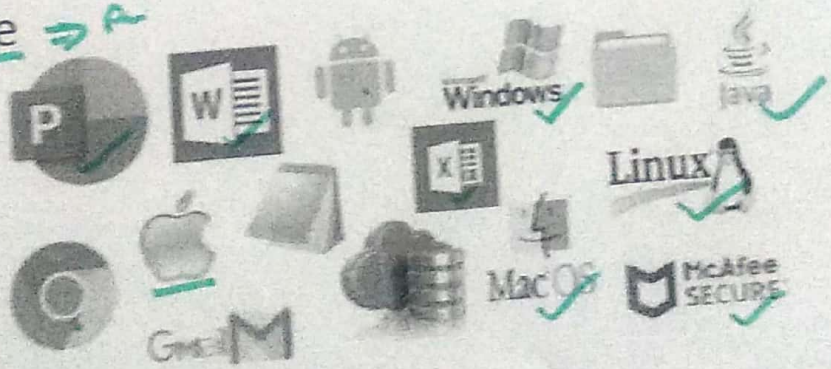
OPERATING SYSTEM

BASICS OF SOFTWARE

- **Software:-** Software is a set of instructions, data or programs used to operate computers and execute specific tasks.

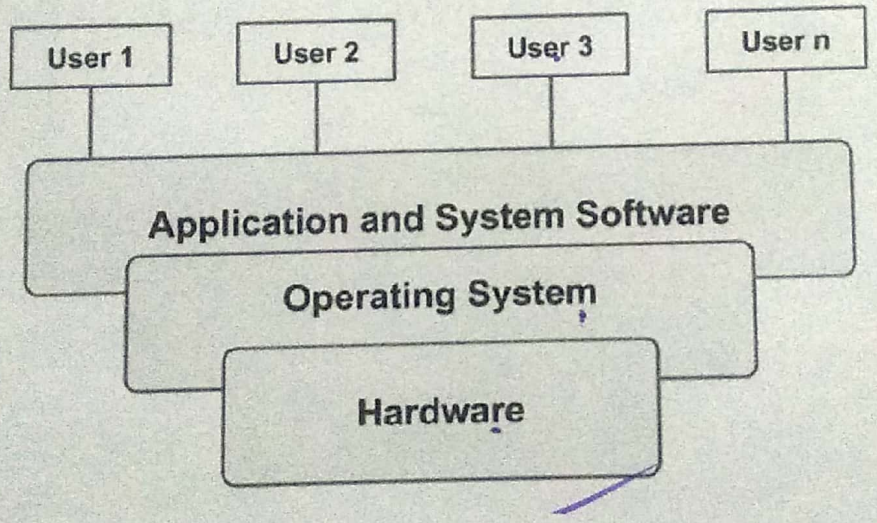
There are Three types of Software-:

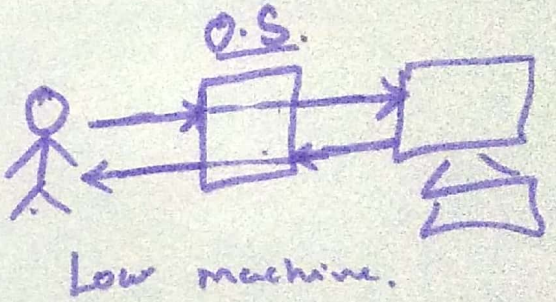
- System Software → O.S
- Application Software ⇒
- Utility Software ⇒



INTRODUCTION TO OPERATING SYSTEM

- An operating system is a program that acts as an interface between the user and the computer hardware and controls the execution of all kinds of programs.

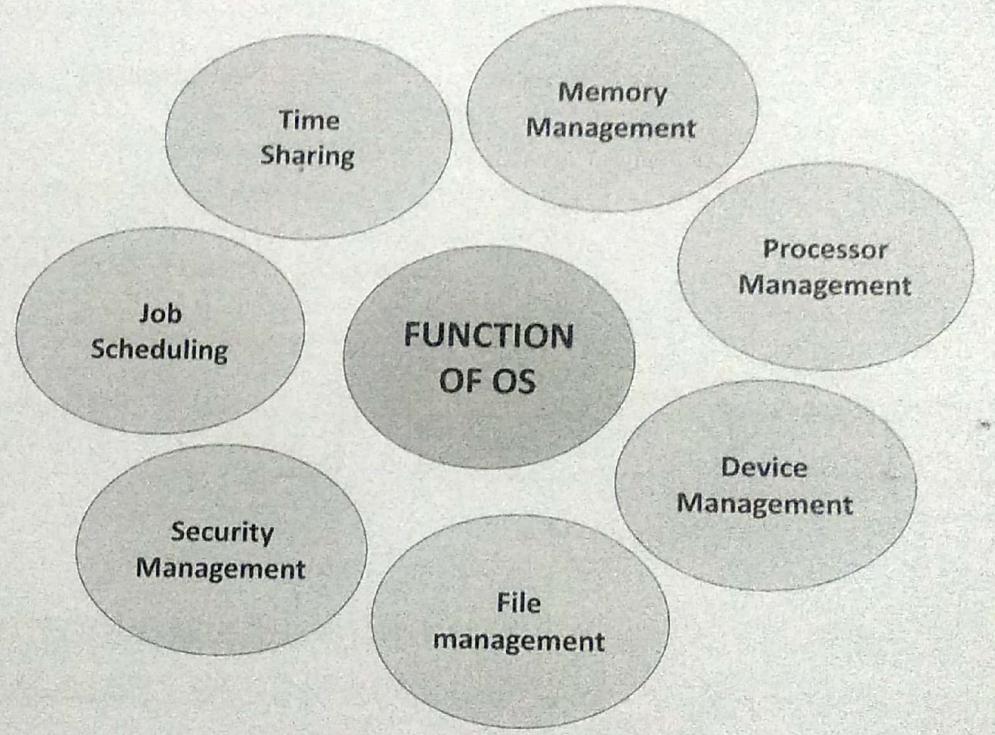


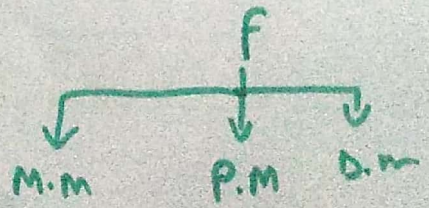


- An OS(Operating System) is a software that controls the internal activities of the computer hardware and provides user interface.

FUNCTION OF OPERATING SYSTEM

- Memory Management
- Processor Management
- Device Management
- File Management
- Security Management
- Job Scheduling
- Time Sharing etc.

