

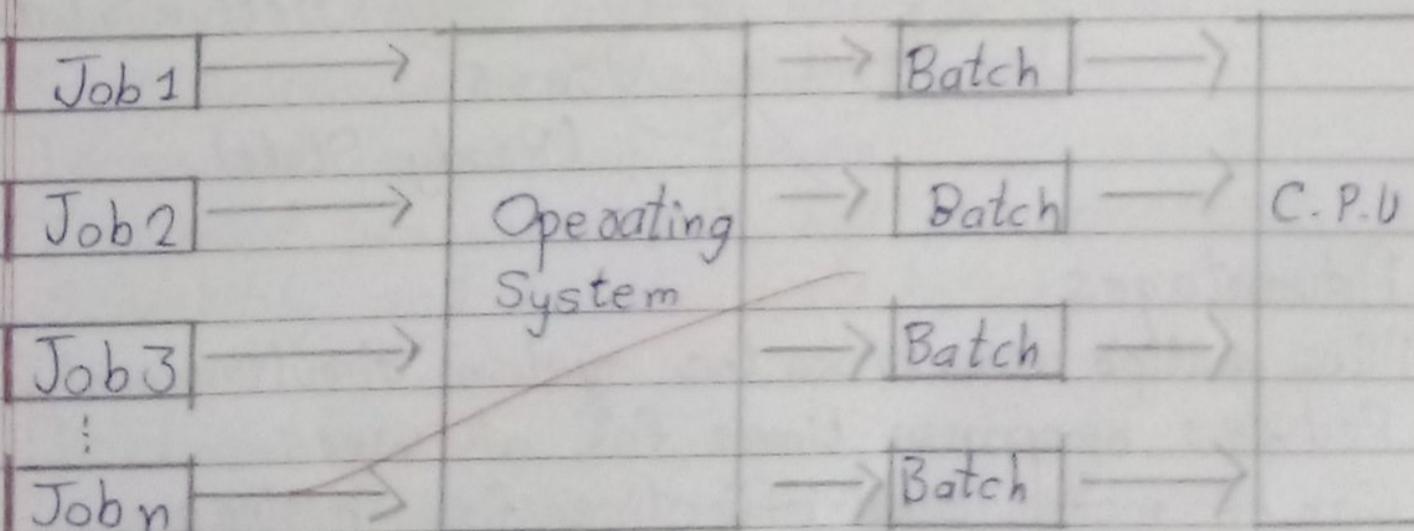
Q) Define Operating System (OS) and Explain different types of operating Systems.

Ans: An Operating System (OS) acts as an intermediary between computer hardware and the computer user. It manages hardware resources and provides services for computer programs. It performs basic tasks as controlling and allocating memory, prioritizing system requests, controlling input and output devices, facilitating networking, and managing files.

Types of Operating Systems

① Batch Operating System

- Jobs are processed in batches without user interaction, jobs with similar needs are batched together and run through the system.
- Ex: Early IBM mainframe operating system.



