Operating System Assignment

Q-1) Write short note on :-

i) Multiprogramming, multitasking, Multiprocessing

Multiprogramming or Multitasking :-

- When two or more programs reside in memory at the same time, is referred as multiprogramming.
- In multiprogramming assumes a single shared processor;
- It increases the CPU utilization by organizing jobs so that the CPU always has one to execute.
- Multiprogramming Operating System (O.S.) monitor the state of all active programs and System resources using memory management programs to ensure that the CPU is never idle, unless there are no jobs to process.

Advantage :-

- High and efficient CPU utilization
- User feels that many programs are alloted CPU almost simultaneously.

Disadvantage :-

- CPU scheduling is required.
- To accomodate many jobs in memory, memory management is required.

multiprocessing or multitasking :—

- Multitasking is when multiple jobs are executed by the CPU simultaneously by switching between them.
- O.S. handles multitasking in the way that it can handle multiple operations / executes multiple programs at a time.
- Multitasking Operating System is also known as Time-Sharing System.
- These Operating System were developed to provide interactive use of computer system at a reasonable cost.
- Each user has atleast one separate program in memory.
- A program that is loaded into memory and is executing is commonly referred to as a process.
- When a process executes, it typically executes for only a very short time before it either finishes or needs to perform I/O.
- The O.S. allows the user to share the computer simultaneously. Since each action or command in a time-shared system tends to be short.
- Here actually one CPU is being shared among many users.

ii) Buffering :-
Buffering is the process of storing data in main memory which is called as buffer while data is being transfered between two devices or between devices and application.

There are two types of buffering :-
a) Input- buffering
b) Output- buffering

Input- Buffering :
The data is transfered by any input device and is stored in the buffer.
The processor or CPU access the data from the buffer.

Output- Buffering :
Output- Buffering processor stores the data in buffer. Output- device receives the data from buffer.

The number of messages present in buffer is Consider as a queue of message and that queue is managed or implement by using three methods :-
A) Zero Capacity queue
B) Bounded Capacity queue
C) Unbounded Capacity queue

iii) Spooling :-

Spooling is an ~~as~~ acronym for simultanous peripheral operation online.

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

An Operating System does the following activities related to distributed environment:

- Handles I/O device data spooling as devices have different data access rates.
- Maintains the spooling buffer which provides a waiting station where data can rest while the slower device catches up.
- Maintains parallel computation because of spooling process a computer can perform I/O in parallel fashion. It becomes possible to have the computer read data from a tape,

Advantages:

- The spooling operation uses a disk as a very large buffer.
- Spooling is capable of overlapping I/O operation for one job processor operations for another job.

iv) Distributed Operating System :-
Distributed operating System use multiple Central processors to serve multiple real-time applications and multiple users. Data processing jobs are distributed among the processors accordingly.

The processors communicate with one another through various communication lines. These are referred as loosely coupled systems or distributed system. Processors in a distributed System may vary in size and function.

These processors are referred as sites, nodes, computers, and so one.

Advantages:-
- Better services to customers
- With resource sharing facility, a user at one site may be able to use the resources available at another.
- Speedup the exchange of data with one another via electronic mail.
- If one site fails in distributed System, the remaining sites can potentially continue operating
- Reduction of the load on the host computer.
- Reduction of delay in data processing.

v) Real Time Operating System :—
Real Time System is defined as a data processing System in which the time interval required to process and respond to inputs is so small that it control the environment. The time taken by the System to respond to an input and display of required updated information is termed as the response time. So in this method, the response time is very less as compared to online processing.

There are two types of real-time operating Systems
1) Hard real-time Systems :-
It guarantee that the critical tasks complete on time. In hard-real-time system, Secondary storage is limited or missing and the data is stored in ROM. In System, virtual memory is almost never found.

2) Soft-real-time System :—
It is less restrictive. A critical real-time gets priority over other tasks and retains the priority until it completes.
Soft-real-time Systems have limited utility than hard-real-time systems. For example; multimedia virtual reality, Advanced Scientific project like undersea exploitation and planetary rovers etc.