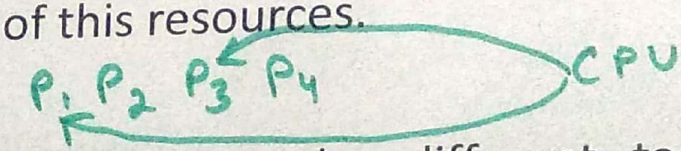




FUNCTION OF OPERATING SYSTEM

➢ **Memory Management:-**

Memory management module performs the task of allocation and de-allocation of memory space to programs in need of this resources.



➢ **Processor Management:-**

The Operating System assigns processors to the different tasks that must be performed by the computer system.

➢ **Device Management:-**

Operating System performs the task of allocation and de-allocation of the devices.

➢ **File Management:-**

Operating System manages all the file-related activities such as organization storage, retrieval, naming, sharing, and protection of files.

FUNCTION OF OPERATING SYSTEM

- **Security Management:-**

Security Management function of an operating system helps in implementing mechanisms that secure and protect the computer system internally as well as externally.

- **Job Scheduling:-**

Job scheduling is the process of allocating system resources to many different tasks by an operating system (OS).

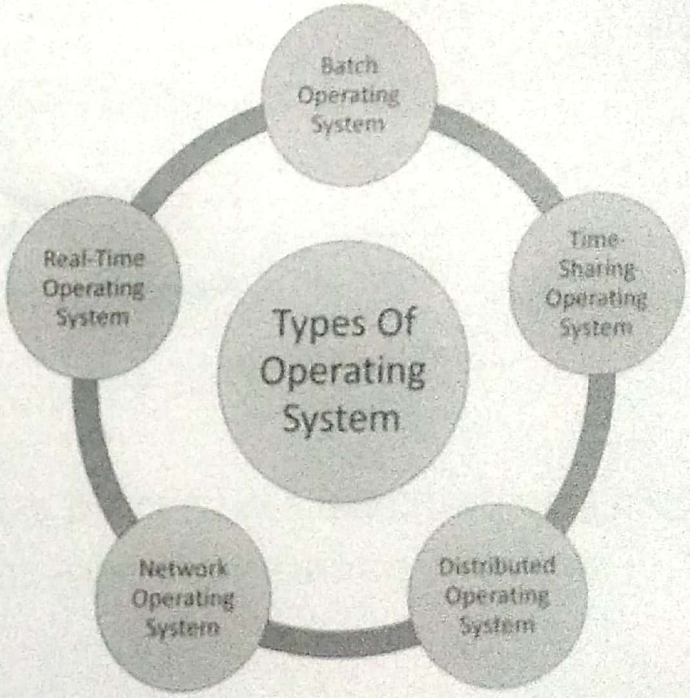
- **Time Sharing :-**

It co-ordinates and assigns compilers, assemblers, utility programs, and other software packages to various users working on computer system.

V. V. I

TYPES OF OPERATING SYSTEM

- Batch Operating System
- Time-Sharing Operating System
- Distributed Operating System
- Network Operating System
- Real-Time Operating System



types of o.s

Bat

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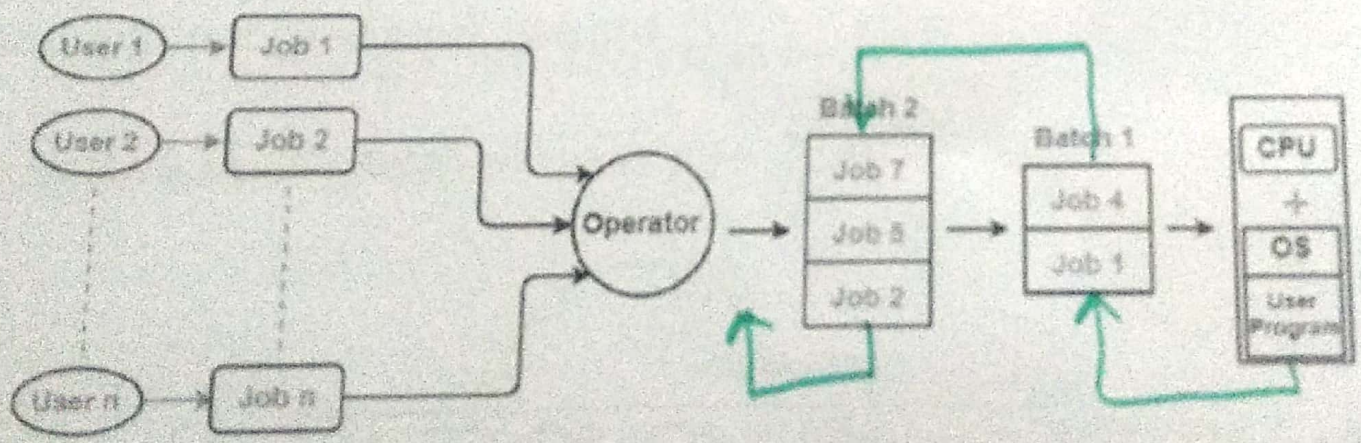
TYPES OF OPERATING SYSTEM

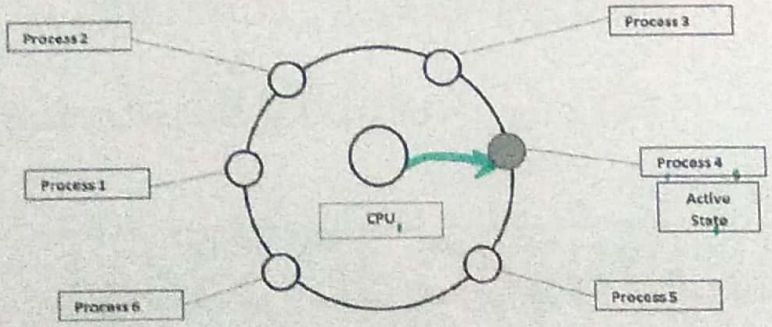
- **Batch Operating System:-**
  - In a Batch Operating System, the similar jobs are grouped together into batches with the help of some operator and these batches are executed one by one.