Advantages

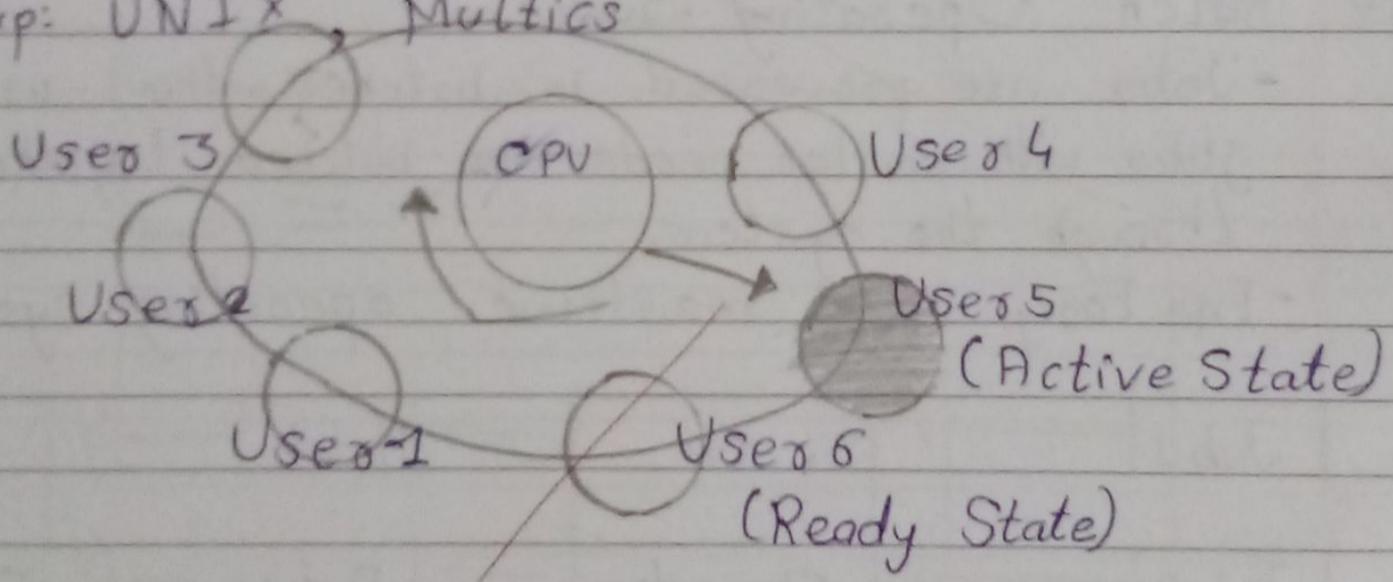
- Reduces Errors
- Increases processing speed
- Simplifies processing job management
- Cost-effective for large data processing

Disadvantages

- Lack of interaction, user cannot correct errors immediately.
- No priority to urgent jobs.
- System failure can disrupt all batch jobs.
- Difficult to debug and troubleshoot due to lack of immediate feedback.

② Time-Sharing Operating System

- Multiple users can access the system concurrently. Time-sharing divides system time into small intervals and switches between tasks quickly, giving the illusion of simultaneous execution.
- Exp: UNIX, Multics



Advantages

- Allow multiple users to use the system simultaneously.
- Reduces response times for all users.
- Can be more cost-effective for business.