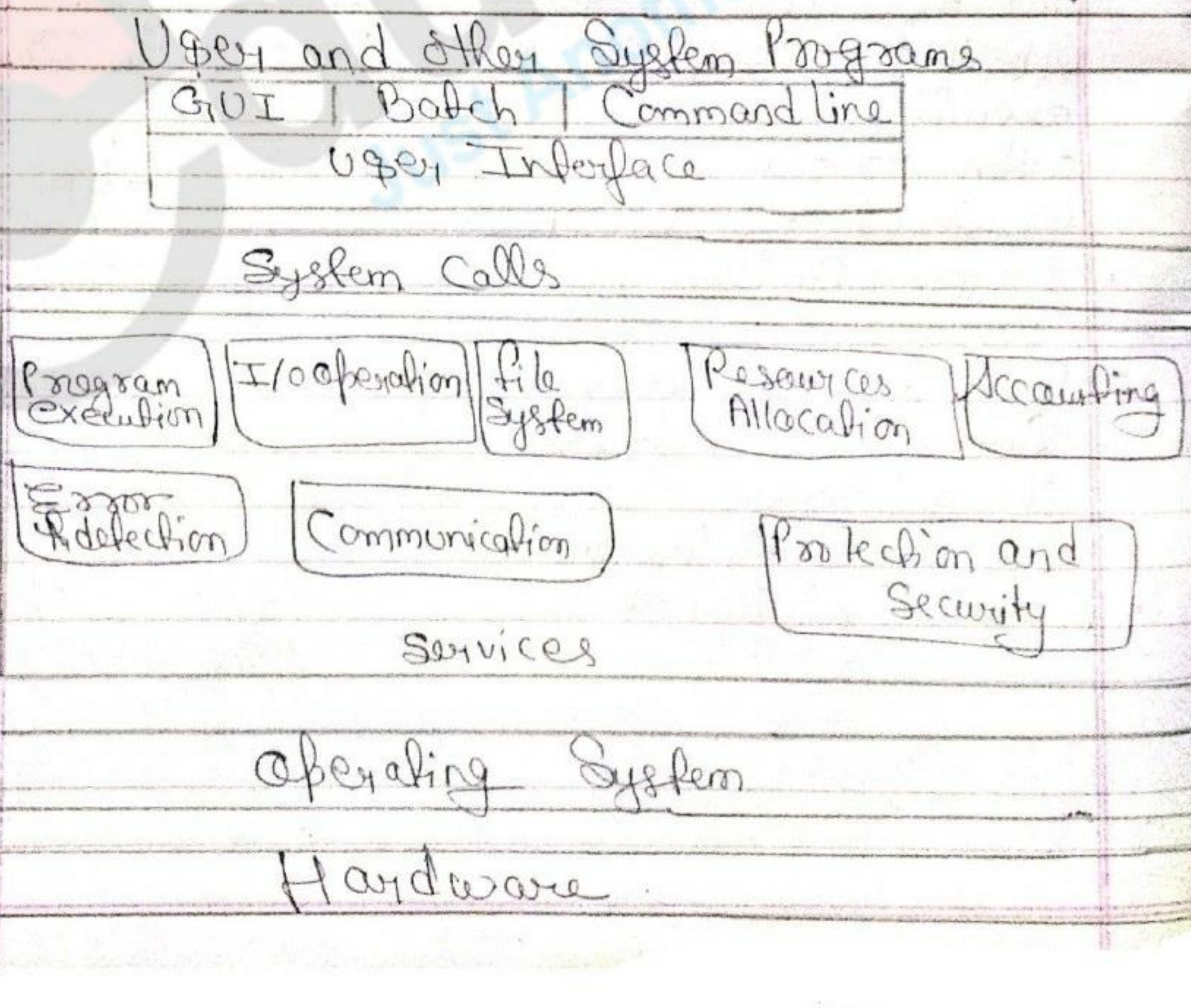
vi) Context Switch :
A Context Switch is the mechanism to store and restore the state or context of a CPU in process control block so that a process execution can be resumed from the same point at a later time. Using this technique, a Context Switcher enables multiple processor to share a single CPU. Context switching is an essential part of a multitasking operating system features.
When the scheduler switches the CPU from execution one process to execute another, the state from the current running process is stored into the process control block. After this, the state for the process to run next is loaded from its own PCB and used to set the PC, register, etc. At that point, the second process can start executing.
When process is switched the following information is stored for later use.

- Program Counter
- Scheduling information
- Base and limit register value
- Currently used register
- Changed state
- I/O State information
- Accounting information.

