

SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT

UNIT 04

LECTURE 08

Unit-4 Strategies

4.6	Yield Management and its Application
4.7	Queuing Systems
4.8	Essential Features of Queuing Systems

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21MGH402T SERVICES SCIENCE AND SERVICE OPERATIONS MANAGEMENT SYLLABUS

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Unit-1 - Service – Definition	9 Hour
<i>Characteristics, Stages of economic development, Role of services in economy, Experience economy, Service science, Service dominant logic, Service systems, Service operations, Open system view of service operations, Service package, Strategic service vision, Competitive service strategies, Strategic analysis, Sustainability in services, Competitive role of information in services</i>	
Unit-2 - New Service Development	9 Hour
<i>Innovation in services, Service blueprinting, Service process design, Service system design, Service facility design and layout, Strategic location considerations, Service process analysis, Service encounter triad - Service organization, Contact personnel and Customer, Service profit chain, Technology in service encounter</i>	
Unit-3 - Service Quality Dimensions	9 Hour
<i>Measuring service quality – SERVQUAL gap model, walk through audit, Service quality by design, achieving service quality, Quality and productivity improvement process, Quality tools, Benchmarking, Improvement programs</i>	
Unit-4 - Strategies	9 Hour
<i>Strategies for managing service demand and service capacity, Forecasting service demand, Forecasting models – Subjective models, Causal models and Time-series models, Yield management and its application, Queuing systems, Essential features of queuing systems</i>	
Unit-5 - Managing Service Projects	9 Hour
<i>Characteristics of project, Project management – Principles, Process, and Building team, Selecting the project manager, Roles and responsibilities of project manager, Techniques for project management – PERT, CPM and Gantt charts, Monitoring project performance, Globalization of services, Global service strategies, Domestic growth and expansion strategies, Franchising</i>	

SSSOM Syllabus

Unit-1 Service – Definition

1.1	Characteristics
1.2	Stages of Economic Development
1.3	Role of Services in Economy
1.4	Experience Economy
1.5	Service Science
1.6	Service Dominant Logic
1.7	Service Systems
1.8	Service Operations
	Open System View of Service
1.9	Operations
1.1	Service Package
1.11	Strategic Service Vision
1.12	Competitive Service Strategies
1.13	Strategic Analysis
1.14	Sustainability in Services
	Competitive Role of Information in
1.15	Services

Unit-2 New Service Development

2.1	Innovation in Services
2.2	Service Blueprinting
2.3	Service Process Design
2.4	Service System Design
2.5	Service Facility Design and Layout
2.6	Strategic Location Considerations
2.7	Service Process Analysis
	Service Encounter Triad – Service
2.8	Organization, Contact Personnel and
	Customer
2.9	Service Profit Chain
2.10	Technology in Service Encounter

Unit-3 Service Quality Dimensions

3.1	Measuring Service Quality
3.2	SERVQUAL Gap Model
3.3	Walk Through Audit
3.4	Service Quality by Design
3.5	Achieving Service Quality
	Quality and Productivity Improvement
3.6	Process
3.7	Quality Tools
3.8	Benchmarking
3.9	Improvement Programs

Unit-4 Strategies

4.1	Strategies for Managing Service Demand and Service Capacity
4.2	Forecasting Service Demand
4.3	Forecasting Models – Subjective Models
4.4	Forecasting Models – Causal Models
4.5	Forecasting Models – Time-Series Models
4.6	Yield Management and its Application
4.7	Queuing Systems
4.8	Essential Features of Queuing Systems

Unit-5 Managing Service Projects

5.1	Characteristics of Project
5.2	Project Management – Principles, Process and Building Team
5.3	Selecting the Project Manager
5.4	Roles and Responsibilities of Project Manager
5.5	Techniques for Project Management – PERT
5.6	Techniques for Project Management – CPM
5.7	Techniques for Project Management – Gantt Charts
5.8	Monitoring Project Performance
5.9	Globalization of Services
5.1	Global Service Strategies
5.11	Domestic Growth and Expansion Strategies
5.12	Franchising

Lecture 08 Topics

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5.3	Project Management – CPM
5.4	Project Management – Gantt Charts
5.5	Project Management – Monitoring Project Performance
5.6	Project Management – Globalization of Services
5.7	Project Management – Global Service Strategies
5.8	Project Management – Domestic Growth and Expansion Strategies
5.9	Project Management – Franchising

4.6 Yield Management and its Application

4.7 Queuing Systems

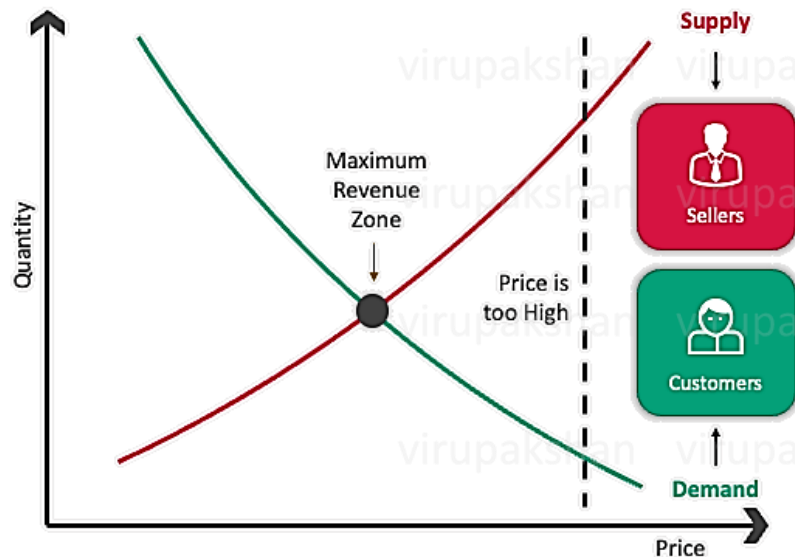
4.8 Essential Features of Queuing Systems

3.1	Quality and Productivity Improvement
3.2	Process
3.3	Quality Tools
3.4	Benchmarking
3.5	Improvement Programs

4.6.1 Yield Management and its Application

The concept of **yield management** is best understood as a **revenue-maximizing strategy** to make full use of service capacity.

