IE 413 - Homework 1

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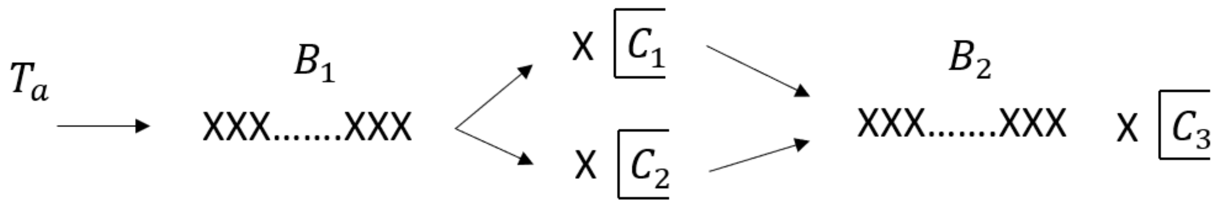
Problem 1 - Coffee Shop

We assumed the area to pick up the order is modeled as a buffer and another cashier/barista.



Entities

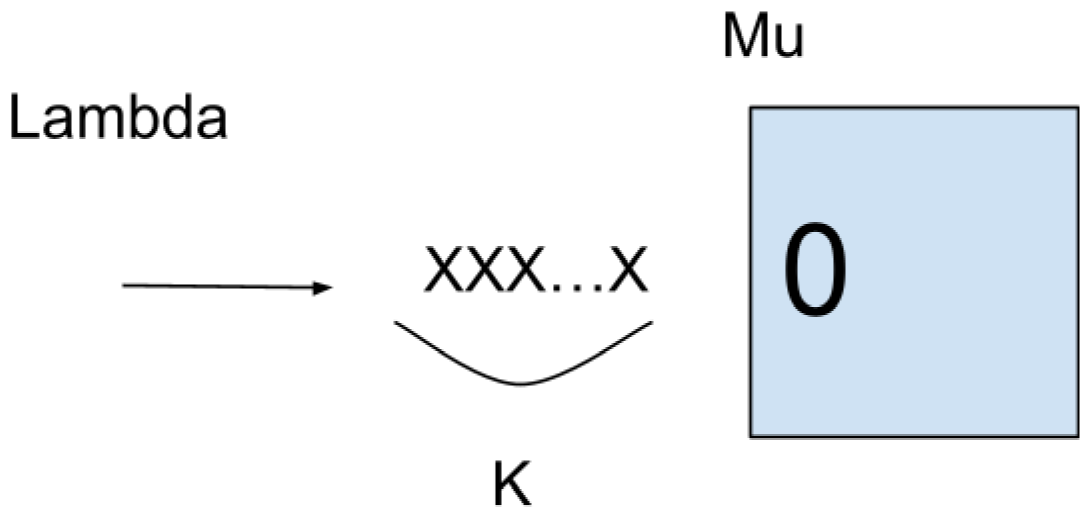
- Cashier/Barista C_i- Assists customers with order
  - $S_i \in \{-2, -1, 0, 1\}$ Status of cashier. 1 meaning they are ready for another customer, 0 meaning they are currently assisting a customer, -1 means the next buffer is full and can't take another customer. -2 means the register is currently closed.
  - $\mu_i \in [10, 300]$ Time to process order for cashier i in seconds. Range is an example and is subject to change. Consider modeling $\mu_i \sim Exp(M_i)$ and assume $M_1 = M_2$
- Buffer B_i- Waiting line to order/pick up food. First come first serve.
  - $n_i \in \{0, 1, 2, \ldots N_i\}$ Current number of customers in buffer i
  - $N_i \in \{20, 21, 22 \ldots 100\}$ Max number of customers that can be in buffer i. Range is an example and is subject to change.
- Customers - people looking to buy coffee.
  - Arrival time $T_A \in [0, 25000)$ - Time between for customers arriving at the coffee shop in seconds. Consider modeling $T_A \sim Exp(\lambda_A)$ dependent on the time of day

Policies

- We have 2 Cashiers/Baristas and they work in a first come first serve manner.
- Cashiers can only process 1 customer at a time and can not process someone if the pick up line is full.
- Customers are indistinguishable

Problem 2 - Call Center

The system is represented as a M/M/1/K queue.



Entities

- Cell phone service operator - handles customer calls.
  - $S \in \{0, 1\}$ Status of operator. 0 is busy, 1 is idle.
  - $\mu \sim Exp(1/T_s)$ Service time is exponentially distributed with mean T_s.
  - T_s = 5 minutes.
- Queue - A caller is in the queue while they are on hold.
  - $Q \in \{0, 1, \dots, K\}$ Number of callers in queue—"on hold."
  - K = 10, the maximum number of callers that can be on hold. If Q = K, no one else can be put on hold.
- Callers - Those calling in and receiving service.
  - $\lambda \sim Exp(1/T_a)$ Interarrival times are exponentially distributed with mean T_a.
  - T_a = 7 minutes.

States & Changes

- S = operator status (0 busy, 1 idle). Q = number of people on hold (does not include person receiving service)
- Q can increment or decrement by one, depending on caller arrival or completion of service, respectively. If Q = K, then cannot increment to K+1.
- S remains at zero while callers are in system, and will equal one when the final caller is completed with zero on hold. Will return to zero when a new caller arrives.

Laws

- No notable laws

Policies

- Operator can only handle one caller at a time.
- Callers are served first come first serve and are indistinguishable.
- No new callers can be put on hold once capacity K is reached.