Q-2 What is operating System? List and briefly explain the functions of operating system.

Operating System :-
operating System is a system Software or a program that acts as an interface between the user of a computer and computer hardware. The Purpose of an O.S. to provide environment in which a user can execute programs.

Goal of O.S. :-
- Make the computer System Convenient to use.
- Use the computer Hardware in an efficient manner.



Functions of Operating System

There are following functions of operating System which are as follows:

a) Process management
b) Main Memory management
c) File management
d) Secondary Storage management
e) Caching
f) I/O System management
g) Protection of Security
h) Communication.

a) Process Management:—

O.S responsibilities in process management:-

i) Create process and deleting process.
ii) Suspending and resuming process
iii) Dead lock handling
iv) Providing mechanism for process Synchronization

b) Memory Management:—

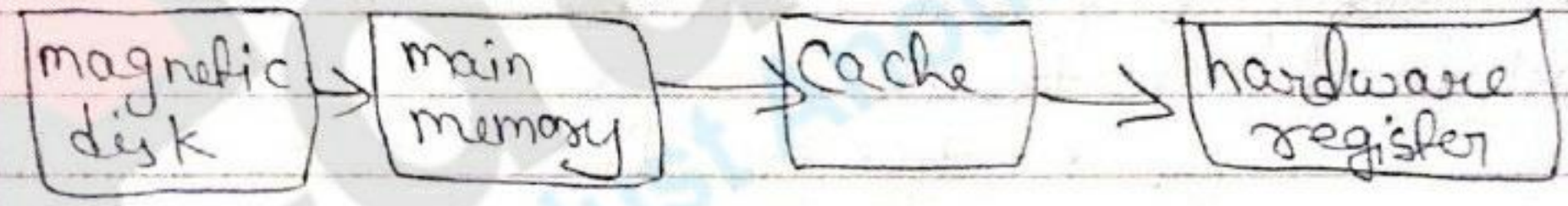
i) Keeping track of which part of memory are currently being used and by whom.
ii) Deciding which process are to be loaded upto memory
iii) Allocating and deallocating memory space as needed.

c) File management:—

1) Create and delete file
2) Read, Write or edit file in different Nodes.
3) Creating & deleting directories.
4) Backing up the files.

d) Mass- Storage management :—
Since the main memory is too small and volatile in nature, the Computer system must provide secondary storage space to back-up the main memory.
The Operating System is responsible for following activities in Connection with mass-storage device:
i) free space management
ii) Storage allocation
iii) Disk Scheduling

e) Caching :-
Every time an O.S. create a temporary storage space called cache memory.



f) I/O System management :—
Protect & hide the procedure of transfering I/O.
i) Device -driver Interface
ii) Protection & Security

g) Protection and Security :-
Protection is the mechanism for controlling the access of process or user to the resources defined by a Computer System.
Security is a mechanism which defends a System from external & internal attacks.