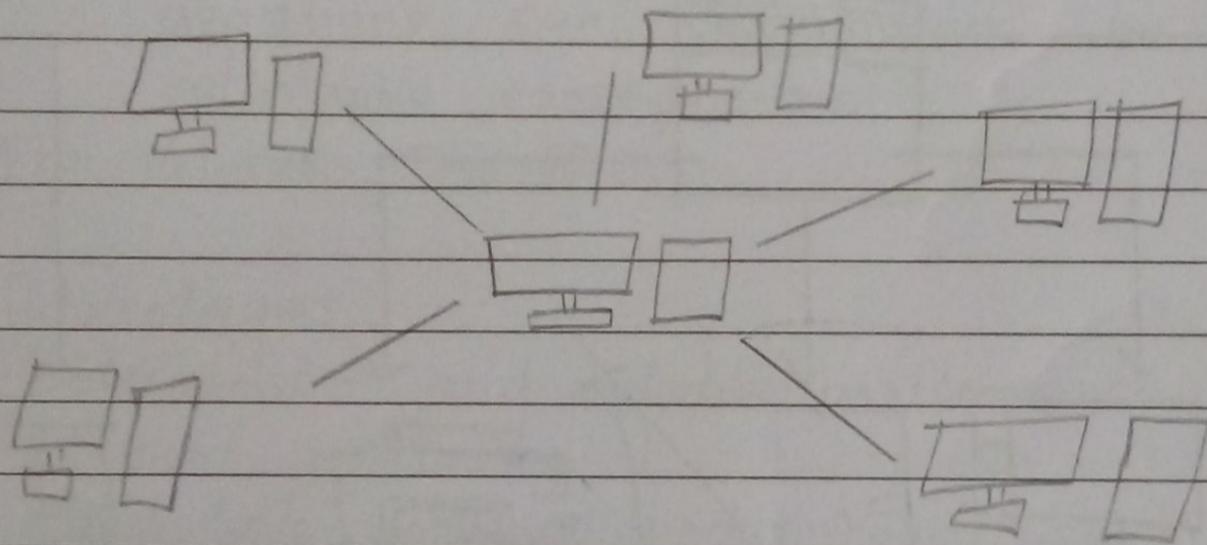
Disadvantages

- limited number of terminals that can be linked to the system.
- Increased complexity due to multiple instances of the operating system.

- potential conflicts between users attempting to use the system simultaneously.

③ Distributed Operating System

- Manages a group of independent computers and makes them appear to be a single computer. It distributes computations among different machines to improve performance and efficiency.
- Exp: Apache Hadoop, Amoeba



~~Advantages~~

- Shared resources and enhanced communication.
- Fault tolerance and reliability.
- Increased processing power.
- Improved performance and response time.
- Scalability and load distribution.

