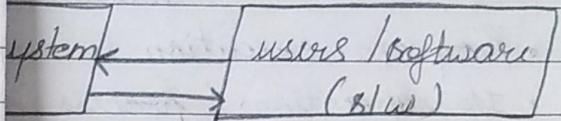
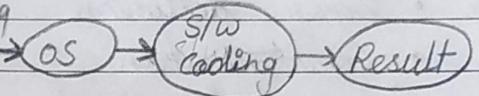


ting system



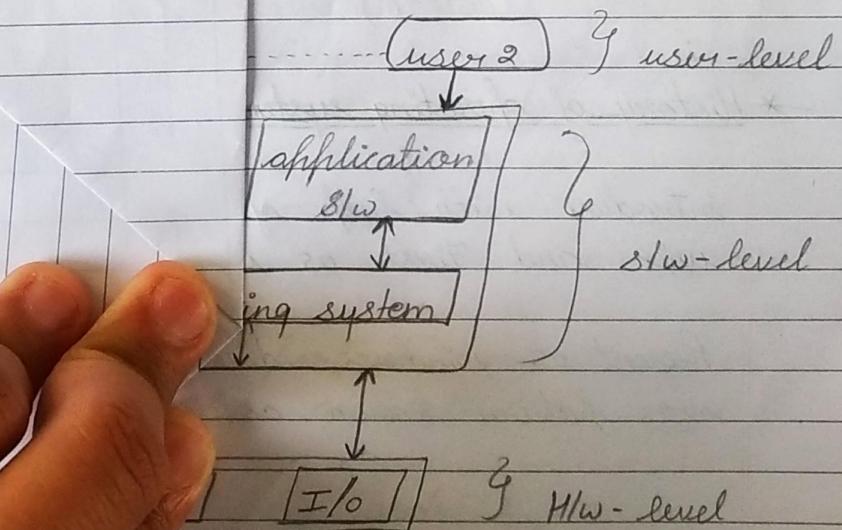
oceding



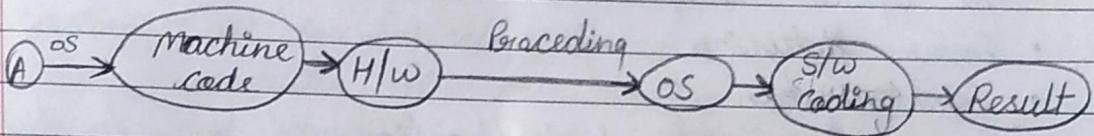
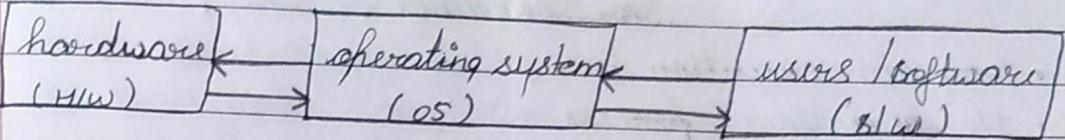
, 10^{-12} seconds

operating system

rating system is an interface for user and computer. In other word / interface between software that means if we want to work with hardware, we required a os. It convert s/w request / data (machine code) & h/w convert into s/w result.



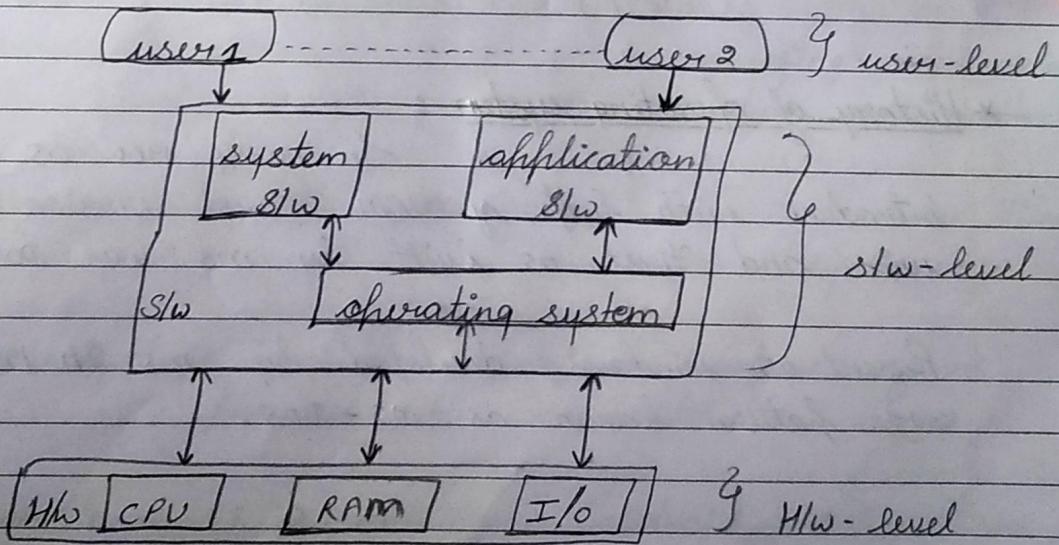
operating system



time set: 10^{-9} seconds, 10^{-12} seconds

* Overview of os :

An operating system is an interface between a computer user and computer. In other word. os is a mediator/ interface between software (user) and hardware that means if we want to communicate between h/w and s/w, we required a mediator known as os. It convert s/w request/ data into h/w input data (machine code) & h/w process result is convert into s/w result.