Batch Operating System

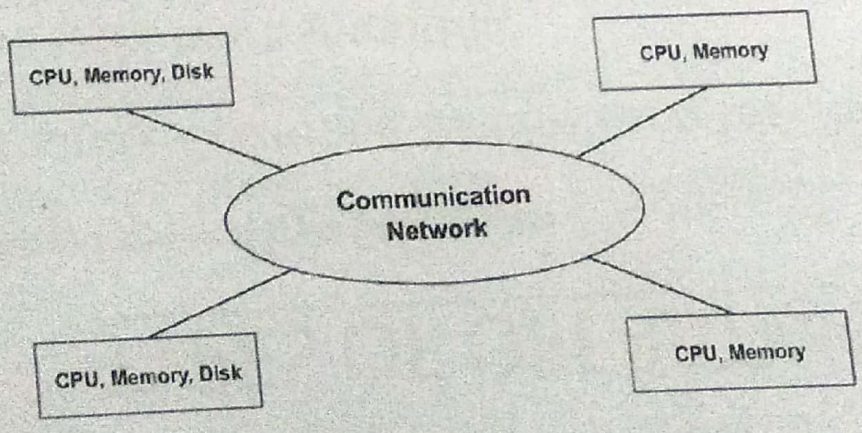
TYPES OF OPERATING SYSTEM

- **Time-Sharing Operating System:-**
  - In Time-Sharing Operating System Each task is given some time to execute so that all the tasks work smoothly.
  - Each user gets the time of CPU as they use a single system.
  - These systems are also known as Multitasking Systems. The task can be from a single user or different users also.



TYPES OF OPERATING SYSTEM

- **Distributed Operating System:-**
  - In a Distributed Operating System, we have various systems and all these systems have their own CPU, main memory, secondary memory, and resources.
  - These systems are connected to each other using a shared communication network. Here, each system can perform its task individually.



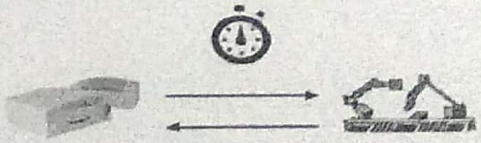
TYPES OF OPERATING SYSTEM

- **Real-Time Operating System:-**

  - In Real Time Operating Systems, each job carries a certain deadline within which the Job is supposed to be completed, otherwise the huge loss will be there or even if the result is produced then it will be completely useless.

There are two types of Real-Time Operating System

- Hard Real-Time Operating Systems
- Soft Real-Time Operating Systems

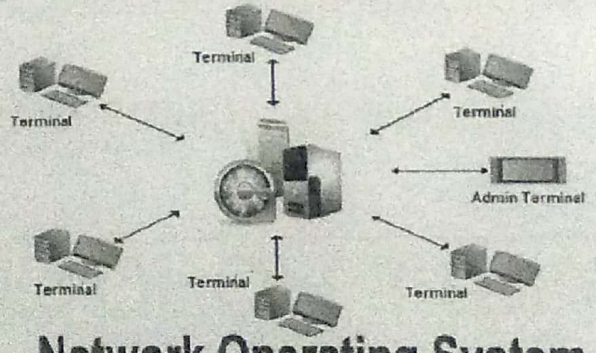


Real-Time Operating Systems

TYPES OF OPERATING SYSTEM

- **Network Operating System:-**

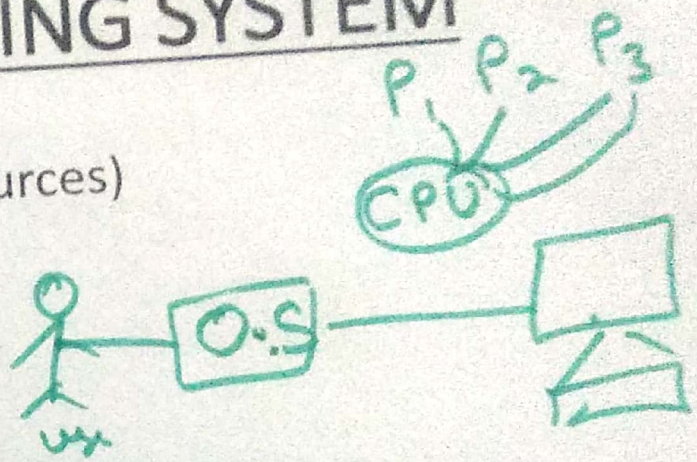
- These systems run on a server and provide the capability to manage data, users, groups, security, applications, and other networking functions.
- These types of operating systems allow shared access of files, printers, security, applications, and other networking functions over a small private network.

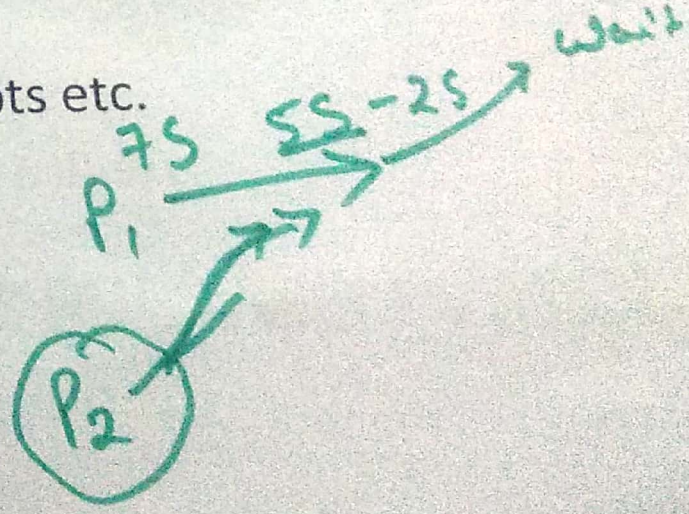


Network Operating System

OBJECTIVES OF OPERATING SYSTEM

- OS allocate resources to processes(Manage resources)
- OS Provide an effective user interface
- OS manage the input and output
- OS Provides Graphical User Interface (GUI) in the form of menu, icons, and buttons
- OS manage the interrupts and handle the interrupts etc.

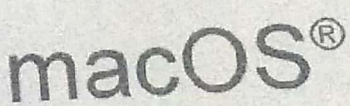




OPERATING SYSTEMS FOR DESKTOP AND LAPTOP

➢ Popular Operating Systems for Desktop and Laptop are:-

- MS(Microsoft)-Windows
- Ubuntu
- Mac OS
- Linux
- Solaris
- Chrome OS etc.



Linux

Google Chrome OS

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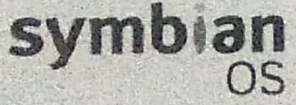
OPERATING SYSTEMS FOR MOBILE PHONE AND TABLETS

- Popular operating Systems for Mobile Phone and Tablets are:-
  - Android
  - iOS
  - Blackberry OS
  - Windows OS
  - Symbian OS etc.