h) Communication :—

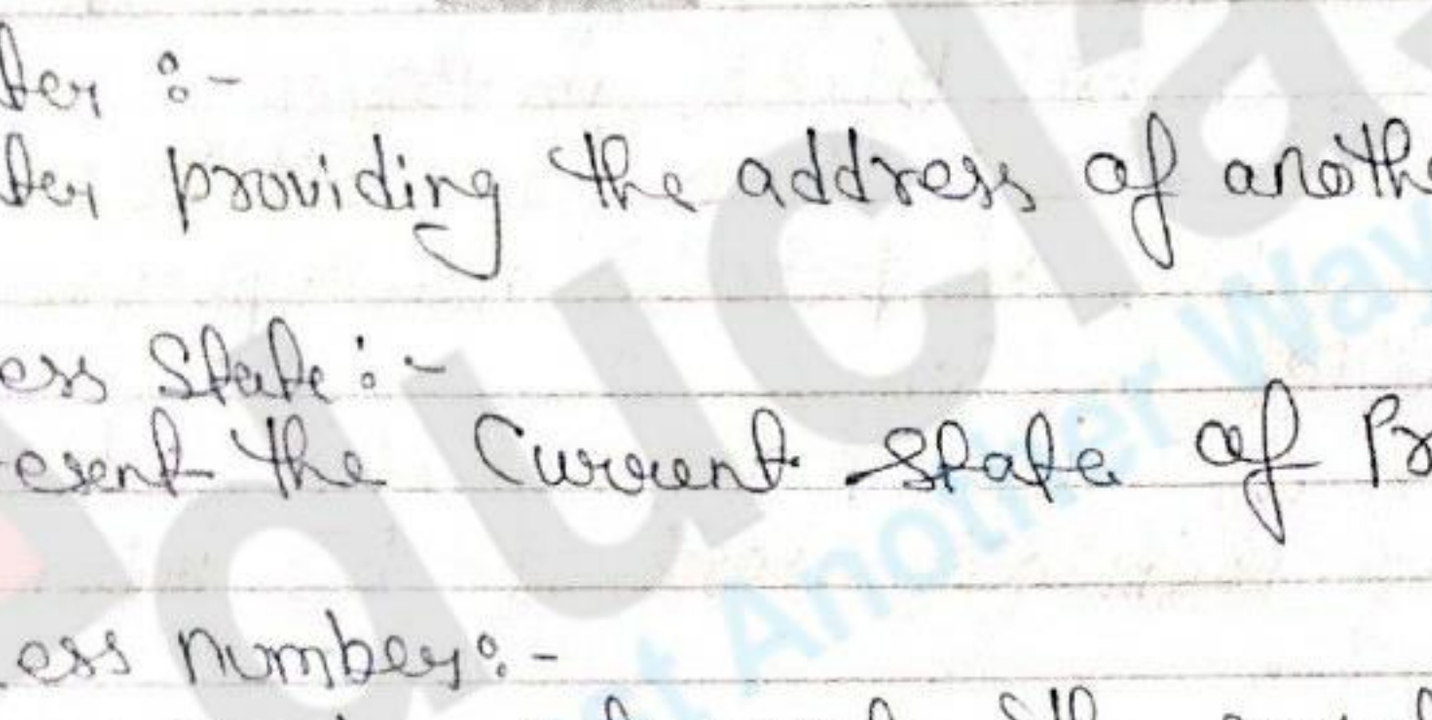
- Two processes often require data to be transfered between them.
- Both the processes can be on one computer or on different computer, but are connected through a computer network.
- Communication may be implemented by two method either by shared Memory or by Message passing.

Q-3 What is Process? Explain the structure of Process control Block in Brief.

- Process is basically a program in Execution.
- The execution of process must progress in a sequential fashion.
- Process is defined as an entity which represent the basic unit of work to be implemented in the System.

Process Control Block (PCB) :—

- Every process has its own process control block. which containsall the information about the process
- Process Control Block is a data Structure maintained by operating System for every process.
- The PCB is identified by an integer Process ID (PID).



PCB

i) Pointer :-
Pointer providing the address of another sub process

ii) Process State :-
Represent the current state of process.

iii) Process number :-
Process number represents the serial number of process.

iv) Program Counter :-
Program Counter indicates the Address of next instruction to be executed.

v) Registers :-
It includes the information about the accumulator, index, stack, pointer, register and any additional information.

vi) Memory limits :-
It contains the information about the memory upper address as well as lower address.

vii) List of open files :-
It contains the list of files which are require to execute the process.

Role of PCB when CPU switching from one process to another operating System.

Q-4) What is Process? Explain about five State models in Process management in detail.

Process :-

- Process is basically program in Execution.
- The Execution of process must progress in a sequential manner.
- Process is defined as an Entity which represents the basic Unit of work to be implemented in System

There are five State models in Process Management which is also called life-cycle of process :-

When a process executes, it passes through different states. These stages may differ in different operating Systems and the names of these states are also not standardized.

In general, process can have one of the following five states at a time.

i) New
ii) Ready
iii) Running
iv) wait
v) Terminate.