* Needs of OS :

i) Interface between the user and computer -

It is very easy to explain. OS work as a mediator b/w user and computer or sw and hw.

ii) Booting - It is basically the process of starting the computer. In this loading the main memory in OS and start the system / computer.

iii) Managing I/O devices - It help to operate the different I/O devices means as decide which process are used which devices.

iv) Multitasking - According to this more than one task are process simultaneously.

v) Platform for other application SW - It means users are required different application and different platform all are managed by OS.

vi) Manage the memory - It helps in managing main memory of computers means allocation and deallocation of memory.

vii) Manage the file system - It help to manage files on the system.

viii) Security - It is main important feature of OS provides by authentication access.

* Example of OS. → windows, android, IOS, linux, unix, mac OS.

* Function of os. →

i) Memory management: It refers to

management of primary memory or main memory. We know that main memory is large memory so it provide large fast storage that can be access directly by the CPU.

- In multiprogramming, the OS decide which program process will get memory when and how much.
- Allocation and deallocation the memory process request and no longer needs.

ii) Process management / scheduling: In multiprogramming environment, the OS decides which process gets the processor when and how much time. This function is called process scheduling.

- The program responsible for this task is known as traffic controller.
- Allocation and deallocation of processor and no need for long time.

iii) Device management: An OS manage device communication via their respective drivers.

- It keeps of all devices program responsible for their task is known as I/O controller.
- Decide which process gets the device when and how much time.
- Allocation and deallocation of devices.

iv) File management: It is normally organized into directories for easy use. In other word we can say that directories may contain files.

- Allocation and deallocation of resources.
- The collective facilities of file is known as file system.

v) Storage management: According to this OS decide which data is stored when and how long time. It also responsible for allow user to maximize the utilization of storage devices.

- It improve the performance of data storage.

vi) Security: It means password and other similar techniques to prevent unauthorized access to data or program.

vii) Control over system performance: It manage requesting time and response time.

viii) Job accounting: In this various jobs are managed by using time sharing.

ix) Error detection: Production of dumps, error message and other error debugging. Coordination b/w other SW & users.

x) Coordination b/w other SW & users: Coordination and assignments of compiler, interpreter, assemblers and other SW to other computer system.

* Types of OS :

- i) Batch OS
- ii) Distributed OS
- iii) Real-time OS
- iv) Multiprogramming OS
- v) Time sharing OS
- vi) Network OS
- vii) Parallel OS

i) Batch OS -

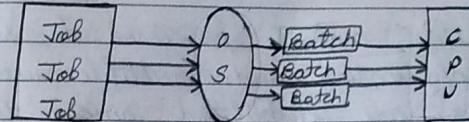
In this OS collect the program / process and data together in a batch before processing start. An OS following some features :

- (a) The OS define a job which have predefined sequence of commands as a single unit.
- (b) It keeps a number of jobs in memory and execute them without any manual intervention.
- (c) The jobs are submitted to CPU, First come First serve computer.

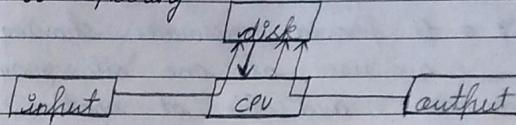
Advantages :
• It takes much of the work of the operator to the computer.
• It increases performance as a new job get started as soon as the previous job is finished.

Disadvantages :

- (i) Difficult to errors. (detecting / debugging)
- (ii) Job
- (iii) One batch job can affect pending jobs.



Batch OS shooting -

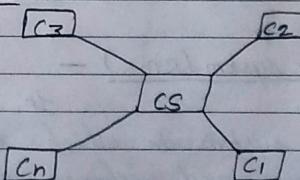


Simultaneous peripheral operation online (shooting)

⇒ In this technology and mechanism looking at the limitation of moderate speed of magnetic tape it was must be stored in hard disk. So after the processing on input result are stored into harddisk now these process is called simultaneous peripheral operation online (shooting).

Advantages :
• It uses a disk as a very large buffer.
• It capable of overlapping I/O operations for one job with process or another job.

ii) Distributed OS -



CS = Central system / server

C = client / node

(client - server architecture or sharing mechanism)

It use multiple central processor to serve multiple real time application and multiple users. Data processing jobs are distributed among the processor accordingly.

- Advantages:
- It provide resource sharing Facility, a user at one site may be able to use the resource available at another.
 - Exchange of data one to another via networking online or offline.
 - If one site can be failed then remaining system will continue but if central processor / server is failed then entire network / system will goes down.
 - It provide better service to the customer, fast processing.

Two types of DOS :

- (A) Client server - It worked on client server architecture or mechanism as above. It worked on basically world wide web (internet).
- (B) Peer-to-peer network os - It worked on basically world wide web (internet).

iii) Real time operating system (RTOS) -

It is defined as a data processor system in which the time interval required to process and response to input so that it provide controlling environment.

Sharing the processes, when two or more processes inside in memory at the same time is known as multiprogramming as its main object is to increase CPU maximum utilization of CPU. In this keeps several jobs in memory at same time.

Advantages :-

- ④ High and efficient CPU utilization.
- ④ User feel like many programs allotted to CPU at the same time.