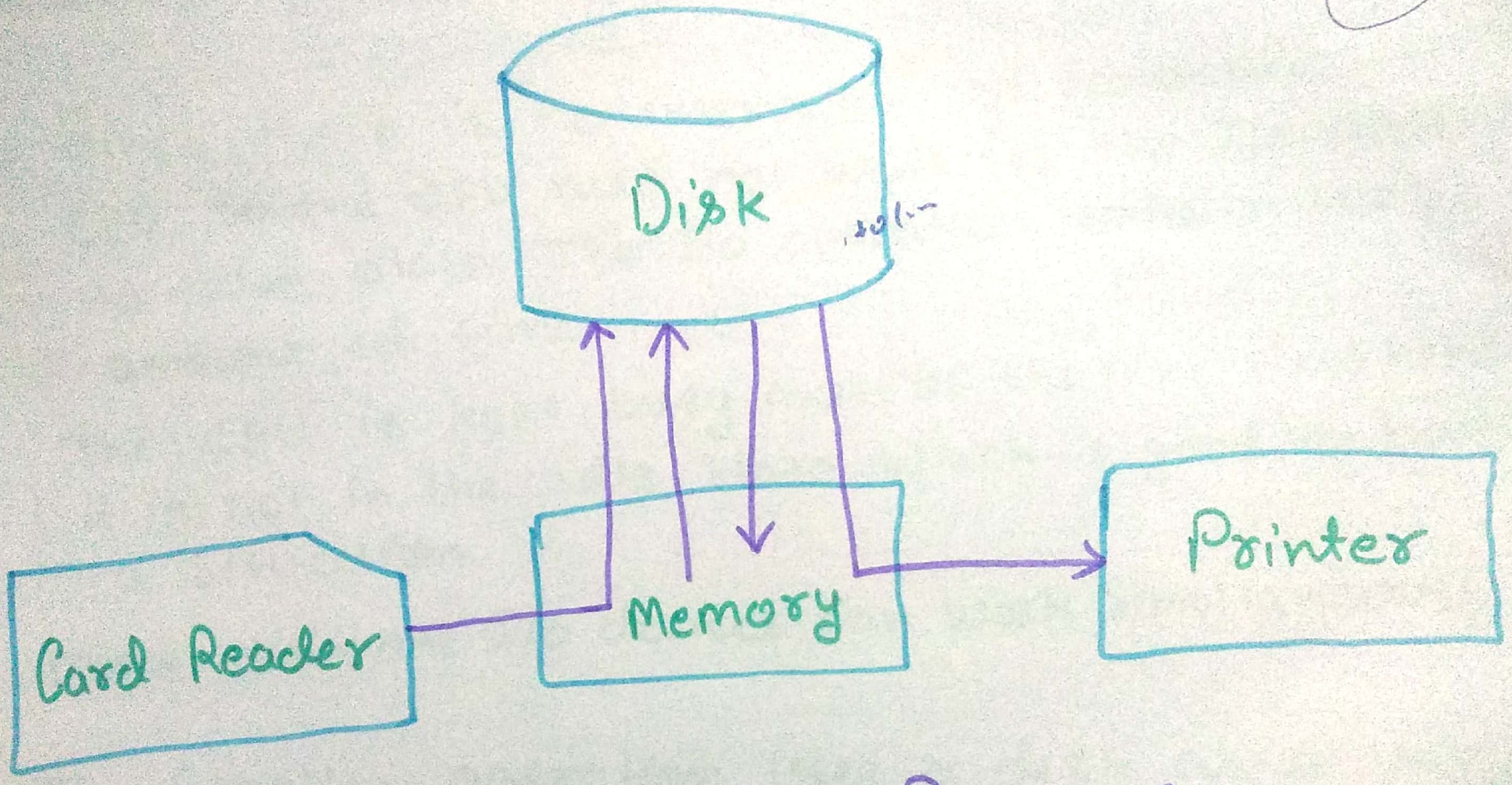


Spooling

⇒ Spooling stands for "Simultaneous Peripheral Operations Online".

⇒ In Spooling, more than one I/O operations can be performed simultaneously. Such as at the time when the CPU is executing some process then more than one I/O operation can also be done at the same time.

⇒ Spooling refers to putting data of various I/O Jobs in a buffer. This buffer is a special area in memory or hard disk which is accessible to I/O devices.



Spooling Process

Advantages of Spooling

⇒ Since there is no interaction of I/O devices with CPU, so the CPU need not wait for the I/O operation to take place. The I/O operation take a Large amount of time.

⇒ The CPU is kept busy most of the time and hence it is not in the idle state which is good to have a situation.

⇒ More than one I/O devices can work simultaneously.

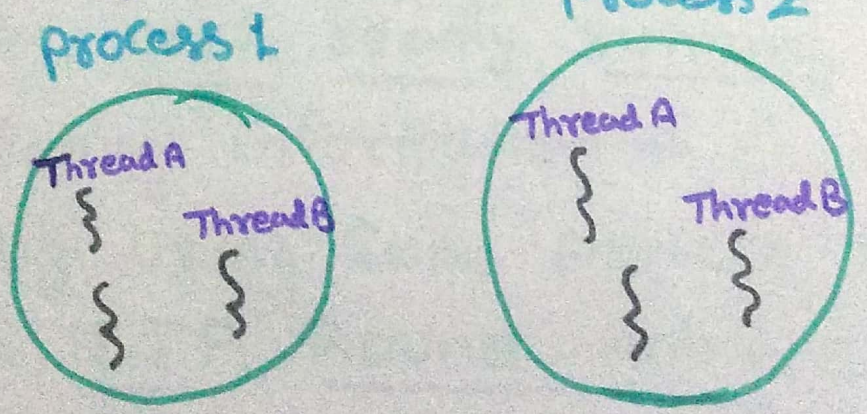
⇒ The Spooling operation uses a disk as a very Large buffer.

Introduction To Process

⇒ A Process is the instance of a Computer program that is being Executed by one or many threads.

⇒ In the Operation System, a Process is Someting that is Currently under Execution. So, an active program Can be Called a Process.

⇒ for Example:→ When you want to search Something on web then you start a browser. So, this Can be a process.



Process Attributes

A process has various attributes associated with it. Some of the attributes are :→

⇒ Process ID ⇒ Every process will be given an id called Process ID to uniquely identify that process from the other processes.

⇒ Process State ⇒ Each and Every process has some States associated with it at a particular instant of time. This is denoted by process state. It can be new, ready, running etc.

⇒ CPU Scheduling information ⇒ Each process is Executed by using Some process Scheduling algorithms like FCFS, SJF, Round-Robin etc.

Process Attributes

⇒ I/O information:⇒ Each process needs some I/O devices for their execution. So, the information about device allocated and device need is crucial.