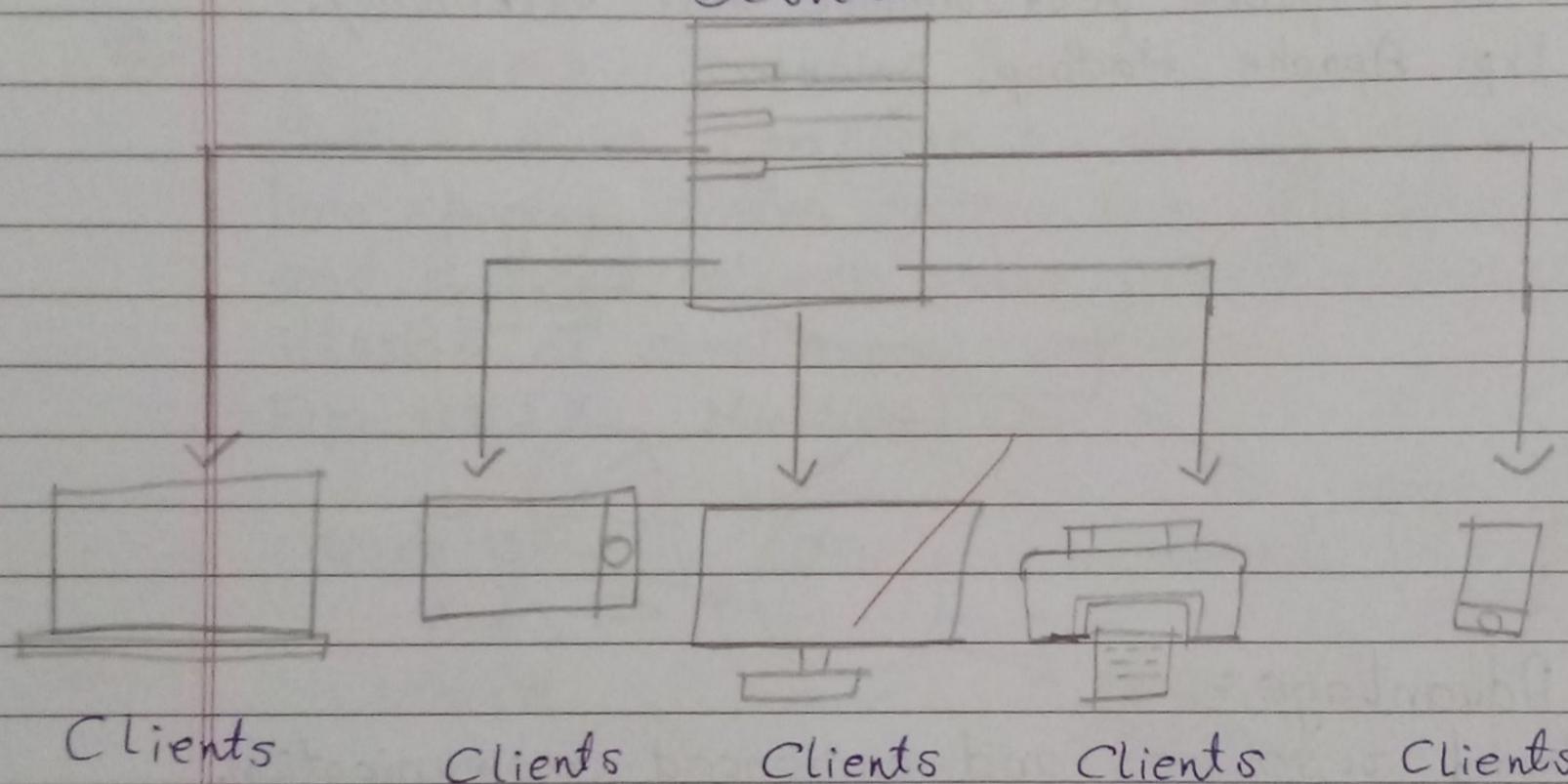
~~Disadvantages~~

- Increased complexity
- Network dependency and susceptibility to failure.
- Security risks
- Synchronization and consistency issues.
- Higher cost of implementation and maintenance.

④ Network Operating System

- Provides features for computers connected on a network to communicate and share resources. Manages data, users, groups, security and applications over a network.
- Exp: Novell Netware, Microsoft Windows Server

Server(s)



Advantages

- Centralized administration
- Resource-sharing
- Security
- Multi-user functionality
- Scalability

Disadvantages

- High cost
- Complexity
- Dependence on single server
- Potential for bottlenecks
- Regular maintenance

⑤ Real-Time Operating System (RTOS)

- Designed to process data as it comes in, typically without buffer delays, used in environments where time constraints are critical.
- Types:
 - Hard Real-Time Systems: Strict timing constraints, missing a deadline can result in system failure.
 - Soft Real-Time Systems: More flexible, deadlines can occasionally be missed without catastrophic consequences.
- Exp: VxWorks, Free RTOS
- Advantages
 - Deterministic and reliable performance.
 - Efficient multitasking.
 - Predictable behavior under heavy use.
 - Effective management of hardware resources
- Disadvantages
 - Higher complexity and development cost.
 - Limited user interface and applications.
 - Requires precise and accurate programming
 - Can be less flexible than general-purpose operating system.

⑥ Embedded Operating System

- Designed to operate on small machines like PDAs, with limited resources. They are typically specialized for specific tasks.
- Exp: Embedded Linux, Embedded windows

Advantages

- Demand minimal effort and compact size.
- Simple design
- Perform specific tasks within large systems
- Found in various devices, hardware instrumentation, and home appliances.

Disadvantages

- Limited functionality
- Difficult to update or upgrade
- Limited resources and memory
- Can be complex to troubleshoot and repair.

⑦ Mobile Operating system

- Designed specifically for mobile devices such as smartphones and tablets. These OSs are optimized for mobile specific features like touch interfaces and low power consumption.
- Exp: Android, iOS.
- Advantages
 - Portability
 - User-friendly for touch input
 - Connectivity: Built-in support for mobile networks, GPS and various sensors.
- Disadvantages
 - Security Risks: Susceptible to malware and security breaches through apps.
 - Privacy concerns: Apps may conflict and misuse personal data.

⑧ Multiprocessing Operating System

- Supports the use of more than one processor at the same time. These systems can execute multiple processes simultaneously.
- Exp: Linux, UNIX

- Advantages

- Enhanced Performance: Parallel execution of processes improves system performance
- Fault tolerance: Failure of one processor doesn't halt the entire system.
- Resource Utilization
- Scalability

- Disadvantages

- Complexity
- ~~Synchronization Issues~~
- ~~Cost~~
- Power Consumption

⑨ Desktop Operating system

- Intended for use on personal computers, these OSs support a wide range of applications and peripherals.
- Exp: Microsoft Windows, macOS, Linux distributions.