Disadvantage :-

- ④ It must required CPU scheduling.
- ④ Accommodates many jobs in memory if required memory management.

v Multitasking OS:-



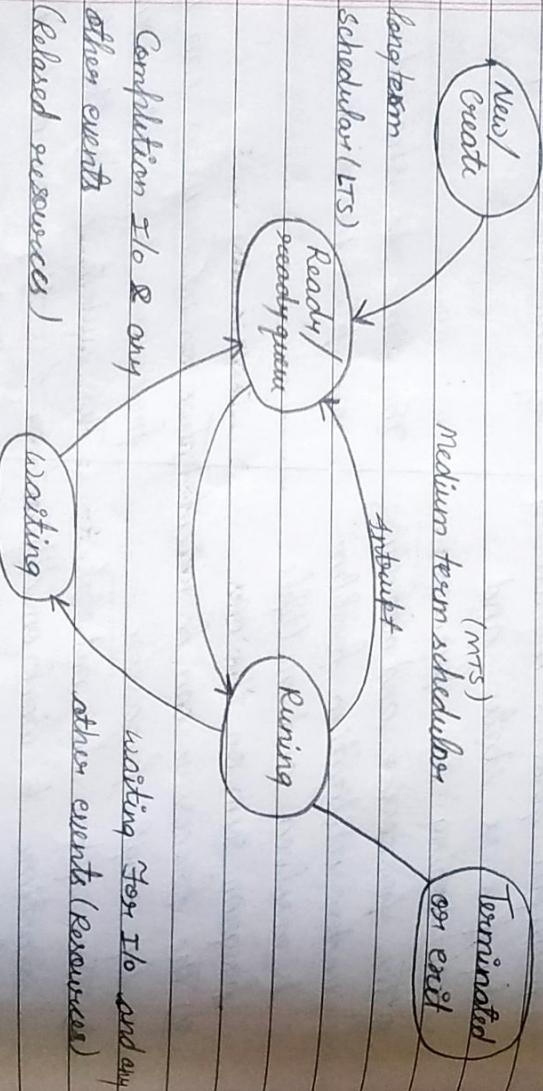
In this when multi-jobs are executed by the CPU don't simultaneously by switching between them. Switching occurs is frequently that the user interact each program while it is running. Multitasking as are also known as time sharing as.

A time sharing OS use the concept of CPU scheduling and multiprogramming to provide user with a small time called is time quantum.

A program that is loaded into memory and is

- Process is a dynamic object and program is static object.
- A process is an active entity and program is passive.
- Process resides in main memory and program resides in secondary storage.

PCV - Submitted / admitted



Steps :

- i New - This state indicate that the process has been created.
- ii Ready - This state of a process indicate that the process is waiting to be allocated to a processor.
- iii Running - It indicate that instructions are being executed.

- iii) **Priority:** It is assign to the process according to its importance on the based on time and size.
 - iv) **Process state:** Each process may be in any of the states as above new, ready, running, waiting, terminate.
 - v) **Program counter:** It indicate the address of next instruction to be executed in the processes.
 - vi) **Registers:** They include various types of registers like - general purpose register, accumulator register, index register etc.
 - vii) **Accounting information:** It include actual CPU time used in executing a process.
 - viii) **I/O status information:** It standing I/O requests, list of open files, allocation of peripheral devices to process.
- * OS-process scheduling:-
- The process scheduling is the activity of the process manager that handle the removal of running process from the CPU and the selection of another process for a particular stage / scheduling / method / mechanism.
- It is a essential part of multiprogramming OS.

I) LTS (Long-term-scheduling) :

It is also called as job scheduler. It determines which processes are admitted to the system for processing. It selects processes from the queue and loads into the main memory for execution. That's called is job scheduling.

The primary objective of LTS is to favor balance of jobs. It also controls the degree of multi-programming.

II) STS (short-term-scheduling) :

It is also known as CPU scheduler. Its main objective is to increase system performance according to selecting criteria of scheduling algorithm. It is the change of ready state to running state of a process. It is faster than LTS.

III) MTS (medium-term-scheduler) :

It is also known as swapping scheduler as it is a part of swapping method. It removes the processes from the memory to reduce the degree of multi-programming.

A running process may become swapped if it makes any I/O-request. A suspended process cannot make any processes towards completion.

In this condition to remove the process from memory and make space for other processes, the suspended process moves to the secondary memory is called swapping.

* Difference between LTS, STS, MTS:

LTS	STS	MTS
It is a job scheduler it is a CPU scheduler	It is a process swapping scheduler	It is a process
In this swap is low	In this swap is high	than SIS then among them both of them
3. It controls the degree of multi-programming of multi-programming	4. It does not use of time it use minimum use	It is a part of time sharing - os.
5. It selects the processes which are ready to from pool and load into memory for execution.	6. It selects those processes from pool and load which are ready to process into memory and execution can be continue	4. It re-introduce the

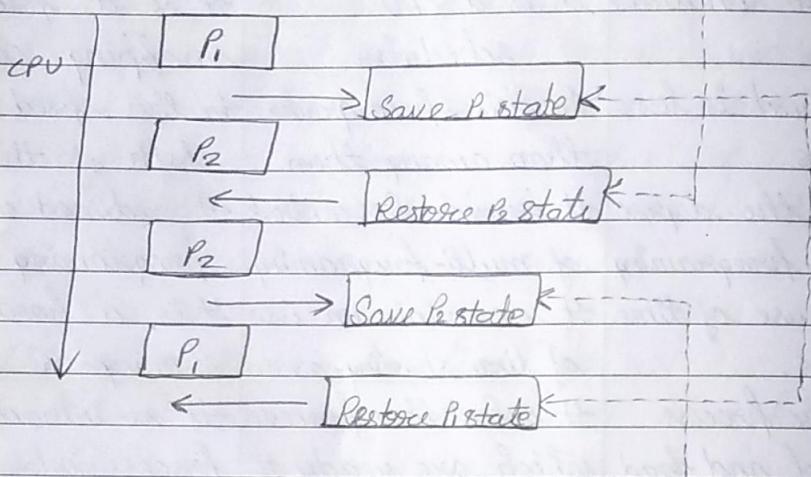
* Context switching :

It is the mechanism to store and restore the data on context of a CPU

In process control block. So that, a process execution can be resumed from the same point a later time. Using this technique, context switching enable multiple process to share a single CPU. & context switching is a essential facets of multi-programming as feature.