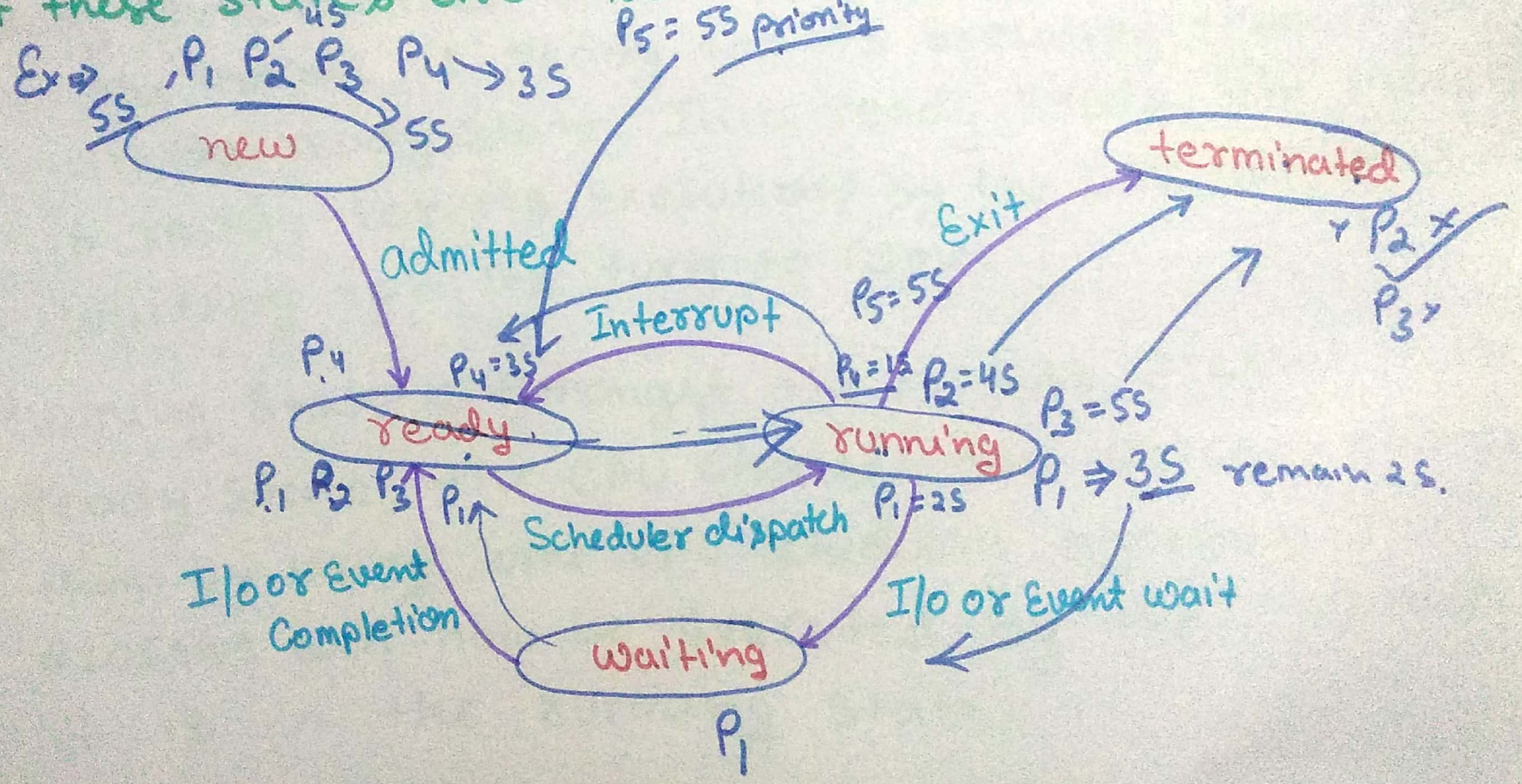
⇒ Priority ⇒ Every process has its own priority. The process with the heighest priority among the processes gets the CPU first.

⇒ Process Counter ⇒ process (program) counter stores The address of the last instruction of the process on which the process was suspended.

M.M.E States of a Process / process Life Cycle.

⇒ During the Execution of a process, it undergoes a no. of states.

⇒ These stages may differ in different O.S, and the names of these states are also not standardized.



States of a Process

New State ⇒ This is the state when the process is just created. It is the first state of a process.

Ready State ⇒ After the creation of the process, when the process is ready for its execution then it goes in the ready state. In a ready state, the process is ready for its execution by the CPU but it is waiting for its turn to come.

Running State ⇒ Amongst the process present in the ready state, the CPU chooses one process amongst them by using some CPU scheduling algorithm. The process will now be executed by the CPU and it is in the running state.

Waiting or Blocked State:⇒ During the Execution of the process, the process might require some I/o operation like writing on file or some more priority process might come. In these situations, the running process will have to go into the waiting or blocked state and the other process will come for its Execution.

Terminated State:⇒ After the Complete Execution of the process, The process comes into the terminated state and the information related to this process is deleted.

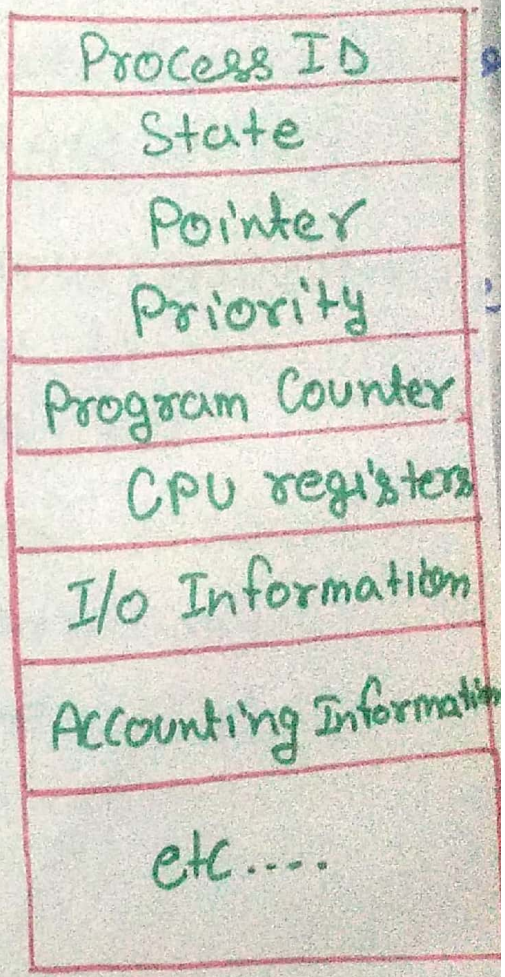
Process Control Block (PCB) / Task Control Block (TCB)

⇒ A process Control Block (PCB) Contains information about The process.

⇒ A process Control Block is a data Structure maintained by the O.S for every process.

⇒ The PCB is identified by an integer process ID (PID).

⇒ A PCB keeps all the information needed to keep track on a process.



Process Control Block (PCB)

Pointer ⇒ It is a Stack pointer which is required to be saved when the process is switched from one state to another to retain the current position of the process.

Process state ⇒ It stores the respective state of the process.

Process number ⇒ Every process is assigned with a unique id known as process ID or PID which stores The process identifier.

