## OPERATING SYSTEM)

An operating System Can be defined as an interface between user and hardware. It is responsible for the execution of all the processes, Resource allo Cation, CPU management, File management and many other Tasks. The Purpose of an operating System is to brouide an environment in which a user can execute programs in a Convenient and efficient manner.

Types of Operating Systems :-

- Botch OS: A Set of Similar Jobs are Stored in the main memory
  for execution. A Job gets assigned to the CPU, only
  when the execution of the previous Job Completes.
  - Multiprogramming OS: The main memory Consists of lobs waiting for CPU time. The OS selects one of the bracesses and assigns it to the CPU. Whonevou the ene cuting process needs to wait for any other operation like (Ilo), the OS selects another process from the Job Pueue and assigns it to the CPU. This way, the CPU is never light idle and the User gets the flavour of 9 thing madifile to be done at ance

multitasting OS: - Multitasting Os Combines the banding multiproguen ming OS and CPU Schedul to buyour Twick switches Hu Jobs. The Switch is so a that the Usen Com interact with each program as it has 1 Time shaving Os :- Time-shaving Systems refluire interest With the Usan to instruct the Os to Various takes. The Os responds with an output. The insta are usually given through an imput device like key board Real time OS :- Real-Time OS are usually built for dedicated systems to accomplish a special Set of tasks within deadlines. Process :- A Process is a perogram under enembion. The Value of the program Country (PC) indicator address of the next instruction of the process be executed. Process Scheduling :-Avoidal Time :- Time at which the process are in the Heady Tucke. (ii) Completion Time & Time at which process Completes (iii) Burst Time :- Time refluired by a process &

(iv) Twen- Around Time :- The difference blu Completion time and available time

Twin Awdund Time = Completion Time - Avoid Time

(v) Waiting Time :- Time difference blu turn Around time and burst time.

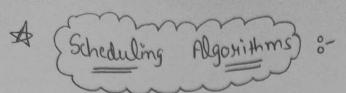
Waiting Time = Twin around time - Burst Time

Thread: - A Thread is a light weight process and forms
the basic unit of CPU Utilization. A process can
be including multiple Threads.

- · A Thread how its own program Counter, Megistar set
- A Thread shares he sounced with other threads of the Same process: the Code Section, the data Section, files
- Note: A new Thurad, on a child process of a given process, Con be in the duced by Using the forth () system Call. A process with n forth() Call generates 2nd child processes.

Thouse are Two types of Threads:

- · User Threads (User Threads are imple mented by users)
- · hund Threads ( hound Threads are imple monted by Os)



1) First Come First Serve (FCFS) :- Simplest Scheduling of that Schedules according to

arrival times of processes.

- Shortest Job First (SJF): Processes which have the sho burst time are Scheduled first.
- 3 Shortest Remaining Time First (SRTF): It is a Presentive mod SJF algorithm in who Jobs are scheduled according to the shortest remaining time
- Round Robin (RR) Scheduling: Each buccess is assigned fixed time, in a cyclic way:
- Purionity Based Scheduling (Non Preemptive): In this Schedul Processes are scheduled according to their priorities, is higher than processes is scheduled first. If two processes priorities then scheduling is acc. to the arrival time.
- Highest Response Ratio Nent (HRRN) :- In this Schedulling, highest merponse matio are scheduled. This algorithm awaids

Response Ratio = ( waiting Time + Burst time) Blasst Time

Multidevel Queue Scheduling (MLa) & According to the priority
of the process, processes are