According to this, CPU start a process to run a particular time slot (Fixed time / time quantum) then switch to CPU to another process and earlier process is stored at the state then goes to next process after that some process continue

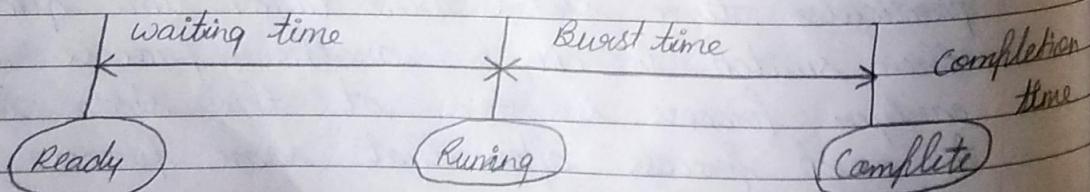
all these processes then CPU come at First process resume at the store state is called context switching.



CS are computationally intensive since registers and memory state must be saved and restored. To avoid the amount of CS time, some hardware system two or more set of processes register. It has some like :-

- a. PC (program counter)
- b. SI (scheduling information)
- c. Base and limit register value
- d. Currently used register
- e. Change state
- f. I/O state information
- g. Accounting information

* Various time related to the process -



i) Preemptive : In this category suspension / preemption is allowed based on the priority which is defined upon AT, BT (size of process) etc. In this also selects a process and it runs for a maximum or fixed time known as time quantum or time slot. If it is running at the end of the time interval, it is suspended and scheduler selects another process if it is available in ready queue. Here is high priority process is immediately rescheduled.

ii) Non-preemptive : According to its name it indicates that an activity whose suspension of control is not allowed. In this scheduling algorithm in select a process to run and then just let it run, until it blocks (either on I/O waiting of any other) or until it voluntarily (in middle) releases the CPU. Even it work complete in hours, days etc until it complete. Priority does not play any role in this scheduling type.

Types of non-preemption -

FCFS/FIFO → (First come First serve / First in First out)

In this scheduling also with his algorithm process are assigned in a border First in First out or First come First serve. Basically there is a single queue of ready processes.

When the first job/process enter the system, it is started immediately and allows to run as long as it requires, when the new process comes in they are put on to the end of the ready queue.

PID	AT	BT	CT	TAT	WT	RT
P ₀	3	6	13	7	7	Mode \Rightarrow Non-preemptive
P ₁	2	3	5	3	0	0
P ₂	5	9	25	20	11	11
P ₃	0	2	2	9	0	0
P ₄	2	5	10	8	3	3

Gantt chart

P ₃	P ₁	P ₄	P ₀	P ₂
0	2	5	10	16
				25

$$\text{Avg. AT} \Rightarrow 3+2+5+0+2 = \frac{12}{5} = 2.4$$

$$\text{Avg. WT} \Rightarrow 7+0+11+0+3 = \frac{21}{5} = 4.2$$

(SPT) (SNT)

b) Shortest job first / shortest job next \rightarrow In this scheduling algorithm

job requiring the minimum CPU time is selected first. For CPU allocation. This scheduling mechanism assumes the run time for processes in advance. This policy reduces the waiting time for shortest job. Here, run time is a type of a priority for its selection (BT).

- This is non-preemptive type algorithm.
- Best algorithm to minimize waiting time.
- Easy to implement in batch systems, where required CPU time is known & in advance.

PID	AT	BT	CT	TAT	WT	RT
P ₁	0	9	9	9	0	0
P ₂	1	3	4	3	0	0
P ₃	2	4	13	11	7	7
P ₄	4	5	5	1	0	0

iii) Shortest remaining time first/next (SRTF) \rightarrow It is a

version of SPT. In this algorithm, the scheduler chooses the process whose remaining run time (BT) is the shortest. The run time has to be known in advance. When a new job arrives, its total time is compared to the current process remaining time. If the new job needs less time to finish than the current process is suspended and the new job starts. This algorithm allows new short job to get good service.

