QUEUING THEORY

Consider

I. Commercial Service Systems:

Where customers receive service from commercial organizations.

Example: 1. Barber Shop

2. Hotel / Cafeteria

3. Customers / Shoppers in a supermarket.

II. Transportation Service Systems:

Where vehicles receive service from such organizations.

Example: 1. Cars waiting at a traffic light

2. Planes waiting to land or take off

3. Trucks waiting to be loaded or unloaded.

III. Business – Industrial Service Systems:

Example: Machines waiting for repair.

IV. Social Service Systems:

Example: 1. Patients waiting for treatment in a hospital

2. Cases waiting to be tried in courts

3. Letters waiting to be typed by a secretary.

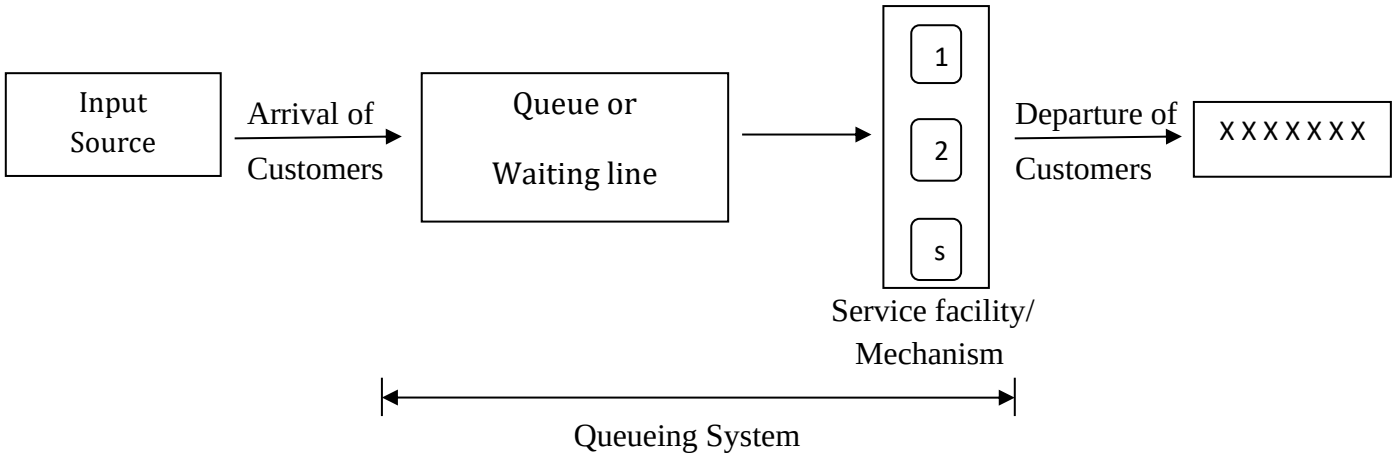
All the above examples have in common the phenomenon of **waiting**. In many of the real life situations we observe this phenomenon of **waiting**. The waiting phenomenon is the direct result of **randomness** in the operation of the service facilities.

In general, the customer's arrival & his service times are random. Our objective is to obtain some characteristics that measure the performance of the system understudy. Queuing theory deals with the mathematical study of 'queues' or 'waiting lines'.

Some measures of performance are:

(i) Expected waiting time of a customer.
(ii) Expected idle time of the service facility or the degree of utilization of the service facility.

Basic Structure of Queueing models:



Following assumptions are made:

1. Customers requiring service are generated over time by an **Input Source/Calling Source**.
2. As the customer arrives at the Queuing System/facility he joins the queue.
3. The server chooses a customer for service by some rule (**service discipline**).
4. The required service is performed for the customer by the **`service mechanism'.**
5. Upon the completion of a service, the customer leaves the system and the process of choosing a new (waiting) customer is repeated.

There are many alternative assumptions that can be made.

1. **Input source (Calling Population)**: finite or infinite.

   a) customers may arrive & get served individually or in groups – bulk queues.

2. **Queue size** - finite or infinite.

3. **Service discipline**: FCFS, LCFS or SIRO, priority queues.

4. **Service facility / mechanism**: Single server, or parallel servers or queues in series (tandem queues), network queues.

5. **Human behavior**: (i) Jockeying – jumping from one queue to another

   (ii) Balking – do not join the line anticipating long delay.

   (iii) Reneging – may walkout after being in the queue for a while because the wait has been too long.