Process Counter ⇒ It is Stores the Counter which Contains the address of the next instruction that is to be Executed for the process.

Register ⇒ These are the CPU registers which includes: accumulator, base registers and general purpose registers.

Memory limits ⇒ This field Contains the information about memory management System used by Operating System. This may include the page tables, segment tables etc.

Open file list ⇒ This information includes the list of files opened for a process.

Process Scheduling Queues

⇒ The OS maintains all PCBs in Process Scheduling Queues.

⇒ The OS maintains a separate queue for each of the process states and PCBs of all processes in the same execution state are placed in the same queue.

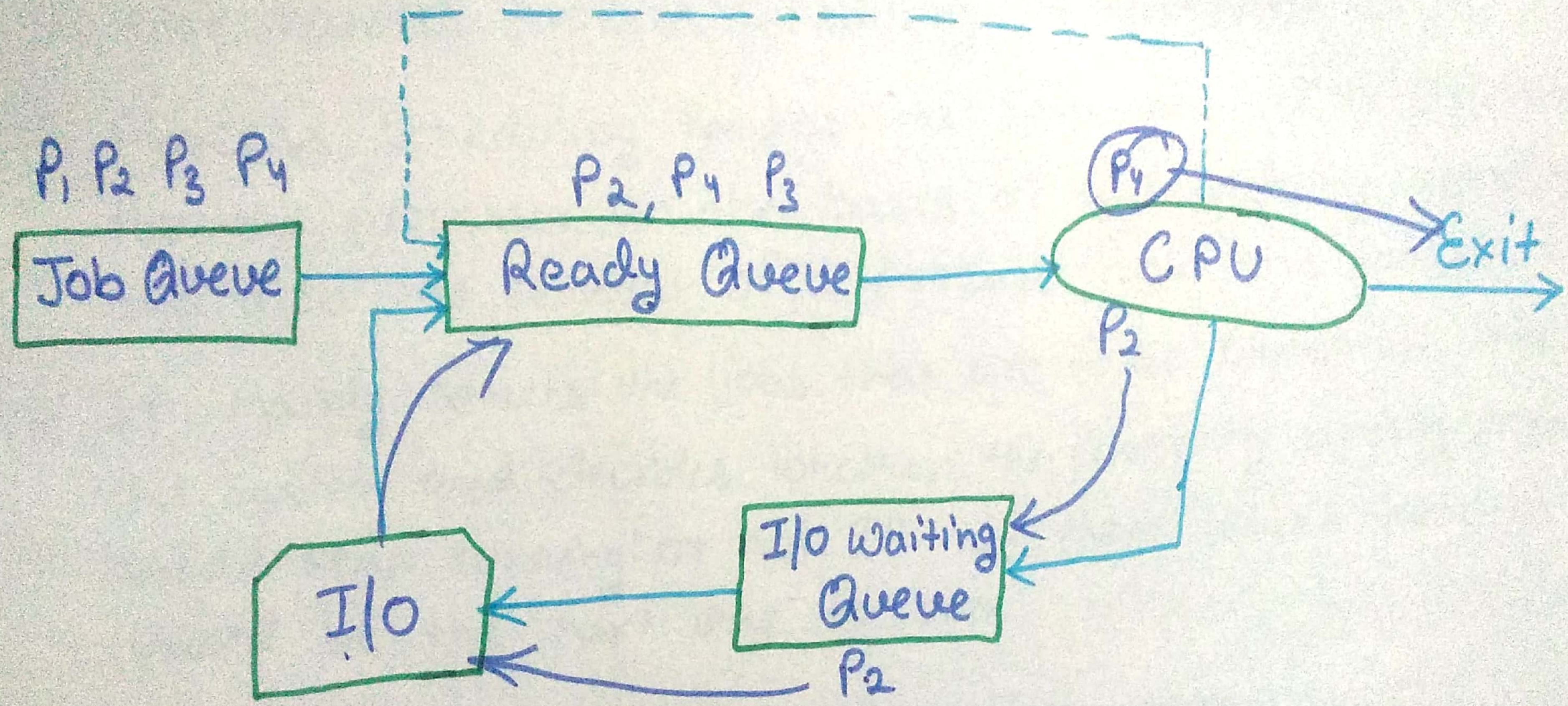
⇒ When the state of a process is changed, its PCB is unlinked from its current queue and moved to its new state queue.

Process Scheduling Queues

⇒ Job queue :→ This queue keeps all the processes in the System.

⇒ Ready queue :→ This queue keeps a set of all processes residing in main memory, ready and waiting to execute. A new process is always put in this queue.

⇒ Device queue :→ The processes which are blocked due to unavailability of an I/O device constitute this queue.



Schedulers in O.S

⇒ A Scheduler is a special type of System Software that handles process scheduling in numerous ways.

⇒ Process Scheduling handles the selection of a process for the processor on the basis of a scheduling algorithm and also the removal of a process from the processor.

⇒ It mainly selects the jobs that are to be submitted into the system and decides whether the currently running process should keep running or not. If not then which process should be the next one to run.

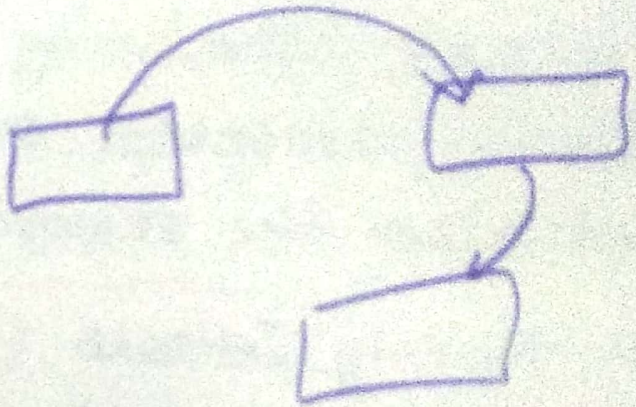
⇒ It is an important part of multiprogramming O.S.

Types of Schedulers

1) Long-term Scheduler

2) Short-term Scheduler

3) Medium-term Scheduler



Types of Schedulers

2) Short term Scheduler :-

⇒ A Short-term Scheduler also known as a CPU Scheduler increases system performance as per the chosen set of criteria. This is the change of ready state to running state of the process.