PID	AT	BT	CT	TAT	WT	RT
P ₀	3	4	15	12	8	8
P ₁	2	5	11	9	4	4
P ₂	0	2	2	0	0	0
P ₃	1	3	5	4	1	1
P ₄	9	1	6	4	3	3

Gantt chart:

P ₁	P ₂	P ₂	P ₄	P ₁	P ₁	P ₃
0	1	2	3	4	5	6
						13

$$\text{Avg. TAT} = 9+3+11+1 = \frac{24}{4} = 6$$

$$\text{Avg. WT} = 4+0+7+0 = \frac{11}{4} = 2.75$$

$$\text{Avg. RT} = 0+0+7+0 = 7/4 = 1.75$$

Ex- PID	AT	BT	CT	TAT	WT	RT
P ₁	3	5+4+3+2+10	13	10	5	5
P ₂	1	3+2+10	5	4	1	0
P ₃	2	2+10	3	1	0	0
P ₄	1	3+2+10	8	7	4	4

Gantt chart:

	P ₂	P ₃	P ₂	P ₄	P ₁		
0	1	2	3	4	5	8	13

Mode \Rightarrow Preemptive

$$\text{Avg. TAT} = 10 + 4 + 1 + 7 = \frac{22}{4} = 5.5 \quad (\text{Gated} \Rightarrow \text{BT})$$

$$\text{Avg. WT} = 5 + 1 + 2 + 4 = \frac{10}{4} = 2.5$$

$$\text{Avg. RT} = 5 + 0 + 0 + 4 = \frac{9}{4} = 2.25$$

* Priority scheduling :-

A priority is associated with each process and the CPU is allocated to the process with the highest priority. Equal priority processes are scheduled in FCFS (First come First serve). The basic idea behind priority scheduling is static forward, each process is assigned a priority, and the runnable process with the highest priority is allowed to run. Each process may be assigned a maximum time quantum. It can be assigned to processes statically and dynamically.

- It is a non-preemptive and preemptive type of algorithm.
- Same priority of processes are execute at FCFS scheduling.
- It can be decided based on memory requirements, time requirements and other resources requirements ('input / output').

widely used algorithm. The RR scheduling algorithm is primarily used in a time sharing and a multiuser system, where the primary requirement is to provide, unusual good response times and in general to share the system.

Each process assigned a time interval, known as quantum or time slice (T_q , T_R) and range in micro sec pic seconds.

To implement RR, we keep ready queue as a FIFO queue of processes and new process are added to the end of the ready queue.

The CPU scheduler selects the first process from the ready queue, set a timer equal to time quantum. If the process equation. It is ensured that no process can run for more than one time slice, when there are other processes waiting in the ready queue. If a process required more than CPU time to complete after exhausting one time slice, it goes to end of the ready queue to wait the next allocation. If the process has blocked or completed before the time quantum has elapsed, another process is scheduled to run.

<u>Ex-</u>	PID	AT	BT	CT	TAT	WT	RT
R ₁	0	5	12	12	7	0	
R ₂	1	4	11	10	6	1	
R ₃	2	9	6	4	9	2	
R ₄	4	1	9	5	4	1	

Time quantum $\Rightarrow 2$
Mode \Rightarrow Preemptive

PGD	BT	CT	TAT	WT	RT	TO = 20
P ₁	53	134	134	81	0	default : All the processes are arrived at the same time.
P ₂	17	137	137	20	20	
P ₃	8	162	162	94	37	
P ₄	24	181	181	97	57	

Ready queue: P₁ | P₂ | P₃ | P₄ | P₁ | P₃ | P₄ | P₁ | P₃ | P₃

Running queue: P₁ | P₂ | P₃ | P₄ | P₁ | P₃ | P₄ | P₁ | P₃ | P₃
0 20 37 57 77 97 117 131 134 154 162

$$\text{Avg. CT} = \frac{554}{4} = 138.5$$

$$\text{Avg TAT} = \frac{554}{4} = 138.5$$

$$\text{Avg. WT} = \frac{292}{4} = 73$$

$$\text{Avg. RT} = \frac{114}{4} = 28.5$$

* Important questions:

- Q. What is scheduling? Explain various types of scheduling using example.
- Q. Explain non-preemptive scheduling using suitable examples.
- Q. What is FCFS/FSFO scheduling? explain with using suitable example.

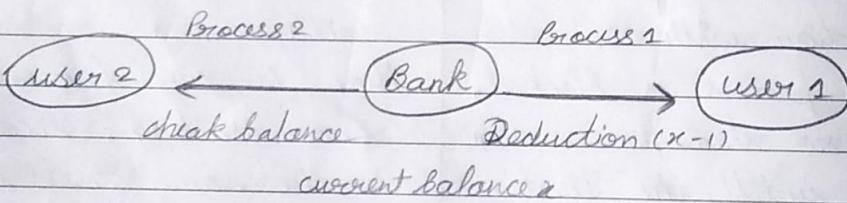
Q1

If we have 5 processes p₁, p₂, p₃, p₄, p₅ and arrival time is 1, 3, 0, 2, 1 and burst time is 5, 3, 4, 3, 2 then calculate CT, TAT, WT.

- 10x Q. What is round robin scheduling algorithm? explain in detail using suitable example.
- Q. What is priority scheduling mechanism?
 - Q. What is context switching? explain in detail.

all applications on a device and basically help in the smooth functioning of our computer. Because the OS has to perform many tasks simultaneously.

Ex We consider a bank account in bank. A bank that stores the AC balance of each customer in the same database. Now suppose, you initially have x rupees in your AC. Now you take out some amount of money from your Bank AC and at the same time someone tries to look at the amount of money stored in your AC. As you are taking out some money from your AC, after the transaction the total balance left will be lower than x , but the transaction takes sometime and the person reads x as your AC balance which leads to inconsistent data.