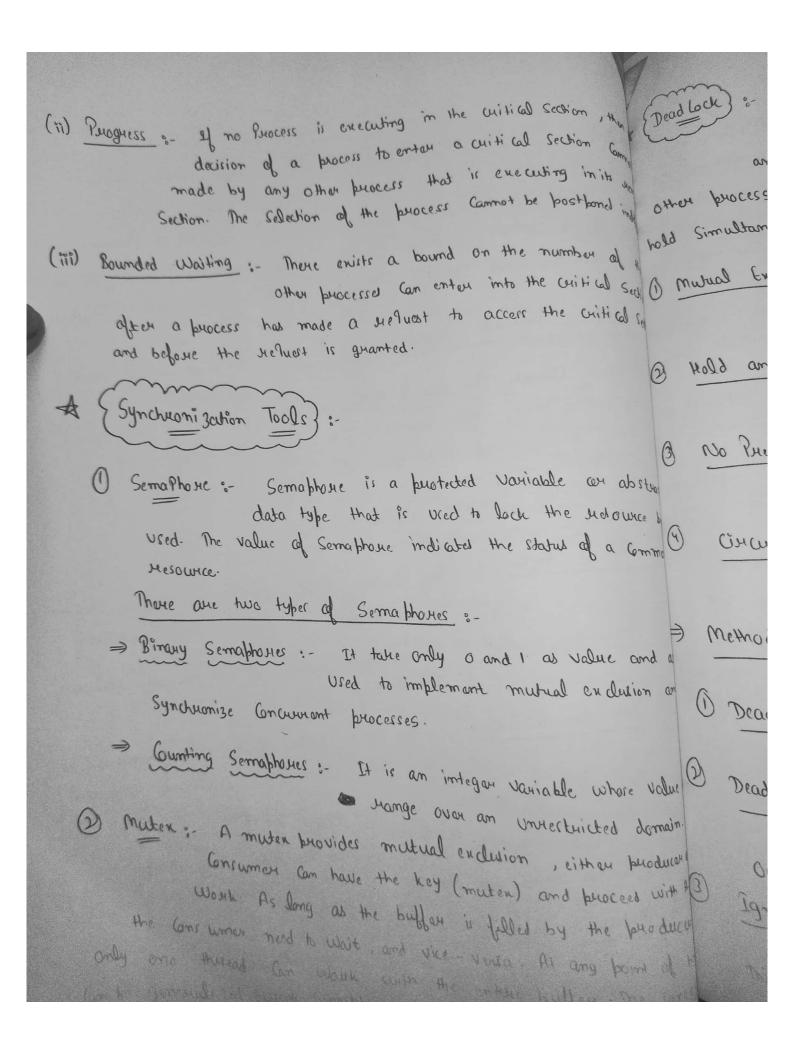
placed in the different Queues. Grandvally high priority processes are placed in the top level Queue only after Completion of processes from the top level Queue, lower level Pueued processes are scheduled.

Multilevel Feedback Queue (MLFQ) Scheduling :- It allows the between Queuer. The idea is to Separate processes acce to the characterities of their CPU bursts. If a process uses too much CPU time, it is moved to a lower-priority Queue.

## The Cuitical Section Phoblem:

- (1) Critical Section: The Position of the Gode in the bruguam where Shared Variables are accessed and or Updated.
- Remainder Section: The memoring position of the program excluding the critical Section.
- Bace around Section: The final output of the Code depands on the order in which the variables are accessed.

  This is tarmed at the stace around Condition.
- => A Solution for the critical Section Problem most satisfy the following three Conditions:
  - (i) Mutual Enclusion: If a process Pi is energeting in its critical Scalar than no other process allowed to enter



Deadlock) :- A Situation where a set of processes are bloched because each process is holding a tresource and waiting for another resource actuired by some other process. Deadlock Can arise if following four Conditions hold Simultaneously (Neccessary Conditions). 1) Muhal Exclusion: - one on more than one resource is non-Sharable (only one process (an use of a time). Hold and Wait :- A process is holding at least one Medounce and waiting for resources. No Precimption :- A resource connot be taken from a process psty unless the process releases the resource Circular Wait :- A Set of processes are waiting for cach Other in circular form. Methods for Handling Deadlock :- There are three ways to handle deadlock 1) Dead lock Phenom from on avoidance: The idea is to not let the System into a deadlock State. Deadlack Detection and necessary: Let Deadlack occur, then do Preemption to handle it once main Occurred. Igroue the Rueblam all together: - if dead lock is very none than let H happen and Heback the System There is the approach that both windows and when high

Bankeri Algorithm? :- It is used to avoid deadlack. Itis of the deadlack - avoidance methodi. named as Banker's Algorithm on the banking System where bank never allocates available last in such a manney that no longer satisfy the reliebements of all of its Contomory. (Memony Management): - These technilues allow the mem to be should among multiple plan · Overlays: - The Memory should Contain only those instruction and data that are relieved at a given time. Surapping: In Multi purguamming, the instructions that have Used the time slice are surapped out of the тетону. > Techniques :-(a) Single Partition Allo Cation Schemes: - The memory is one part is helpt to be used by the OS and the Other hept to be used by the users. divided into two but (b) multiple Partition Schemes 9-(i) fixed Partition: The memory is divided into fixed sign (ii) variable Partition: The memory is divided into variable so

- te: Variable Partition allocation Schemes:
  - 1) First Fit: The aviving process is allotted the first hole of memory in which it fit completely.
  - Best fit: The avoiving process is alloted the hole of memory in which it fits the best by leaving the minimum memory empty.
  - 3 Woust fit: The autiving process is alloted the hale of memory in which it leaves the maximum gap.