Yield management is a **comprehensive system** that **incorporates many of the strategies** discussed earlier in this unit (e.g., using reservation systems, overbooking, and segmenting demand).



$$YM\% = \frac{\text{Achieved Revenue}}{\text{Potential revenue}} * 100$$

4.6.2 Yield Management and its Application- Example

$$YM\% = \frac{\text{Achieved Revenue}}{\text{Potential revenue}} * 100$$

Example

On a specific night a hotel has 100 rooms available, with a full tariff rate of £120 per room, therefore its maximum potential revenue is $100 * £120 = £12,000$. However, on that night it sold 70 rooms and achieved an average room rate of £90, therefore its achieved revenue is $70 * £90 = £6,300$.

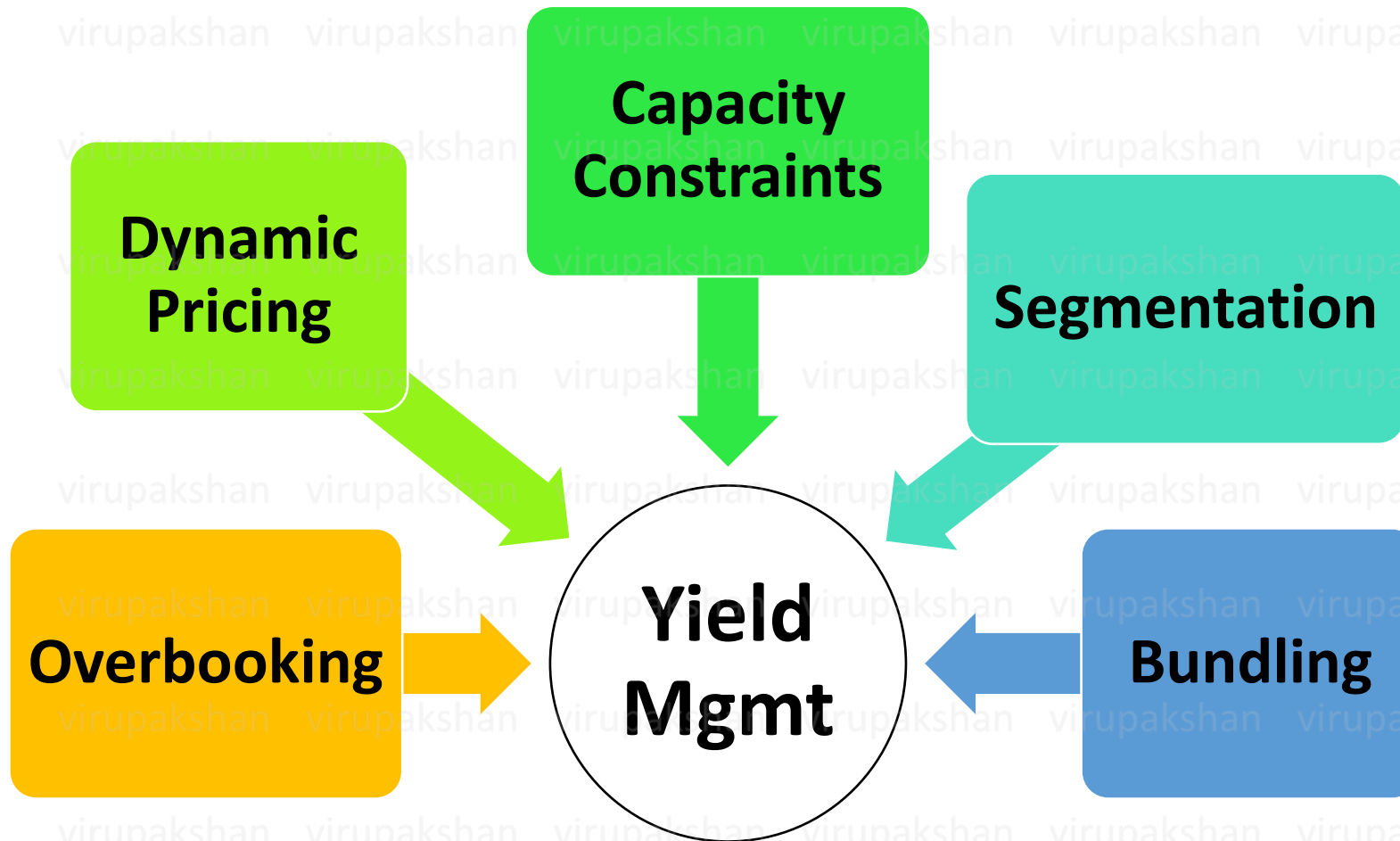
$$YM\% = \frac{£6,300}{£12,000} * 100 = 52.5\%$$

4.6.3 Yield Management and its Application: For Service Firms

Yield management is most appropriate for **service firms** that exhibit the following **characteristics**:

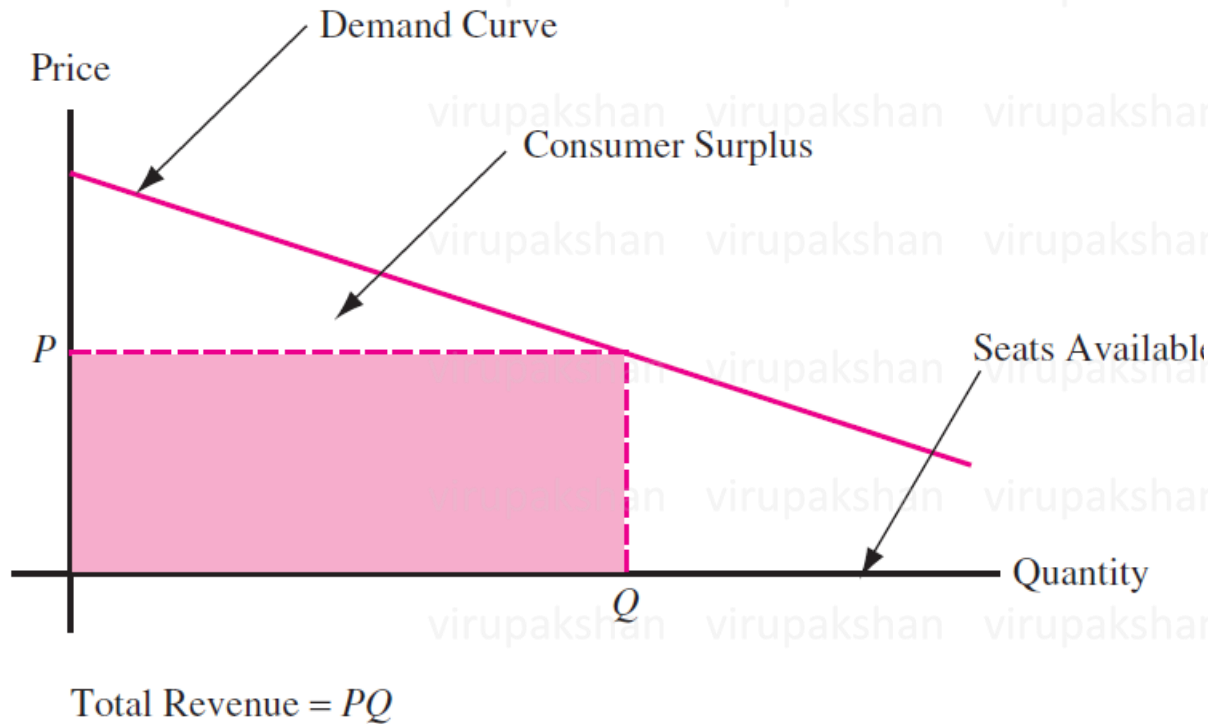
- ✓ *Relatively fixed capacity*
- ✓ *Ability to segment markets.*
- ✓ *Perishable inventory.*
- ✓ *Product sold in advance.*
- ✓ *Fluctuating demand.*
- ✓ *Low marginal sales costs and high marginal capacity change costs.*