- Advantages

- Powerful Hardware
- Versatility
- Robust Performance
- Peripheral Support

- Disadvantages

- Portability
 - Energy consumption
 - Cost

⑩ Multi-threading Operating System

- Allows different parts of a single program to run concurrently, Multi-threading improves the performance of applications by splitting tasks into smaller threads.

- Exp: Modern Versions of Windows, Linux.

- Advantages

- Improved Performance
 - Resource Sharing
 - Responsiveness
 - Parallelism
 - Scalability

- Disadvantages

- Complex Development
 - Synchronization Challenges
 - Overhead
 - Deadlocks
 - Security Risks

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Q) Explain O.S/ Write a short note on following:

1. O.S as resource manager
2. Single and Multi user O.S
3. Functions of O.S
4. Characteristics of O.S

Q) Explain Evolution of Operating System.

Q) Write a short note on following:

1. O.S as resource Manager

→ An Operating System (O.S) functions as a resource manager, managing the allocation and coordination of hardware resources such as the CPU, memory, storage and peripheral devices. It abstracts hardware complexities, providing a stable and consistent environment for applications. By managing resources, the O.S optimizes performance, prevents conflicts, and ensures equitable distribution of resources among processes.

Advantages:

- Efficient Resource Utilization: The OS optimizes the use of hardware resources, ensuring that no single application monopolizes resources.
- Simplified Application Development: Developers do not need to manage hardware details directly, as the OS provides necessary abstractions.

Disadvantages:

- Overhead: The OS itself consumes resources, which may slightly reduce the resources available to applications.
- Complexity: Managing resources effectively, especially in complex systems, requires sophisticated algorithms and mechanisms, which can be challenging to implement and maintain.

2. Single and Multi User Operating System

- Single-User O.S: These are designed to manage the computer's resources for one user at a time, providing a straight forward environment where a single user has full control over system resources. Ex: include older versions of windows and DOS.

Advantages:

- Simplicity: Easier to use and manage, with fewer security and resource allocation issues.
- Less Resource Intensive: Typically requires less power, uses fewer resources to run, making it suitable for personal computers with limited hardware.

Disadvantages:

- Limited Functionality: Only one user can use the system at a time, which is not ideal for collaborative or networked environments.

- Inefficient for Multiple Users: Lacks the ability to manage and isolate resources among multiple users, leading to potential security and performance issues in shared environments.
- Multi-User O.S.: These can manage and support multiple users simultaneously, often in networked environments. Examples include Linux, Unix and modern versions of Windows Server.

- Advantages:

- Resource Sharing
- Security: Provides mechanisms to isolate users and their processes, ensuring that actions of one user do not affect others.
- Cost-Effective

- Disadvantages:

- Complexity
- Resource Competition: If not managed properly, multiple users might compete for resources; potentially leading to reduced performance.

3. Functions of Operating System

i) Process Management: It controls and coordinates computer process.

ii) Memory Management: It manages the computer's memory, including the allocation (and reallocation) of memory space to programs.

iii) File System Management: It controls the creation, deletion and modification of files.

iv) Device Management: It manages device communication via their drivers.

v) Security and Access Control: It ensures data protection and controls user access.

Advantages:

- Improved system performance and efficiency.
- Multitasking capabilities.
- Provides a standard set of services to application software.

Disadvantages:

- Can be complex and challenging to learn.
- Requires regular updates and maintenance.
- Can consume significant system resources.

4. Characteristics of Operating System

i) Process Management: Manage Process, which are instances of programs in execution.

They control the execution of processes, including their creation, termination, and coordination.

ii) Memory Management: Responsible for managing the computer's memory, including the allocation of memory space to process as they run.

iii) File System Management: Manage files and directories, providing mechanisms for storing, retrieving, and organizing data.

Advantages:

- Resource Management: OS efficiently manages computer resources, ensuring optimal use.
- Application Platform: It provides a platform for applications to run, making software development easier.
- Security
- Reliability: It ensures system stability and minimal downtime.