i) New :-

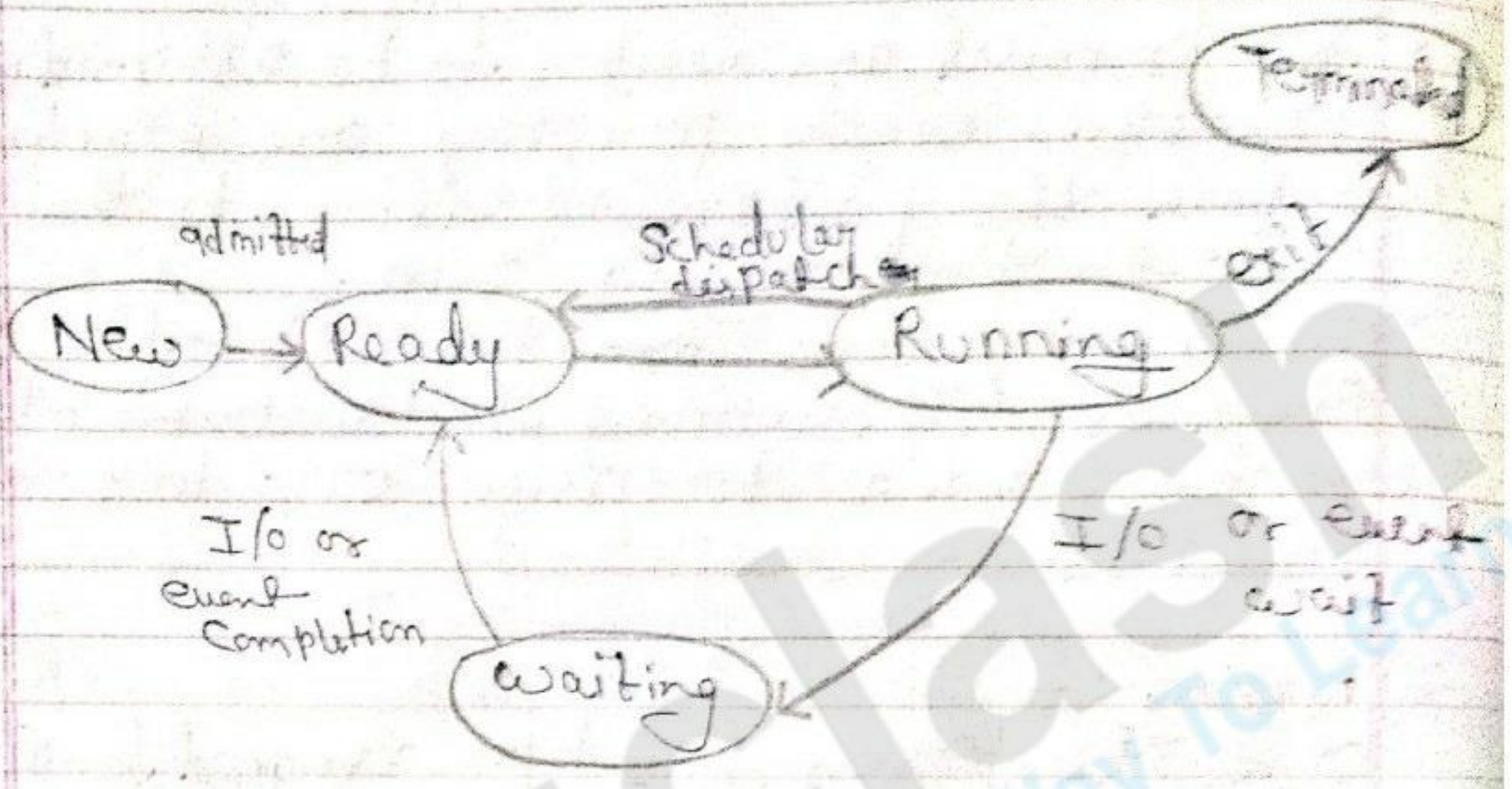
- In this, Processes is being Created.
- In this State, instruction of process are being executed.

ii) Ready :
The processes are waiting to be assigned to processor. Ready processor are waiting to have the process allocation to them by O.S. so that they can run.
Process may come into this state after new state or while running it by but interrupted the schedular to assign CPU to some othe process.

iii) Running :-
Once the proces has been assigned to a processor by the O.S. schedular, the process state is set to running and the processor executes its instructions.

iv) Waiting -
Process moves into the waiting state if it need to wait for ~~for~~ resource, such as wait for input for user input, or waiting for file to become available.

v) Terminated or Exit :-
Once the process finishes its Execution, or it is terminated by the operating system, it is moved to the terminated state where it waits to be removed from main memory.