4.6.4 Yield Management and its Application: Strategies

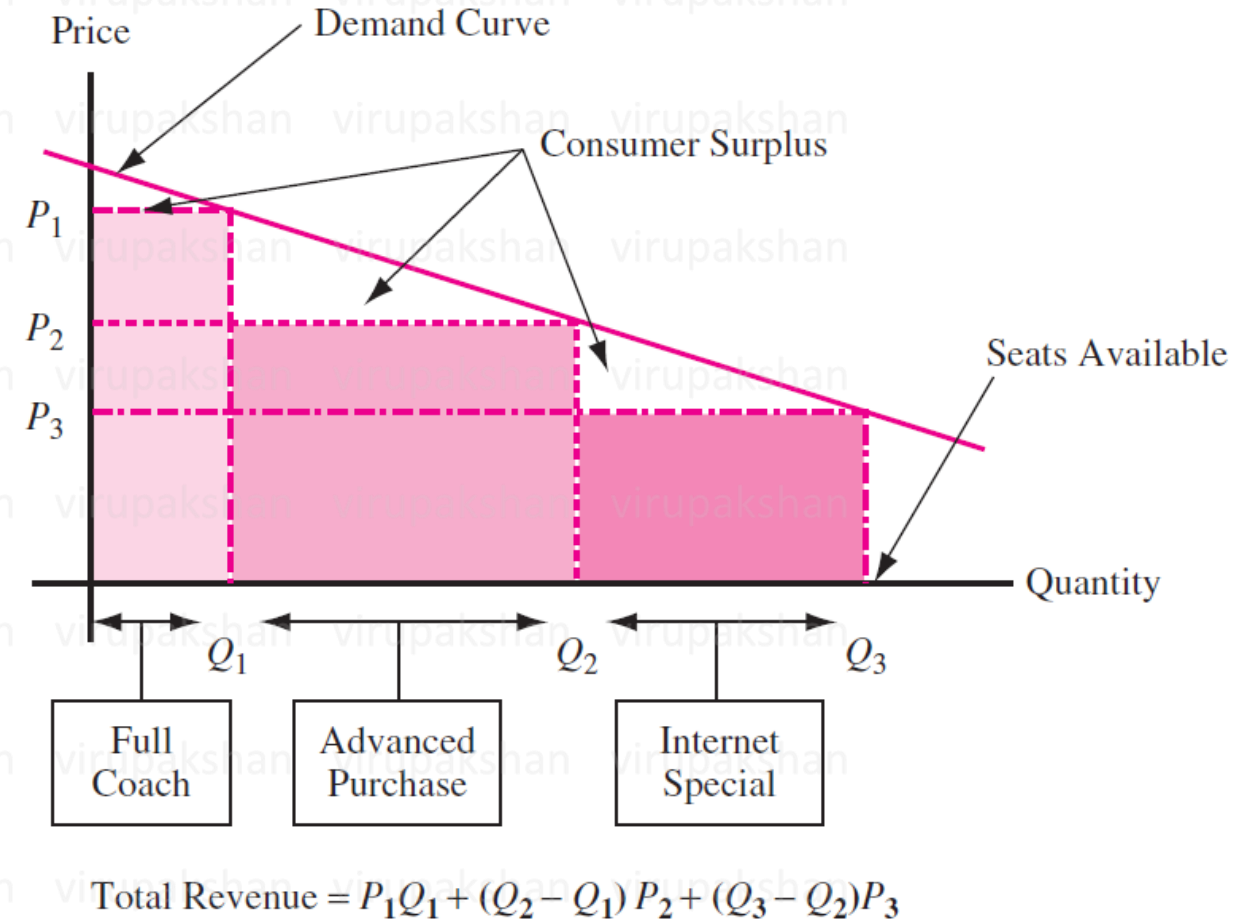


4.6.5 Yield Management and its Application: Traditional Pricing vs YM Pricing

a. Traditional Fixed Price



b. Multiple Pricing Using Yield Management



4.7.1 Queuing Systems

Q1. What is a Queuing System?

Answer:

A **queuing system** is a service system in which customers arrive for service, wait in a queue if the service facility is busy, receive service, and then leave the system.

It is used to study and manage waiting lines in service organizations. Since customer arrivals and service times are often unpredictable, queuing systems help managers reduce waiting time, improve customer satisfaction, and efficiently utilize service resources.



4.7.2 Queuing Systems

Q2. Why are queuing systems important in service management?

Answer:

Queuing systems are important because they help managers:

- **Reduce** customer waiting time.
- **Improve** customer satisfaction.
- **Determine** the optimum number of service counters or employees.
- **Improve** employee utilization.
- **Reduce** operational costs.
- **Balance** the cost of providing service with the cost of customer waiting.
- **Improve** overall service efficiency.