Disadvantages:

- Complexity
- Resource Intensive: Some OS can be resource intensive, requiring powerful hardware.

Q) Explain Evolution of Operating System.

Evolution of Operating System

Operating systems have evolved significantly since the early days of computing, adapting to the increasing complexity and demands of technology.

Here's an overview of key phases in their evolution:

1. Batch OS Processing Systems

In the 1950s and early 1960s, the earliest operating systems were developed for batch processing. These systems allowed the execution of a sequence of jobs without human intervention. Users submitted jobs (like programs and data) to a central computer, where they were processed in batches.

Advantages: Efficient resource use, automation.

Disadvantages: No user interaction, Long wait times.

2. Time-Sharing Systems

Introduced in the 1960s, time-sharing systems allowed multiple users to interact with a computer simultaneously. The system rapidly switched between users, giving the illusion of concurrent execution.

Advantages: Real-time interaction, resource sharing.

Disadvantages: Increased complexity, security issues.

3. Multiprogramming

Multiprogramming systems emerged in the mid-1960s, allowing multiple programs to reside in memory simultaneously and execute concurrently. The OS managed the allocation of CPU time among the programs, improving overall system efficiency.

Advantages: Improved CPU utilization, reduced idle time.

Disadvantages: Complex memory management, resource contention.

4. Distributed Systems

With the advent of networking in the 1970s and 1980s, distributed systems were developed. These systems allowed multiple computers to work together, sharing resources and workloads over a network.

Advantages: Scalability, fault tolerance.

Disadvantages: Network dependency, complex coordination.

5. Personal Computing

The 1980s saw the rise of personal computers (PCs) and the development of operating systems tailored for individual use, like MS-DOS and early versions were designed to be user-friendly and ran on relatively inexpensive hardware.

Advantages: Accessibility, intuitive GUIs.

Disadvantages: Limited multitasking, security concerns

6. Modern Operating Systems

In the 1990s and 2000s, operating syst

Q) Define Scheduling and explain types of schedulers and with suitable diagram.

Ans: Scheduling is a crucial aspect of computer environments, particularly in managing how processes and threads, which are components of programs in execution, are assigned to the CPU. The operating system is responsible for determining which program or process gets CPU time, ensuring efficient execution. There are various methods to configure and optimize this scheduling process, each with different scheduling strategies and goals, such as maximizing CPU utilization, minimizing response time, or balancing load among processes.

Types of Schedulers

1. Long Term Scheduler

- The long-term scheduler controls the degree of multiprogramming by bringing new processes into the ready state. It ensures a balanced selection of both I/O-bound and CPU-bound processes to optimize system performance.

2. Short Term Scheduler

- Also known as the CPU scheduler, the short-term scheduler selects a process from the ready state and schedules it for execution. It ensures that no process experiences starvation due to high burst time by managing the scheduling efficiently.

3. Medium Term Scheduler

- The medium term scheduler is responsible for suspending and resuming processes, typically through swapping. It moves processes between main memory and disk storage to

free up memory and manage the process mix, helping to maintain a balance between I/O-bound and CPU-bound processes.