Note :-

- · Best fit does not neccessarily give the best results for memory
- · The Cause of external fragmentation is the Condition in fixed Partitioning and variable Partitioning Saying that the entire process should be allo cated in a Contigous memory location. Therefore Paging is used.
  - Paging: The Physical memory is divided into clear size frames.

    The main memory is divided into fined size Pages.

    The Size of physical memory frame is clual to the size of a virtual memory frame.
  - Segmentation: Segmentation is implemented to give usual a view of memory. The logical address space is a collection of Segments. Segmentation can be implemented with an without

\* Page Fault :- A Page Fault is type of infurrible, Hoisely the hardware when a running Program account me many Page that is mapped into the virtual address show but not loaded in Physical memory.

Page Replacement Algorithms :-

## 1 First in first out (FIFO):-

This is the Simplest Page replacement Algarithm. In this Algarithm In this Algarithm In this Algarithm In the System keeps track of all Pages in the man in a Queue, the oldest Page is in the front of the Page when a Page needs to be replaced, the page in the front of Queue is selected for normal.

For Example, Consider Page reflexance (tring 1,3,0,3,5,6) and Page Slots. Initially, all slots are empty, so when 1,3,6 they are allocated to empty slots - 3 Page Faults. When 31 it is already in memory so - 0 Page Faults. Then s for slot ie 1 - 1 Page Fault. Finally, 6 Comes the oldert available in memory so it replaces the oldert available in memory so it replaces the oldert are available in memory so it replaces the oldert are available in memory so it replaces the oldert are available in memory so it replaces the oldert are also not be a Page fault.

Belady's Anomaly: Belady's Anomaly proves that it is possible to have more Page faults when increasing the number of Page frames while using the first in first out (FIFO) Page replacement Algorithm. For example, if we consider reference String (3 2 1 0 3 2 4 3 2 1 0 4) and 3 slots, we get a total Page faults, but if we increase slots to 4, we get 10 Page faults

Offinal Page Replacement :- In this Algorithm, Pages are replaced which are not used for the longest

duration of time in the future.

Let us Consider Page reference String 7012030423032 and 4 Page Slots. Initally all slots are empty, so when 7012 are allocated to the empty slots -> 4 Page faults. O is ready there so -> 0 Page fault. When 3 Carne it will take the place of 7 because it is not used for the Congest duration of time in the future -> 1 Page fault. O is already there so -> 0 Page fault. 4 will takes place of 1 -> 1 Page fault. Now for the further Page referencing string -> 0 Page fault because they are already available in the memory.

Oftimal Page replacement is Porfect, but not Possible in Practise as an operating System cannot know future refuests. The use of Optimal Page replacement is to set up a banchmark so that other replacement algorithms can be analyzed against it

## (3) Least Recently used (LRU):

In this Algorithm, the Page will be replaced with the is least recambly used let say the Page reference string 030433032. Initially, all slots are empty, so we are allocated to the empty slots  $\rightarrow$  4 Page faults. Of there so  $\rightarrow$  0 Page fault. when 3 Gerner it will take of 7 because it is least recombly used  $\rightarrow$  1 Page fault already in memory so  $\rightarrow$  0 Page fault. 4 will take I Page fault. Now for the further Page reference stringly large fault because they are already available in the

Dish Scheduling :- Dish Scheduling is done by objusting to Schedule I/O refuests arriving for Dish scheduling is also known as I/O scheduling.

- O Seek Time: Seek Time is the time taken to locate to is to be wead on whiten.
- Rotational lateracy :- It is the time taken by the dains of dish to notate into a position so the
- Transfer Time: It is the time to transfer the data. If

  on the heads.

  Thomson to be transferred.