4.8.1a Essential Features of Queuing Systems

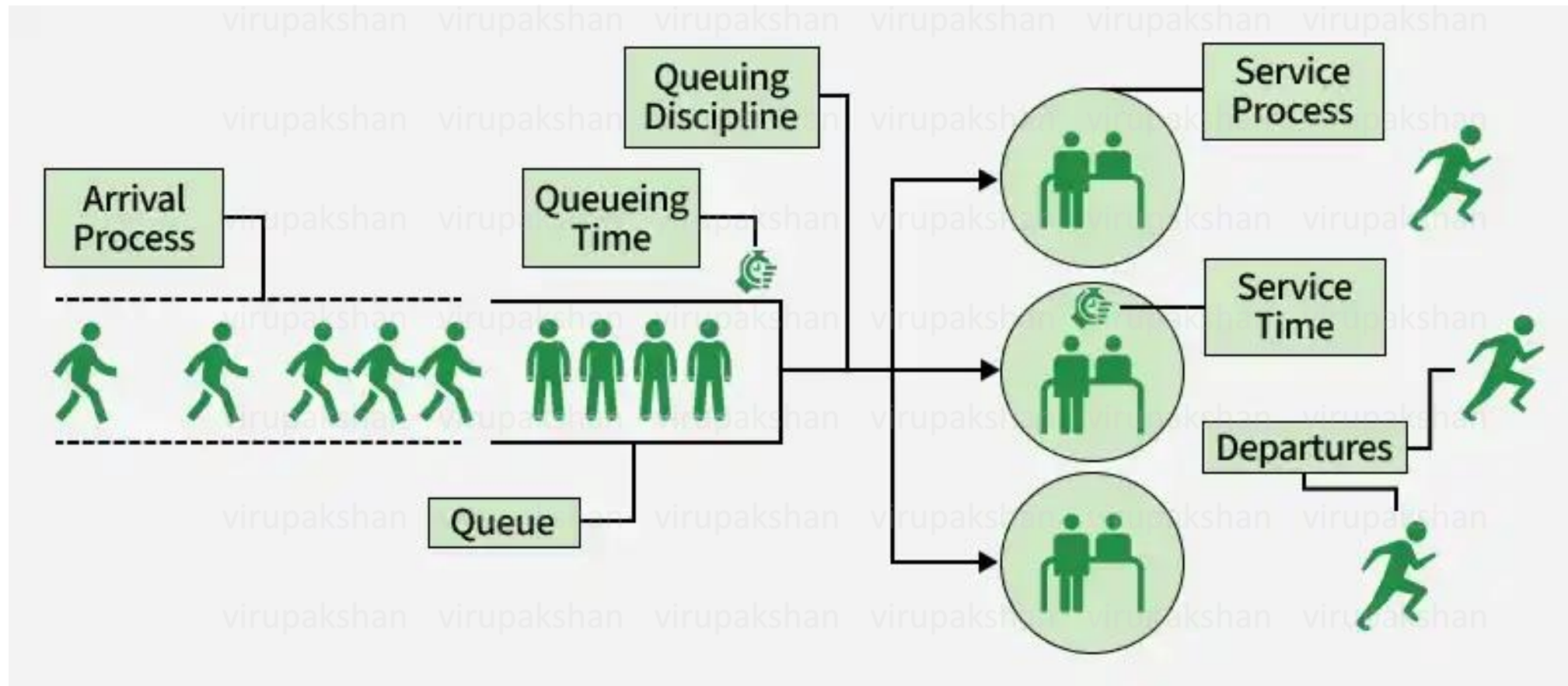
Essential features of a queuing system include

- **Arrival Process** (how customers enter),
- **Queue Discipline** (how they are ordered/prioritized),
- **Service Mechanism** (number and speed of servers), and
- **System Capacity.**

Modern queue management platforms also utilize **virtual queuing** and **business intelligence** analytics to optimize service management

4.8.1b Essential Features of Queuing Systems

Essential features of a queuing system include **Arrival Process, Queue Discipline, Service Mechanism and System Capacity.**



4.8.2a Essential Features of Queuing Systems

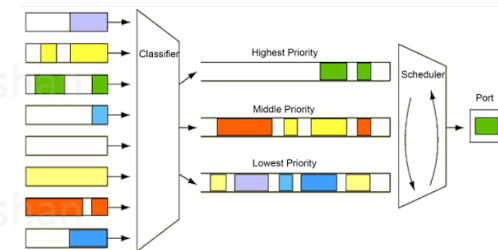
Key Characteristics

1. **Arrival Process:** Defines the rate at which customers enter the system (e.g., random, scheduled, or Poisson distribution).
2. **Queue Discipline:** The logical rule determining who gets served next. Common disciplines are **First-In, First-Out (FIFO)**, **Priority-based**, and **Last-In, First-Out (LIFO)**.
3. **Service Mechanism:** Dictates how customers are served. This encompasses the number of servers and the statistical distribution of service times.
4. **System Capacity:** The physical or virtual limit on how many customers the system can accommodate at one time.

4.8.2b Essential Features of Queuing Systems

Modern Operational Features

- 1. Virtual Queuing and SMS Notifications:** Modern tools use contactless check-ins, digital kiosks, and automated SMS or email alerts to let customers wait remotely, dramatically reducing perceived wait times.
- 2. Real-Time Dashboards:** Customer-facing displays and staff-facing interfaces provide live updates on wait times, creating predictable service experiences and reducing staff interruptions.
- 3. Data Analytics & Business Intelligence:** Systems gather data on peak traffic hours and service durations. Analyzing these metrics helps managers optimize staffing levels, evaluate KPIs, and improve overall operational efficiency



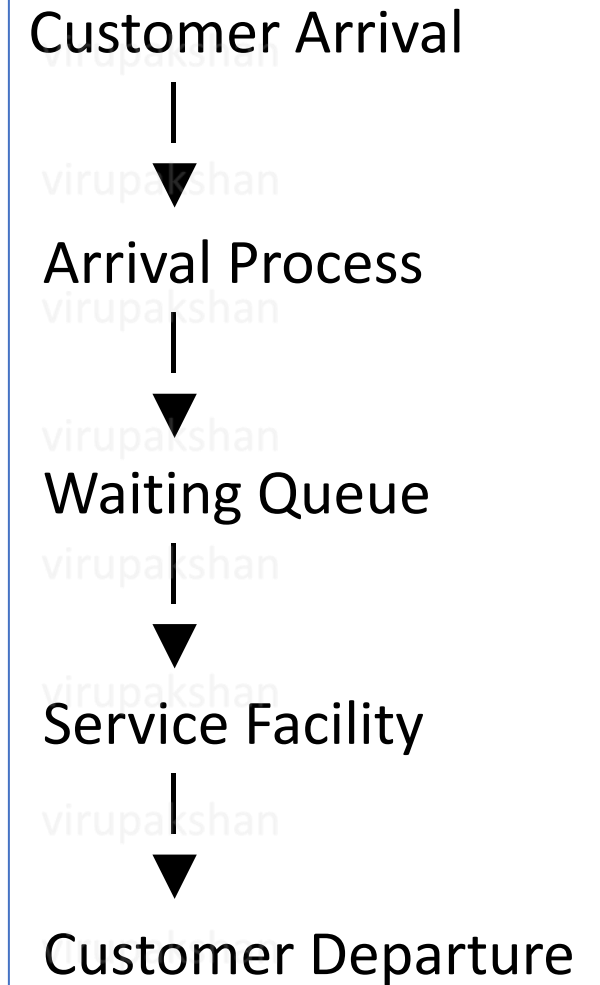
4.8.3 Essential Features of Queuing Systems

Q3. What are the basic components of a queuing system?