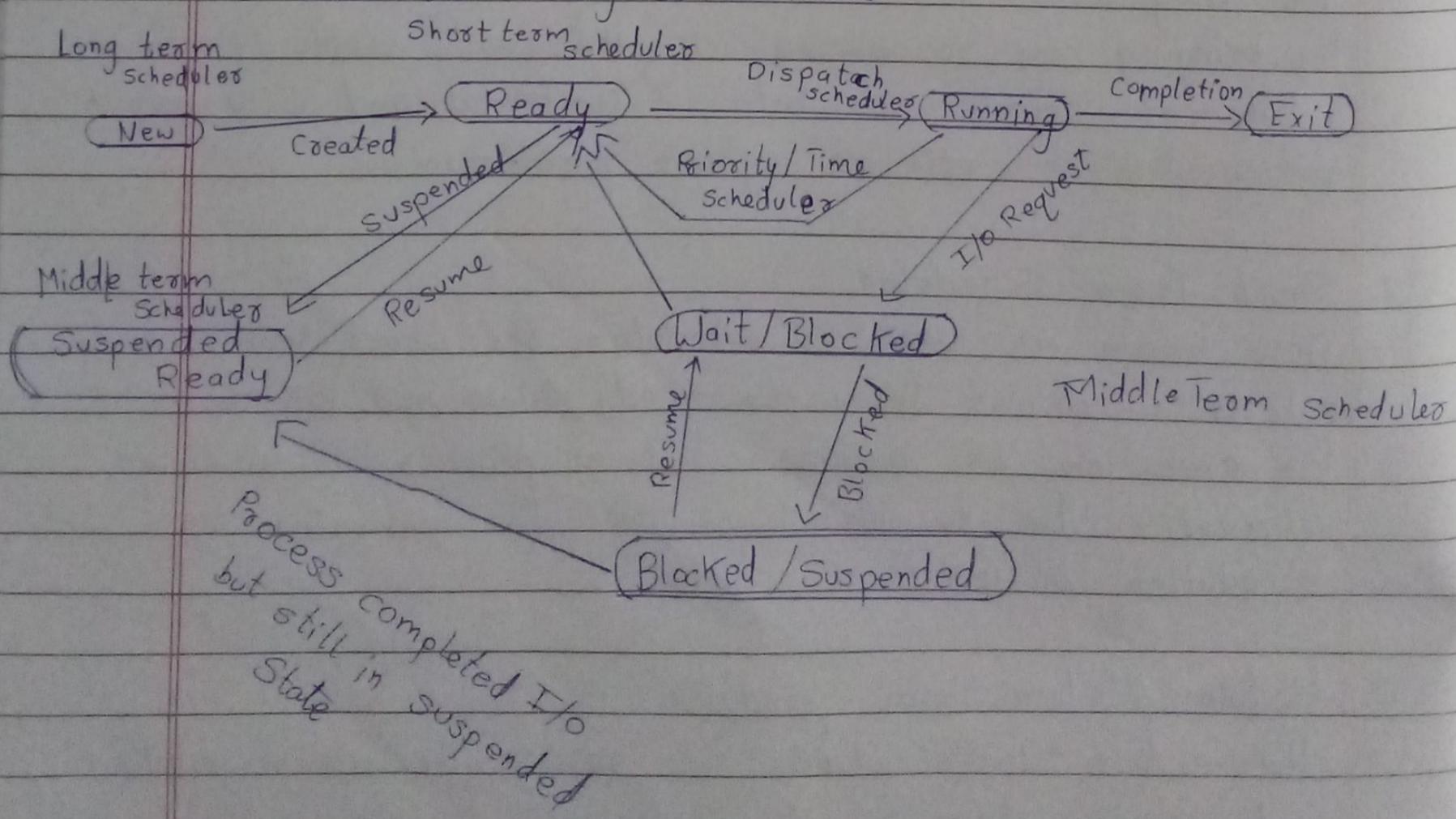
Other types of schedulers

1. I/O schedulers

- I/O schedulers manage the execution of I/O operations such as reading and writing to disks or networks. They use various algorithms, such as FCFS (First-Come, First-Served) and Round Robin (RR), to determine the order in which I/O operations are executed.

2. Real-Time Schedulers

- In real-time systems, real-time schedulers ensure that critical tasks are completed within specified time frames. They prioritize and schedule tasks using various algorithms to meet the timing constraints.



