviation of 20 minutes.
- Find average number of customers in system.
- Compare the results between analytic calculation and DES, and discuss the reason why both results are different.

Problem 2

- For the M/M/1 queue with service rate $\mu = 10$ customers per hour,
- Consider how L (average number of customer in system) and w(average time customer spends in system) increase as the arrival rate λ increases from 5 to 8.64 by increments of 20%, and then to $\lambda = 10$.
- Compare the results between analytic calculation and DES, and discuss the reason why both results are different.

Problem 3

- For the M/M/c queue with service rate $\mu = 3/2$ per minute.
- Arrival rate $\lambda = 2$ per minute.
- Find L_Q, L, w, w_Q.
- Compare the results between analytic calculation and DES, and discuss the reason why both results are different.

Problem 4

- Same model with Problem 3, but service rate is not exponentially distributed, but are kn own to have a standard deviation of 30 seconds.
- Find L_Q, L, w, w_Q.
- Compare the results between analytic calculation and DES, and discuss the reason why both results are different.

Problem 5

- There are two workers who are responsible for 10 milling machines. The machines run on the average for 20 minutes, then require an average 5-minute service period, both times exponentially distributed. Therefore, $\lambda = 1/20$ and $\mu = 1/5$. Compute the various measures of performance for this system.
- Compare the results between analytic calculation and DES, and discuss the reason why both results are different.

Report guideline

- Use MS word and excel.
- The calculation and simulaton results have to be compared.
- Each problem have to be discussed about the reason why same of different between the results from analytic calculation and DES.
- If there is anything you want to discuss other than what is stated, please actively describe.

END OF PRESENTATION

j.woo@snu.ac.kr