Answer:

A queuing system consists of the following components:

1. Customer Arrival
2. Arrival Process
3. Waiting Line (Queue)
4. Service Facility
5. Customer Departure



4.8.4 Essential Features of Queuing Systems

Q4. What are the essential features of a queuing system?

Answer: The essential features of a queuing system are:

1. Calling Population
2. Arrival Process
3. Queue Discipline
4. Queue Capacity
5. Service Mechanism
6. Number of Service Phases
7. Customer Behavior
8. Waiting Space
9. Queue Configuration

Each feature affects the efficiency and performance of the service system.

4.8.5 Essential Features of Queuing Systems

Q5. What is meant by the Calling Population?

Answer: The **calling population** refers to the source from which customers arrive for service.

There are two types:

(a) Infinite Calling Population

The number of potential customers is extremely large, so one customer's arrival does not affect future arrivals.

Examples:

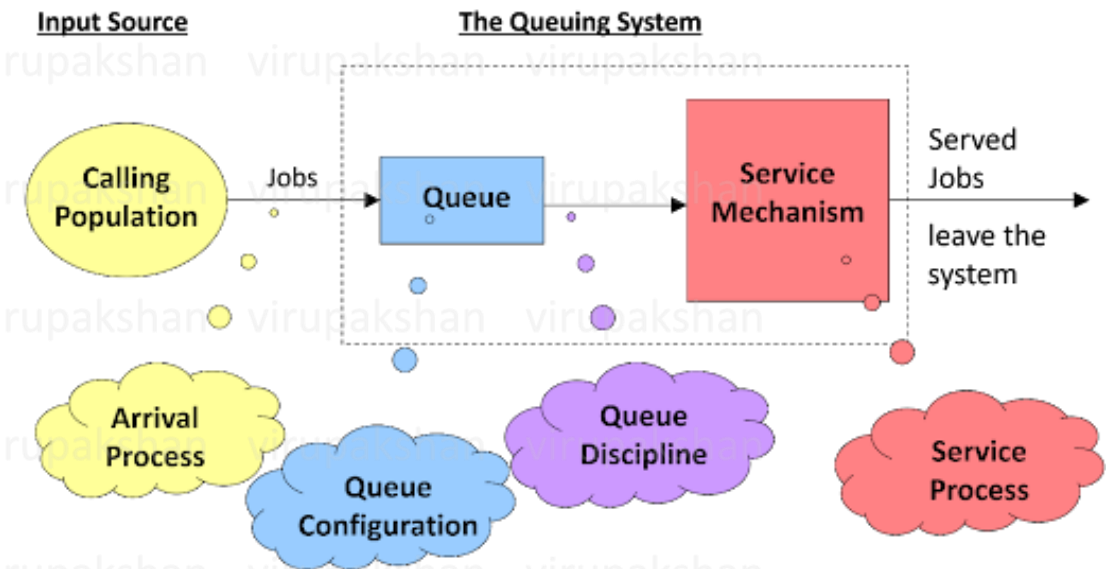
- Bank customers
- Supermarket shoppers
- Restaurant customers

(b) Finite Calling Population

The number of potential customers is limited.

Examples:

- Machines requiring repair in a factory
- Company vehicles awaiting maintenance
- Employees using a shared printer



4.8.6 Essential Features of Queuing Systems

Q6. What is the Arrival Process?

Answer:

The **arrival process** describes how customers arrive at the service facility.

It includes:

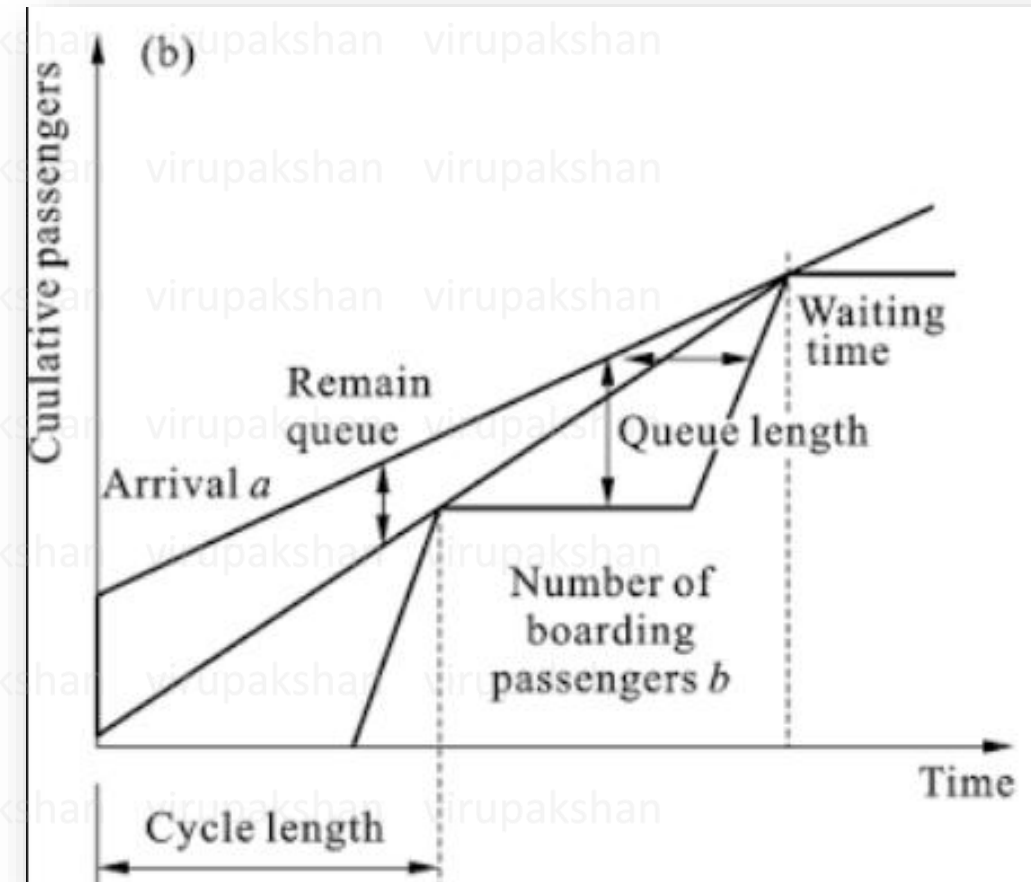
- Arrival rate (λ)
- Arrival pattern
- Time between arrivals

In most service systems, arrivals are assumed to be random and follow a **Poisson distribution**.