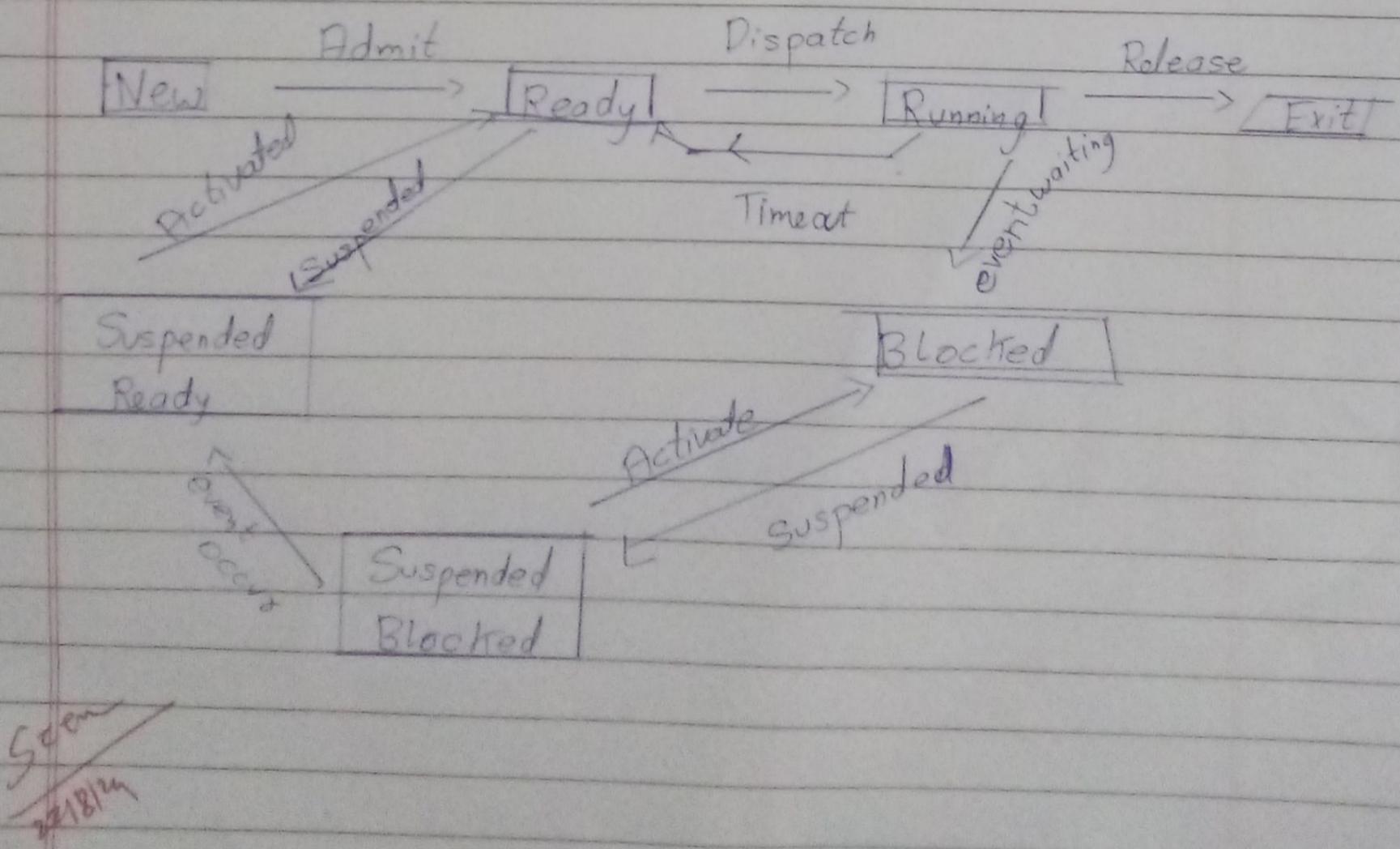
Q) Define Process and Explain process state transition with suitable diagram.

Ans:

A process is an executing instance of a program that includes the program code, its current activity, allocated resources, and the process control information maintained by the operating system.

Process State transition

- i New: The process is created.
- ii Ready: New process in ready queue - Ready for execution.
- iii Running: Process in execution/Running on Processor.
- iv Waiting: Process waiting for some event to occur either user input or resource to be free.
- v Exit: The process completed execution successfully.



Q

Define concurrent processing and explain importance of concurrency processing in modern Operating system.

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