But, here the AC balance is $= x$

After sometime or completion of transaction update the bank AC balance is $(x-1)$

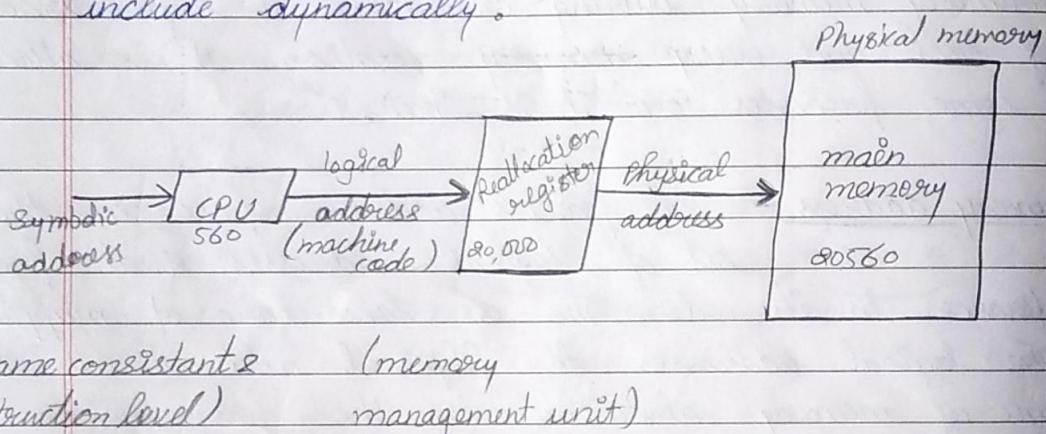
* Memory management :

It is important resources that need to be managed carefully. In computer there is a memory hierarchy means how to manage memory account to requirement of process execution.

the time when a program loaded into main memory

Loading management :- There are two types of loading static and dynamic loaded.

The choice between static or dynamic loading is to be made at the time of computer program development is called static and dynamic if you have to load your program statically then at the time of completion the complete program will be compiled. If you are requiring dynamic loaded program then your compiler will compile the program and for all modules which you want to include dynamically.



According to this diagram CPU generates a logical address from symbolic address. There is a reallocation register which contains some fixed value. There can be many reallocation registers. So, the address value stored in reallocation registers is added logical address and convert into physical address on the memory.

Note : The distinction (same place, same data, multiple

memory. Paging technique play an important role in implementation of virtual memory.

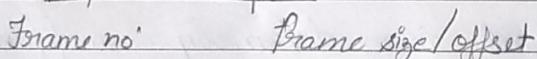
In other word paging mechanism convert the logical address to physical address on that base data retrieve from main memory. Similarly, main memory is divided into small fixed size blocks is called frame and process are divided into same size blocks is called page. Here is, explanation of paging technique main things is page size and frame size should be same.

Page no.	0 th first		Formula	0 th byte	1 st byte
	0	1		2	3
(CPU)	1	2	3	4	5
	6	7	8	9	10
	11	12	13	14	15
	Process size = 4B			(MM memory)	
	Page size = 2B			MM size = 16 B	
	total size = 4B = 2B			Frame size = 2 B	
LA	Page offset			total frames = 16B / 2B = 8	
Page No'					

Page table

0	f ₂	(* 16 B = 4 bytes)
1	f ₄	PA = 4 bytes

K ← 3 byte → K byte →



Page no convert into
frame no in binary

Here is \Rightarrow LA = logical address

PA = Physical address

* Page size and frame size should be same

and denoted by \star .

Ex- Page string = 1, 3, 5, 7, 4, 2, 5, 7, 4, 6, 7

Frame size = 3

f_3	5	5	5	2	2	2	4	4	4
f_2	3	3	3	4	4	4	7	7	7
f_1	1	1	1	7	7	7	5	5	6
	\star	\star	\star	\star	\star	\star	\star	\star	hit

Page hit ratio = $\frac{\text{Total no. of hit page}}{\text{Total no. of page}} \times 100$

$$\frac{1}{11} \times 100 = 9.09$$

Page Fault = $\frac{10}{11} = 90.90$

Ex Page string = 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 1, 2

Frame size = 3

	1	1	1	1	0	0	0	3	3	3	3	3	2
	0	0	0	0	3	3	3	2	2	2	2	1	1
	7	7	7	2	2	2	2	4	4	4	0	0	0
	\star	hit	hit	\star									

Page hit ratio =

Page Fault ratio =

Ex Page string = 3, 4, 0, 2, 1, 3, 3, 4, 1, 4, 0, 1, 2, 5, 4

Frame size = 3

	\star	\star	\star	\star	\star	\star	hit	\star	hit	hit	\star	\star	\star
f_3	3	3	3	2	2	2	4	4	4	4	4	2	2
f_2	4	4	4	1	1	1	1	1	0	0	0	5	5
f_1	0	0	0	3	3	3	3	3	3	1	1	1	4

F ₁	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
F ₂	1	1	1	1	1	4	4	4	4	4	4	4	4	1	1	1	1	1	1
F ₃	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F ₄	7	7	7	7	7	3	3	3	3	3	3	3	3	3	3	3	3	7	7

Page hit ratio = $\frac{12}{20} \times 100 = 60\%$

Page Fault ratio = $\frac{8}{20} \times 100 = 40\%$

60:40

3:2:5

Ex: Frame size = 3

Page string = 7, 0, 1, 2, 0, 3, 0, 4, 2, 1, 2, 3, 0, 5, 6, 3, 3, 0, 1, 7

F ₁	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1
F ₂	0	0	0	0	0	0	4	4	1	1	1	1	5	6	6	6	6	6	6
F ₃	7	7	7	2	2	2	2	2	2	2	2	2	0	0	0	0	0	7	7