Example

A bank receives **20 customers per hour**.

Arrival Rate (λ) = 20 customers/hour



4.8.7 Essential Features of Queuing Systems

Q7. What is meant by Arrival Rate (λ)?

Answer:

The **arrival rate (λ)** is the average number of customers arriving at the service facility per unit time.

Formula

$$\lambda = \text{Average number of arrivals per unit time}$$

Example

If 60 customers arrive in 3 hours,

$$\lambda = 60 \div 3 = 20 \text{ customers/hour}$$

4.8.8 Essential Features of Queuing Systems

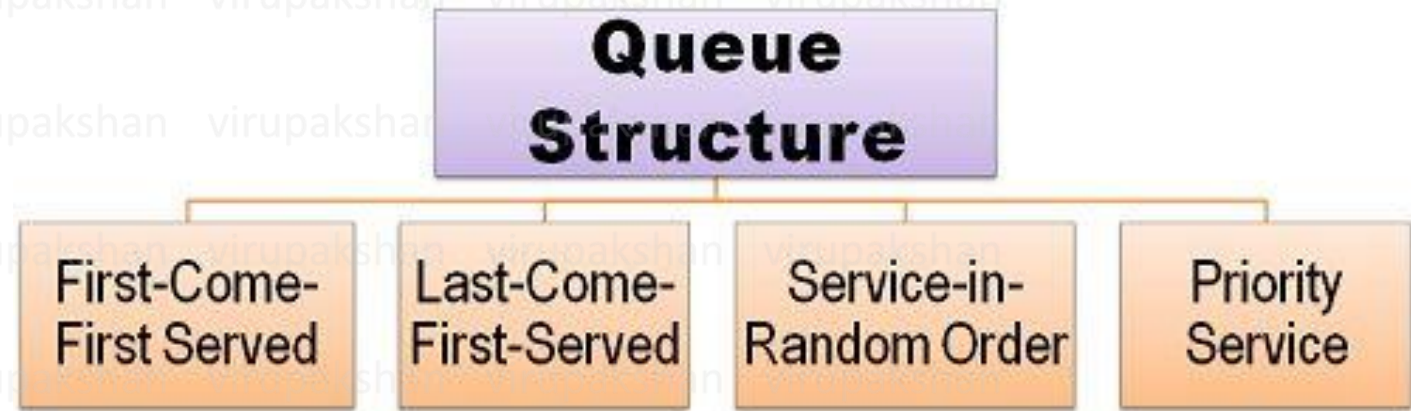
Q8. What is Queue Discipline?

Answer:

Queue discipline refers to the rule used to determine the order in which customers receive service.

The most common queue disciplines are:

- First Come First Served (FCFS)
- Last Come First Served (LCFS)
- Priority Service
- Shortest Processing Time



4.8.9 Essential Features of Queuing Systems

Q9. Explain First Come First Served (FCFS).

Answer:

In **First Come First Served (FCFS)**, customers are served in the same order in which they arrive.

It is the most common queue discipline.

Examples

- Banks
- Railway reservation counters
- Hospitals (general outpatient departments)
- Supermarkets

Illustration

Arrival:

A → B → C → D

Service:

A → B → C → D

4.8.10 Essential Features of Queuing Systems

Q10. Explain Last Come First Served (LCFS).

Answer:

In **Last Come First Served (LCFS)**, the most recently arrived customer is served first.

Example

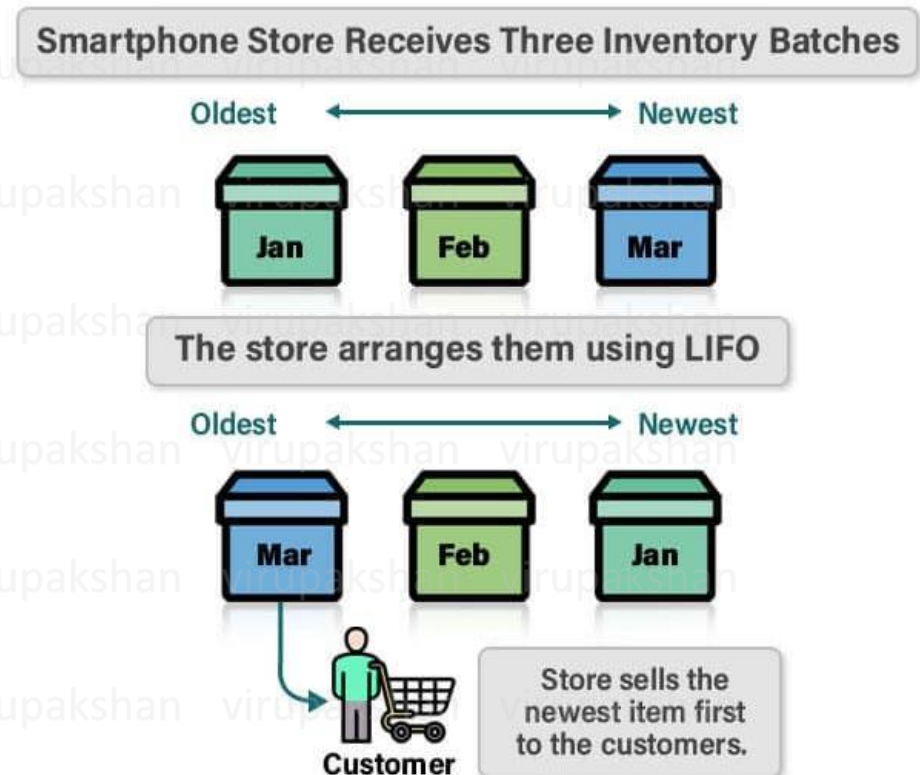
Stack operations in computers.

Arrival:

A → B → C

Service:

C → B → A



4.8.11 Essential Features of Queuing Systems

Q11. What is Priority Service?

Answer:

Priority service gives preference to customers based on urgency or importance rather than arrival time.