Dish Access time: Seek Time + Rotational latency + Thankfur Time

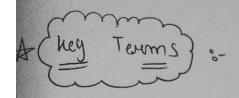
Dish Response Time: Response Time is the awarde of time spont by

Average maponse time is the markonse time of all releasts.

Dish Scheduling Algorithms 8-

- Of FCFS: FCFS is the Simplest of all the Disks Scheduling Algorithms. In FCFS, the relucits are addressed in the Order they arrive in the Disk Queue.
- In SSTF: In SSTF (shoutest Seek Time Finst), refusely having the Shortest Seek Time are executed first. So, the Seek time of every refuest is calculated in advance in a Tuene and then they are scheduled according to their calculated Seek time. As a result, the refuest near the disk arm will get executed first.
- SCAN: In SCAN Algorithm the disk aum moves into abouticular direction and Sourices the Me Puests Coming in its bath and after Meaching the end of the Dirk, it Me vouses its direction and again Souvices the Melust ariving in its bath. So, this algorithm works like an Elevator and honce is also known as elevator Algorithm.
- CSCAN: In CSCAN Algarithm, the dish arm again scans the both that has been scanned, after neversing its directions. So, other and are there may be equally are writing at the scanned are there may be zero or few reliable bording at the scanned area.

(5) Look :- It is similar to the SCAN Disk Scheduling Algorithm except for the difference that the dish arm in spite of of to the and of the dish gow only to the last suchuset of Serviced infront of the head and then revouses its directive Clook: - Ar Look is Similar to SCAN Algorithm, Clook is similar to to CSCAN dish Scheduling Algarithm. In CLOOK, the justom Orm in spite of going to the and good only to the last endopino her to be Serviced in front of the head and than from there futing god to the other ands last reflect. Thus, it also prevents founding the extra delay which occurred due to inneccessary traversal to end of the disk. brocesso H Macro L k-ent is used *purchion* during 6de



D Real Time System is used in the Case When sigid-time relativements have been placed on the operation of a professor. It Contains well defined and fined time Constraints.

A monolithic hound is a hound which includes all operating System Code in a Single executable image.

Micro hund is the hound which huns minimal Performance effecting sources by the Operating System. In the micro hound operations surformed by the brocesson.

Macro kund is the Combination of micro and monolithic hound.

Re-entrancy, It is a very vietal memory Saving technilue that is used for multi-brogrammed time sharing systems. It browides function ality that multiple views can share a single Gby of brogram during the same pariod. It has two key Aspects: The Program Code Connot modify itself and the local data for each view brocess must be Stored Separately.

Demand Paging Specifies that if an area of momery is not Currently being used, it is swapped to disk to make soom bear an applications need.

- Virtual Memory is a very useful momory management technique which enables processed to execute outside of momosy. Puob This Technique is especially used whom an executing program Cannot fit in the physical mamory.
- (8) RAID Stands for Redundant Assess of Independent Dishs. It in used to stoke the same data redundantly to improve the overe Parformance. There are 7 RAID Levels.
- Logical Address space specifies the address that is generated b the CPU . On the other hand, physical address space specifies the address that is sean by the memory unit.
- Fragment ation is a Phenomenon of momory Wastage. It reduce the Capacity and performance because space is used inefficiently. (5)
  - (i) Internal fragmontation: It occurs when we deal wit the Systams that have fined size allocation units.
  - (ii) External fragmentation: It occurs when we deal with the Systems that have Variable - Size allo Cation units.
- shooling is a process in which data is temperarily gathered to be used and executed by a device, program on the System. It is absociated with printing, when different applications send output to the perintar at the same time, shooting heaps those all jobs into a disk file and Jueues them allowed rolly to the buntous

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Standahon is a Resource magnagement Problem. In this Publish, a Waiting brocks downot get the Manauleu it needs for a long time because the Masources are being allocated to other processes 4I Aging is a technique used to avoid standardion in the resource Over Scheduling Systam. Advantages of multithread Programming: ited · Enhance the Hasponiveness to the usous. Resource Sharing within the process. E Conomical. Completely Utilize the multiprocessing Architecture. Thrashing is a Phonomonon in virtual momory schemes ndu When the processor sponds most of its time in swapping ntly. [ pages, nother than executing instructions. wit with d to be t is