Page Fault ratio = $\frac{12}{20} \times 100 = 60$

Page hit ratio = $\frac{8}{20} \times 100 = 40$

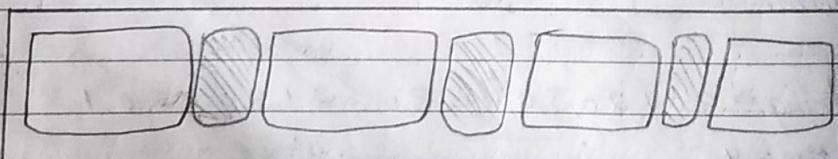
60:40

3:2

Q Explain various types of page replacement algorithms like → FIFO, LRU

* Fragmentation :-

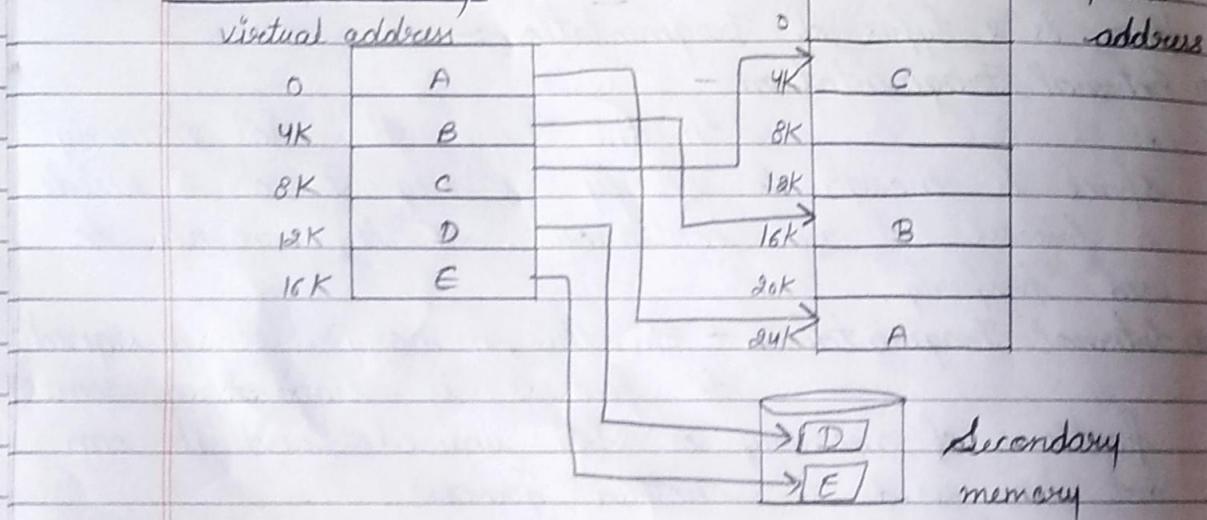
Fragmented memory before compaction



It is a memory management technique in which each process is divided into several segments of different sizes. Each segment have different logical address.

When a process to be execute then corresponding segmentations are loaded into main memory in contiguous manner. It is work same as paging but here segments are variable length and in paging page size fixed.

* Virtual memory :— (VM)



A computer can address more memory then the amount of physically installed on the system. This extra memory is called virtual memory and it is a section of a hard disk that's setup to emulate the computer RAM.

Its main advantage is allow to us extend the use of physical memory by using disk.

It is commonly implemented by demand page. It can also be implemented in a segmentation

another process). Then the requesting process wait until it can acquire the resources.
 ii) Use - The process can operate all resources example if the resource is a printer, the process can print on the printer.

iii) Release - The process release the resources after completion of all kind of jobs, the resource will released automatically or apply some kind of methods / steps.

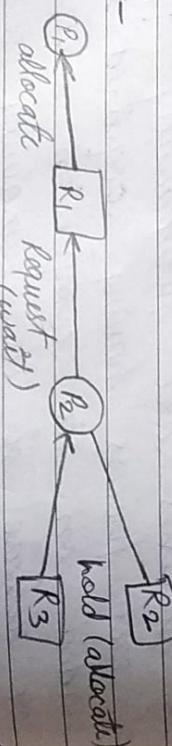
Resource status modeling : According to this deadlock conditions are true or it also called necessary for deadlock occurrence. There are four conditions is :-

i) Mutual exclusion -



In multiprogramming environment, there may be several processes requesting the same resource at a time. Mutual exclusion condition, allows only a single process to access the resource at a time. While, the other processes requesting the same resource must wait and delay their execution until it has been released.

ii) Hold & wait -



A process can hold multiple resources and still request more resources from other processes which are holding them. In the diagram given above process P1 holds resources R2, R3 and process P2

wait for dependencies in the system.

- It includes rolling multiple deadlock processes giving their resources to the blocked processes in the deadlock. So that, they may resume execution.

* Deadlock prevention or avoidance :-

BANKER's algorithm

It is a resource allocation and deadlock avoidance algorithm that test for safety by simulating the allocation. For predetermine maximum possible amount of all resources, then check to test for possible activities, before deciding whether allocation should be allowed to continue.

Banker's algorithm is name because it is use in banking system to check whether loan can be sanction to a person or not.

- Suppose there are n number of account holders in a bank and the total sum of their money is S . If a person applied for a loan then the bank first subtracted the loan amount from the total money that bank has, and if the remaining amount is greater than S , then only the loan is sanction. It is done because if all the account holders come to withdraw their money then bank can easily do it. In other word the bank would never allocate its money in such a way that it can no longer satisfy the needs of all its customer, so that the bank would always try to be in safe state.