Examples

- Emergency patients in hospitals
- VIP airline passengers
- Premium banking customers

4.8.12 Essential Features of Queuing Systems

Q12. What is Queue Capacity?

Answer:

Queue capacity refers to the maximum number of customers that can wait in the system.

There are two types.

Unlimited Capacity

No restriction on the number of waiting customers.

Example: Online customer support.

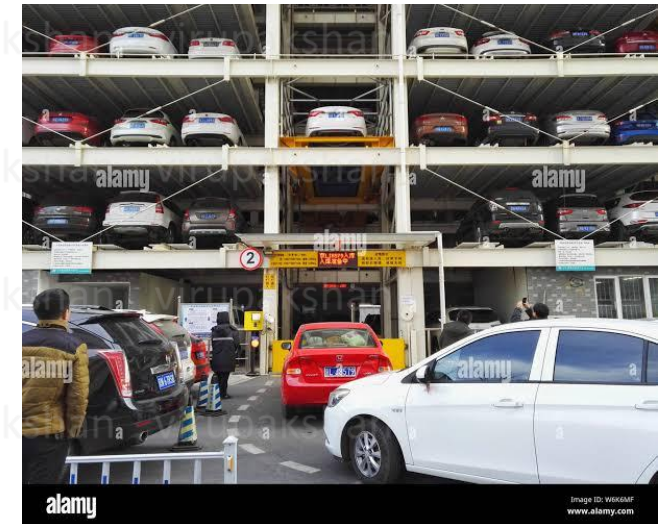
Limited Capacity

Only a fixed number of customers can wait.

Examples

- Parking lots
- Small clinics
- Elevators

If the queue becomes full, new customers are turned away.



4.8.13 Essential Features of Queuing Systems

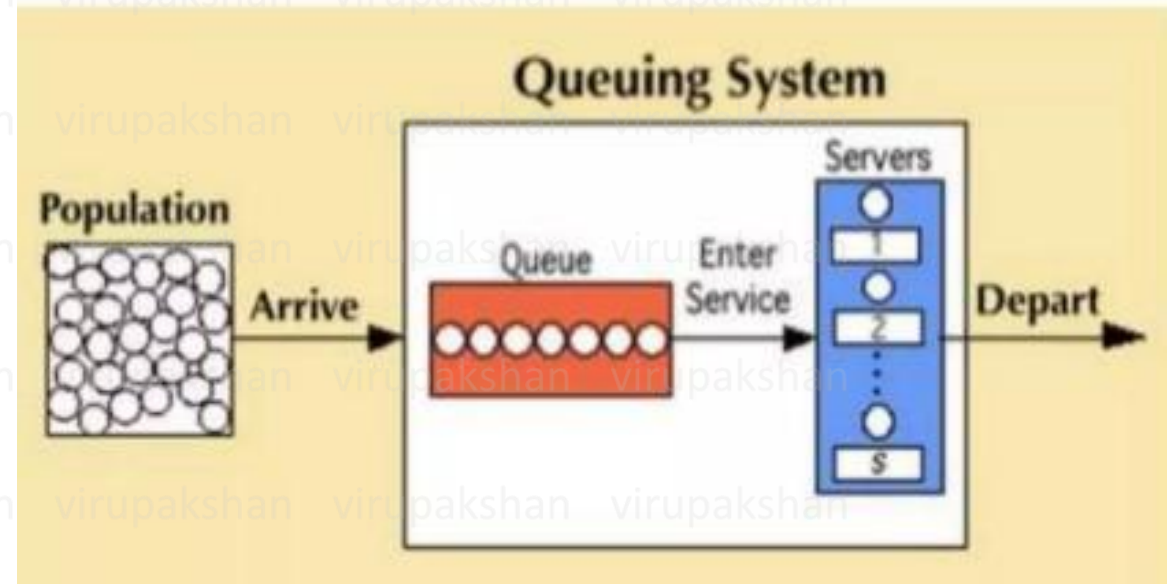
Q13. What is the Service Mechanism?

Answer:

The **service mechanism** describes **how service is provided**.

It includes:

- Number of servers
- Service rate
- Number of service stages



4.8.14 Essential Features of Queuing Systems

Q14. What are Single-Server and Multiple-Server Systems?

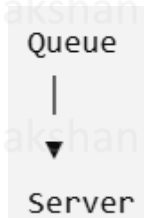
Answer:

Single-Server System

Only one employee or machine provides service.

Examples

- One ATM
- One cashier

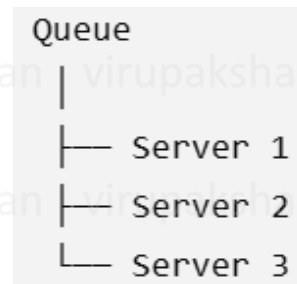


Multiple-Server System

Two or more servers provide the same service simultaneously.

Examples

- Bank counters
- Airport check-in counters
- Hospital registration desks



4.8.15 Essential Features of Queuing Systems

Q15. What is Service Rate (μ)?

Answer:

The **service rate (μ)** is the average number of customers served per unit time.

Formula

μ = Average number of customers served per unit time

Example

A cashier serves **25 customers per hour**.

$\mu = 25$ customers/hour

4.8.16 Essential Features of Queuing Systems

Q16. What are Service Phases?

Answer:

Service phases indicate the number of service stations a customer must pass through.

Single-Phase System

The customer receives service at only one station.

Example

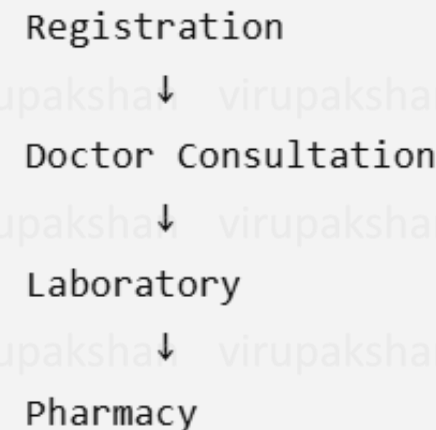
ATM withdrawal.

Multi-Phase System

The customer passes through multiple service stations.

Example

Hospital:



4.8.17 Essential Features of Queuing Systems

Q17. Explain **Customer Behaviors** in a Queuing System.

Answer:

Customers may react differently while waiting.

1. Balking

The customer decides **not to join** the queue because it appears too long.

Example : Leaving a restaurant after seeing a long waiting line.

2. Reneging

The customer joins the queue but leaves before receiving service.

Example : Disconnecting a customer support call after waiting for several minutes.