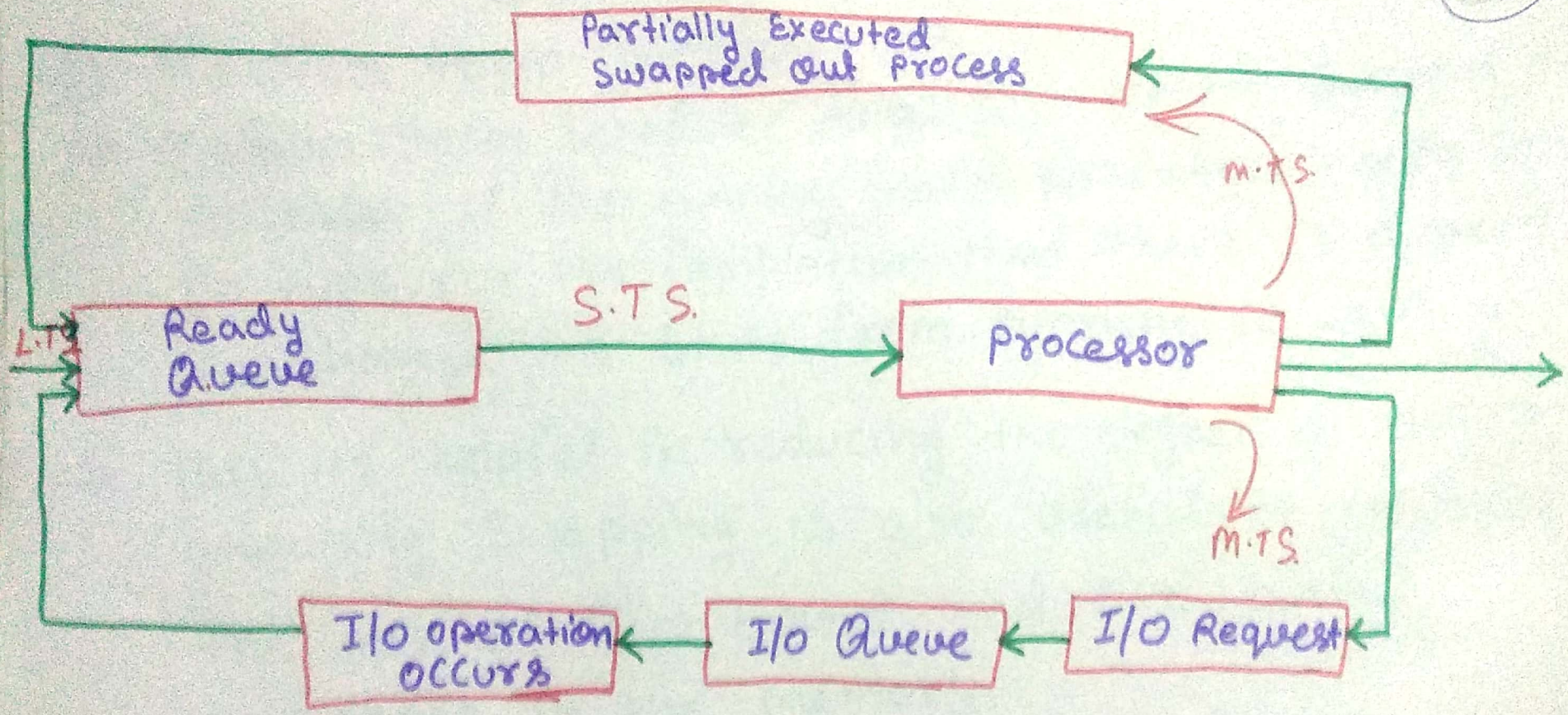
⇒ It selects a process from the multiple processes that are in ready state in order to execute it and also allocates the CPU to one of them. It is faster than long-term schedulers and is also called a dispatcher as it makes the decision on which process will be executed next.

Types of Schedulers

1) Long term Scheduler :→

⇒ Long term Scheduler is also known as job scheduler. It chooses the processes from the pool (secondary memory) and keeps them in the ready queue maintained in the primary memory.

⇒ It selects and loads the processes into the memory for execution with the help of CPU scheduling. It provides a balanced Combo of jobs, Such as I/o bound and processor bound and Controls the degree of multiprogramming.



CPU Schedulers

Types of Schedulers

3) Medium term Scheduler :-

⇒ Medium term Scheduler takes care of the swapped out processes. If the running state processes needs some IO time for the Completion then there is a need to change its state from running to waiting.

⇒ This is helpful in reducing the degree of multiprogramming. Swapping is also useful to improve the mix of I/O bound and CPU bound processes in the memory.

Comparison of OS Schedulers

	Long-Term Scheduler	Short-Term Scheduler	Medium-Term Scheduler
1→	A job scheduler	A CPU scheduler	A process swapping scheduler
2→	Slowest speed	Fastest Speed	Speed is between the other two
3→	Controls the degree of multiprogramming	Provides less control over the degree of multiprogramming	Reduces the degree of multiprogramming
4→	Absent or minimal in the time-sharing OS	Minimal in time-sharing OS	Part of time-sharing OS
5→	Selects a process from pool and loads it into memory for execution	Selects a process that is ready for execution	Re-introduces processes into memory for continued execution

CPU Scheduling in Operating System / Scheduling algorithm

#Some important topic in algorithm ⇒

Arrival time ⇒ Time at which the process arrives in the ready queue.

Completion time ⇒ Time at which process Completes its Execution.

Burst time (B.T) ⇒ Time required by a process for CPU Execution.

Waiting time (W.T) ⇒ Waiting time is the sum of the period Spent waiting in the ready Queue.

Turn Around time (T.A.T) ⇒ It is the total time process in System.

Turn Around time = Waiting time + Burst time.

CPU utilization ⇒ CPU should be kept as busy as possible. In a real system, CPU utilization should range from 40% (for a lightly loaded system) to 90% (for a heavily Loaded System).

Throughput ⇒ Number of processes Completed per unit time is called throughput.

Ex ⇒

process	B.T	A.T
P_1	5	1
P_2	10	0
P_3	3	2

A.W.T

A.T.A.T

Types of Scheduling algorithm

⇒ first Come first Serve (FCFS)

⇒ Shortest-Job-first (SJF) Scheduling (B.T)