Process State / Process life cycle

Q-5 For the Processes given in the table :-

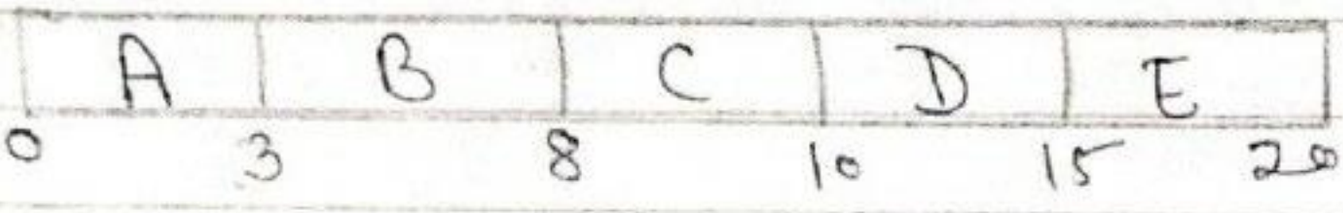
Process	Arrival Time (ms)	Processing Time (ms)
A	0	3
B	1	5
C	3	2
D	9	5
E	12	5

Using FCFS, SJF (both Preemptive and non-preemptive) and RR (quantum = 2) Scheduling algorithm :

i) Draw Gantt chart illustrating process execution
ii) Find the average Turnaround time
iii) Find the average waiting time.

i) Using FCFS :-

Gantt Chart —



∴ Total time = 20 ms

Now,

Processes	AT Arrival Time (ms)	Processing Time (P_T) (ms)	Completion Time (CT) (ms)	Turn Around Time (TAT) (ms)	Waiting Time (WT) (ms)
A	0	3	3	3	0
B	1	5	8	7	2
C	3	2	10	7	5
D	9	5	15	6	1
E	12	5	20	8	3

∴ Average TAT = $\frac{\sum_{i=1}^{n} \text{TAT of } P_i}{n}$ (total no. of Process)

$= \frac{31}{5} = 6.2$ ms

∴ Average WT = $\frac{\sum_{i=1}^{n} \text{WT of } P_i}{n}$

$= \frac{11}{5} = 2.2$ ms

ii) SJF (Preemptive) :-

Gantt Chart

∴ Total Processing time =

Now,

Process	AT (ms)	PT (ms)	CT (ms)	TAT (ms) (CT-AT)	WT (ms) (TAT-P
A	0	3			
B	1	5			
C	3	2			
D	9	5			
E	12	5			

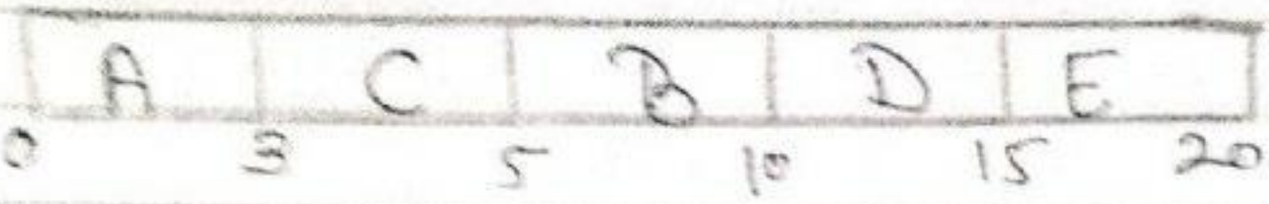
∴ Average Turn Around Time = ——
5

=

∴ Average Waiting Time = ——
5

ii) SJF (Non-Preemptive) :-

Gantt Chart :-



∴ Total Processing time = 20 ms

Now,

Process	AT (ms)	PT (ms)	CT (ms)	TAT (ms) (CT - AT)	WT (ms) (TAT - PT)
A	0	3	3	3	0
B	1	5	10	9	4
C	3	2	5	2	0
D	9	5	15	6	1
E	12	5	20	8	3

∴ Average Turnaround time = $\frac{28}{5}$ = 5.6 ms

∴ Average Waiting time = $\frac{8}{5}$ = 1.6 ms.

iii) Round Robin (RR) :-
Given Quant-um = 2
Gantt chart :-

∴ Total Processing time =
Now,

Process	AT(ms)	PT(ms)	CT(ms)	TAT(ms)	WT(ms)
A					
B					
C					
D					
E					

∴ Average Turnaround Time = $\frac{\sum_{i<1}^{n} TAT\ P_i}{n}$

$= \frac{}{5}$

∴ Average Waiting Time = $\frac{\sum_{i<1}^{n} WT\ P_i}{n}$

$= \frac{}{5}$