3. Jockeying

The customer switches from one queue to another in the hope of faster service.

Example : Changing supermarket checkout lanes.

4.8.18 Essential Features of Queuing Systems

Q18. What is Waiting Space?

Answer:

Waiting space is the physical area available for customers while waiting for service.

Examples

- Hospital waiting room
- Airport lounge
- Bank waiting area



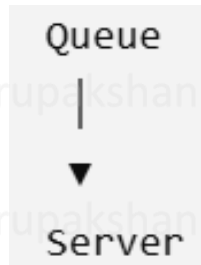
Adequate waiting space improves customer comfort and satisfaction.

4.8.19 Essential Features of Queuing Systems

Q19. What are the different Queue Configurations?

Answer:

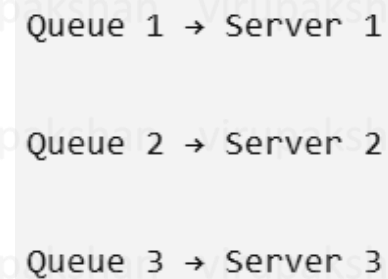
(a) Single Queue – Single Server



Example

One ATM.

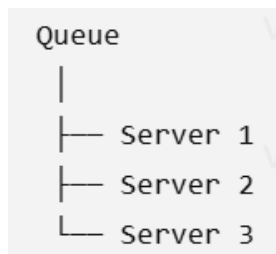
(c) Multiple Queues – Multiple Servers



Example

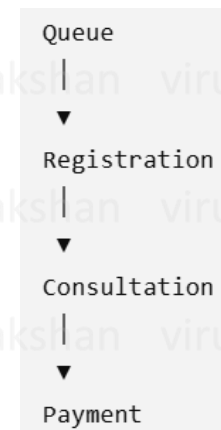
Supermarket checkout counters.

(b) Single Queue – Multiple Servers



Example: Bank with multiple tellers.

(d) Multi-Stage Queue



Example

Hospital service process.

4.8.20 Essential Features of Queuing Systems

Q20. What are the important performance measures of a queuing system?

Answer:

Symbol	Meaning
λ	Average arrival rate
μ	Average service rate
ρ	Server utilization factor
L	Average number of customers in the system
L_q	Average number of customers waiting in the queue
W	Average time spent in the system
W_q	Average waiting time in the queue

4.8.21 Essential Features of Queuing Systems

Q21. How is Server Utilization (ρ) calculated?

Answer:

Server utilization measures the proportion of time the server is busy.

Formula (Single-Server System)

$$\rho = \frac{\lambda}{\mu}$$

Example

A bank receives **20 customers/hour**, and the cashier serves **25 customers/hour**.

$$\rho = \frac{20}{25} = 0.80$$

Interpretation: The cashier is busy **80% of the time**, leaving about **20% idle time**.

4.8.22 Essential Features of Queuing Systems

Q22. Give a real-life example of a queuing system.

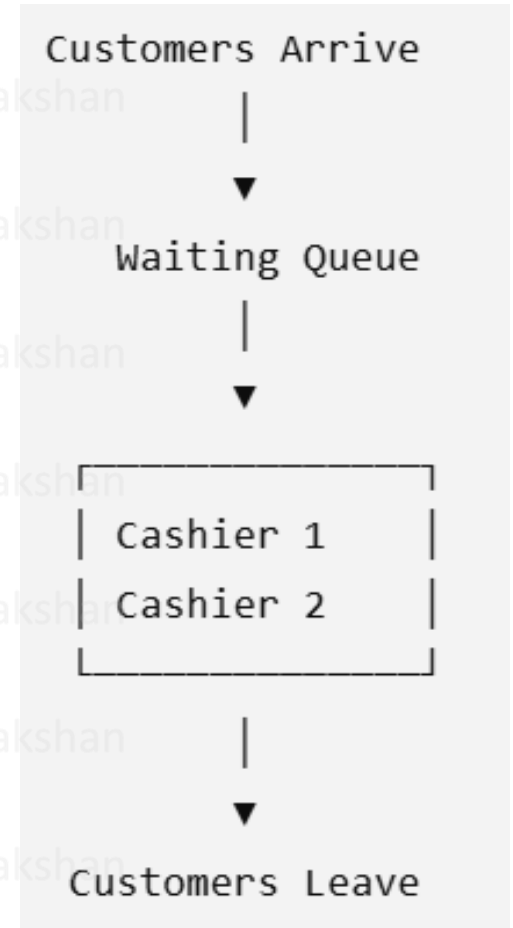
Answer:

Example: Bank

A bank has two cashiers serving customers.

- Calling population: General public (infinite)
- Arrival process: Random arrivals
- Queue discipline: First Come First Served (FCFS)
- Queue capacity: Unlimited
- Service mechanism: Two cashiers (multiple servers)
- Service phase: Single phase
- Customer behavior: Customers may balk or renege during peak hours

Flow Diagram



4.8.23 Essential Features of Queuing Systems

Q23. What are the advantages of queuing analysis?

Answer:

- Reduces customer waiting time.
- Improves customer satisfaction.
- Optimizes employee and resource utilization.
- Reduces operating costs.
- Supports efficient service planning.
- Helps determine the optimum number of service facilities.
- Improves the overall quality of service.

4.8.24 Essential Features of Queuing Systems

Q24. What are the limitations of queuing theory?

Answer:

- Assumes random arrivals and service times, which may not always occur in practice.
- Human behavior such as impatience and queue switching is difficult to model accurately.
- Demand can fluctuate significantly during peak periods.
- Complex service systems with multiple priorities may not fit simple queuing models

4.8.25 Essential Features of Queuing Systems

2-Mark Questions

- Define a queuing system.
- What is arrival rate?
- Define service rate.
- What is queue discipline?
- Differentiate between finite and infinite calling populations.
- Define balking, reneging, and jockeying.

5-Mark Questions

- Explain the essential features of a queuing system with suitable examples.
- Describe the components of a queuing system.
- Explain different queue disciplines.
- Discuss customer behavior in waiting lines.
- Explain the performance measures used in queuing systems.

10-Mark Question

Explain the concept of a queuing system and discuss in detail the essential features of a queuing system with suitable diagrams and examples.

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4.6 Yield Management and its Application

4.7 Queuing Systems

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3.6	Service Quality Improvement Programs
3.7	Service Quality Tools
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3.9	Improvement Programs

SERVICES SCIENCE AND
SERVICE OPERATIONAL MANAGEMENT

UNIT 04

LECTURE 08

Doubts?

THANK YOU!

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