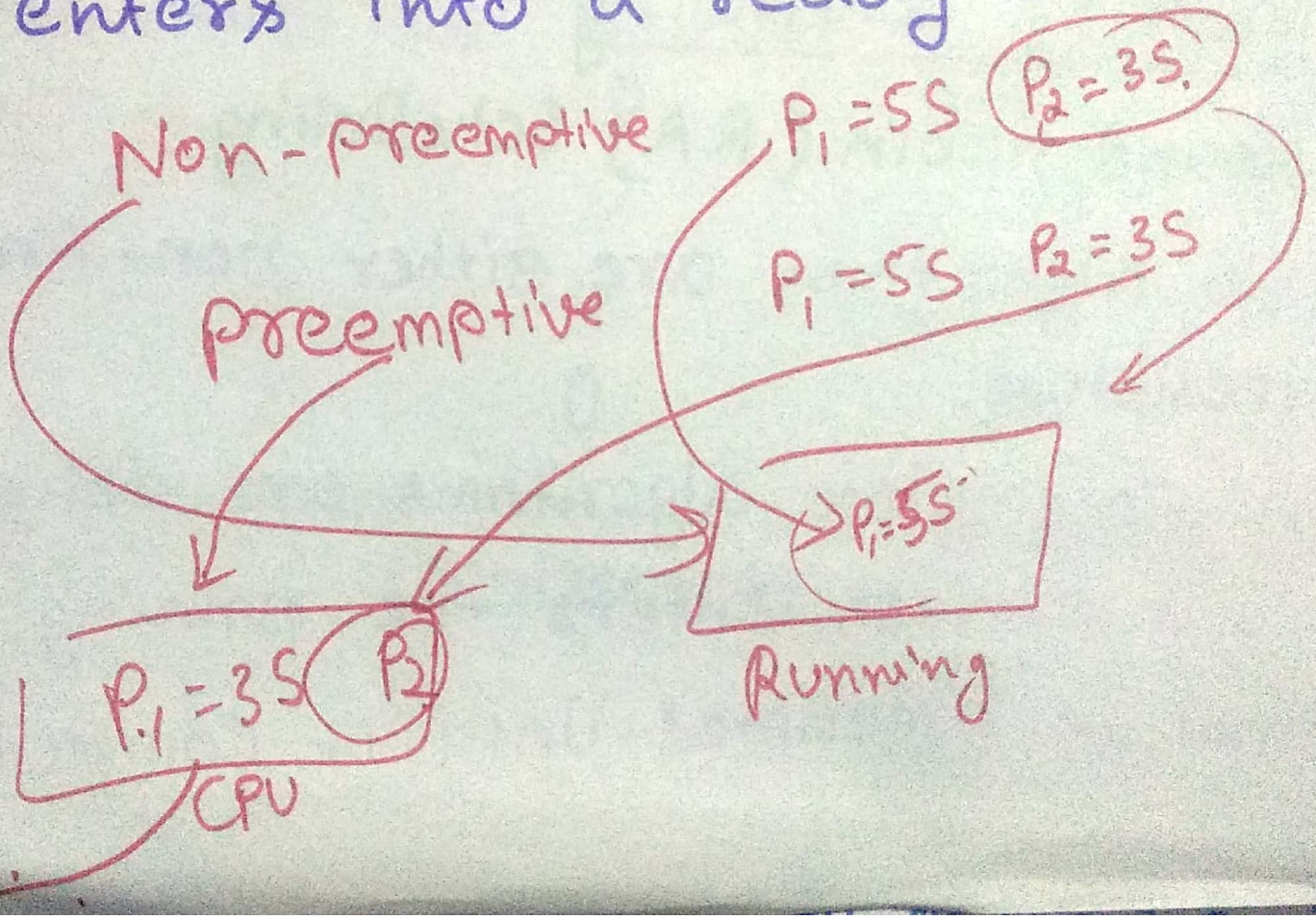
⇒ Priority Scheduling. ⟶ Priority

⇒ Round Robin (RR) Scheduling ⇒ Time Slice / Time quant.

These algorithms are either non-preemptive or preemptive.

Non-preemptive algorithms are designed so that once a process enters the running state, It Cannot be preempted until it Completes its allotted

time, whereas the preemptive Scheduling is based on priority where a Scheduler may preempt a Low priority running process anytime when a high priority process enters into a ready State.



Scheduling Algorithm

1) FCFS (first Come first Serve) ⇒

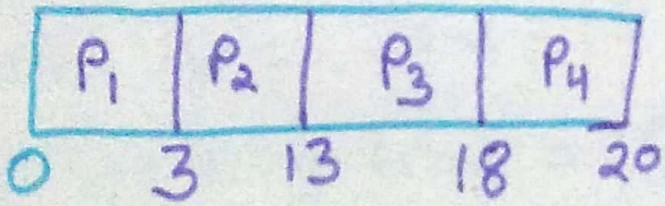
Ex ⇒ @

Process	Burst Time	Arrival time	Completion Time (CT)	T.A.T (CT - A.T)	W.T (TAT - BT)
P_1	3	0	3	3	0
P_2	10	0	13	13	3
P_3	5	0	18	18	13
P_4	2	0	20	20	18

find average Turn around time and average waiting time.

Gantt Chart

Non-Preemptive



Response time =

CPU allocation - A.T

R.T of P_1 = 0 - 0 = 0

R.T of P_2 = 3 - 0 = 3

A.T of P_3 = 13 - 0 = 13

R.T of P_4 = 18 - 0 = 18

Completion time = Completed Execution

Turn Around time = Completion time - Arrival time

T.A.T of P_1 = 3-0 = 3

T.A.T of P_2 = 13-0 = 13

T.A.T of P_3 = 18-0 = 18

T.A.T of P_4 = 20-0 = 20

Average Turn around time = $\frac{3+13+18+20}{4} = \frac{54}{4} = 13.5$ ms.

Waiting time = Turn around time - Burst Time.

W.T of P_1 = 3-3 = 0

W.T of P_2 = 13-10 = 3

W.T of P_3 = 18-5 = 13

W.T of P_4 = 20-2 = 18

average waiting time = $\frac{0+3+13+18}{4} = \frac{34}{4}$ 8.5 ms.

R.T = CPU allocation - A.T

R.T of P_1 = 0 - 0 = 0

R.T of P_2 = 10 - 2 = 8

R.T of P_3 = 5 - 2 = 3

R.T of P_4 = 20 - 3 = 17

Scheduling Algorithm

FCFS (First Come first Serve) ⇒

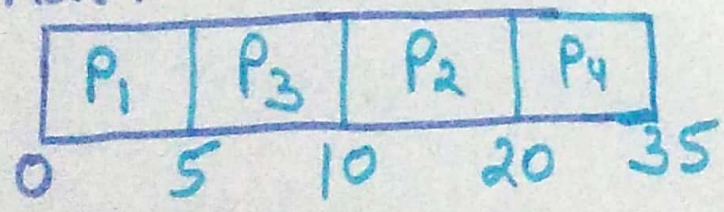
Ex ⇒ Q7

Process	B.T	A.T	Completion Time	T.A.T	W.T	R.T
P_1	5	0	5	5	0	0
P_2	10	2	20	18	8	8
P_3	5	1	10	9	4	4
P_4	15	3	35	32	17	17

A.T.A.T = 16 ms. A.W.T = 7.25 ms.

find Completion time, Average Turn around time, average waiting time and Response time.

Gantt Chart



C.T of P_1 = 5
C.T of P_2 = 20
" P_3 = 10
" P_4 = 35