~~Hol. VNP~~ Banker's algorithm / Deadlock avoidance algorithm

The operating system must also provide controlled sharing of information by authorized users and protection by un-authorized users.

Characteristics of file system :-

- a) The physical I/Os (input output computer system) provide a basic capability for the program to perform their own I/O without involving of I/O intations.
- b) The logical I/Os procedure for efficient organization and access of data on I/O-devices. This process is also known as access method.
- c) The file system provides for protection and controlled sharing of files existing in the system.

Basic file operations :-

- a) Create - Find the space for the file and make an entry in the directory.
- b) Open - Find file and determine if has already being open. If not open search directory.
- c) Close - Determined the open count and remove the file.
- d) Read - Read data from the file.
- e) Write - write data in the file.
- f) Delete - Release file space and erase records.
- g) Truncate - Delete contents of a file but keep file properties and never recover.

Attribute of the file :-

- a) Name - Every file carry a name for recognition in the file system. One directory can not have

access otherwise not.

iii) Indexed access - If a file can be stored on any of the field then index can be assigned to a group of certain records, files, topics, particular character etc. According to this method easy to locate a particular selected topic and go to direct on that location.

~~iv)~~ iv) Mapped access -

It provides a normal form of access is called mapped access. When process open a file, it is mapped to a segment then that file are stored into main memory and use to access the physical address because CPU is always worked on logical address, so conversion of physical to logical address is called mapped/mapping.

v) Binding of access method -

In this access method when the operating system is defining various types of access method for a same file. It means if a file is accessed more than one way of accessing method is called binding access method.

* Directory structure :- A disk is typically partitioned, also known as slice and mini disk.

There are various types of directory structure :-

v) Single-level D.S. -

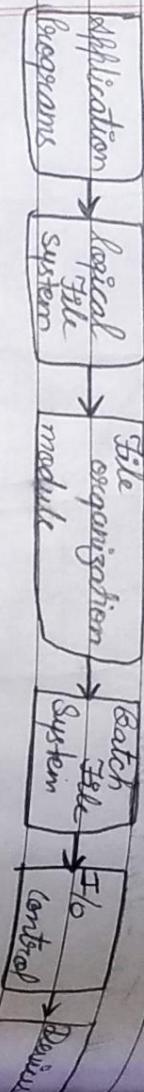
Directory

--	--	--	--	--	--	--	--

all Files :- f₁ f₂ f₃ f₄ f₅ f₆ f₇ f₈

In this files are contained in a same directory, it

* File system structure :-



*/ All these are perform under controlling of os It provide efficient access to the disk by allowing data to be stored, located and retrieved data / file in a terminate / easy way.

This flow chart show elaborates how the file system is divided in different stages / layers and also defined functionality of each layer.

* File allocation method :-

There are various methods which can be use to allocate disk space to the files. Selection of an appropriate allocation method will significantly effect the performance and efficiency of the system. All allocation methods provide a way in which the hard disk will be utilized and the file will be accessed, on that bases various types of allocation methods are suitable.

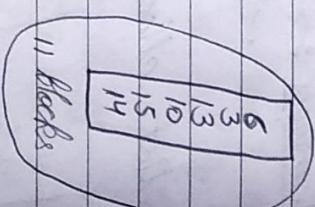
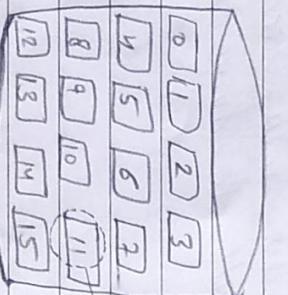
~~*) Contiguous allocation method -~~

Hard disk			filename	start	length	allocated block
0	1	2	ABC.txt	0	3	0,1,2
3	4	5	video.mp4	4	2	4,5
6	7	8	Rs.docx	9	5	9,10,11

In the contiguous allocation method, if the blocks

- Any free blocks can be utilized in order to satisfy the file block request.
 - File can continue to grow as long as the free blocks are available.
 - Directory will only contain the starting block address.
- Disadvantages -
- Random access is not provided.
 - End of the pointers in the link list must not be broken otherwise they will get corrupted.
 - It need to traces each blocks.

c) Index allocation method -



Hard disk

In here, index allocation method store all the disk pointers in one of the block is called index block. It does not hold the file data but it hold the pointers to all the disk blocks allocated to the particular file.

Advantages :- It support direct access.

If a bad data block causes the loss of only that blocks.

Disadvantages :- Size of file depends upon the number of pointers, a index block can hold. Having an index block for a small file is

are BIOS. (Basic Input output system) like - mother board, processor and some other hardware that are part of kernel software.

In these devices "For use during the using of a system that needs device drivers to function. For example - plug and play action.

* Interrupt Driver I/O :- It is an approach to transfer data between memory and device using processor. So, it improves the performance of system. An alternative approach can be use where after issuing I/O commands.

* Functioning of Interrupt Driver I/O :- It consider that the data has to be stored in the main memory from the I/O modules.

* Memory mapped I/O :- As a CPU needs to communicate with the various memory and I/O devices. There are three ways :
a) Separate set of address, control and data bus to I/O memory.
b) It have common bus (data and address bus) for I/O memory but separate control lines.
c) It had common bus (data, address and control) for I/O and memory.

* DMA (direct memory access) :- It is a method of transferring data from the computer RAM to another part of