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Operating System
Assignment no. 1

(1) Explain Operating System Structure
Operating System Structures are
1. Monolithic System
2. layered System
3. Virtual machine
4. Client - Server Model

(1) Monolithic System
- This type of operating System can be treated as having no structure. the operating system is constructed as set of procedures and each procedure can call any other ones whenever needed.
- Each procedure is system has a precise interface in terms of parameters and results
- Every procedure can call any other one, if the called one offers some useful computation that the calling procedure needs.

(2) layered System
- Another approach of organizing the operating system is as a hierarchy of layes, each one constructed upon the below it.
- The first system built in this way was the The system developed at the technische hoss School e:Dijkstra a students.

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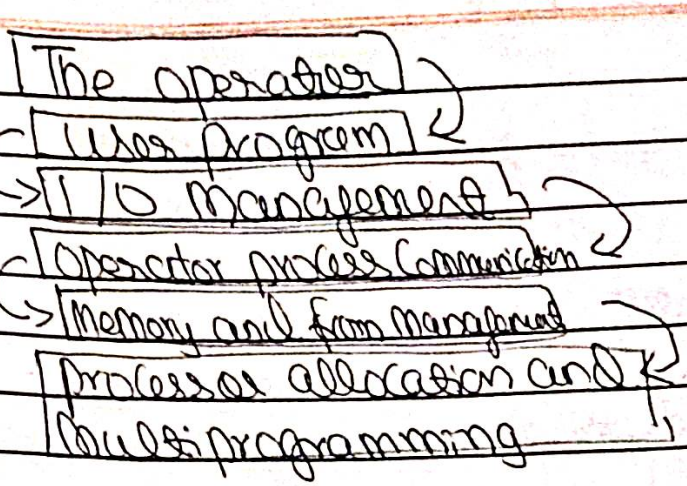

(3) Virtual machine
- A time sharing system provide
- Multiprogramming and
- An extended machine with a more convenient interfaces than the bare hardware

(4) Client Server Model
- A trend in modern operating system is to take the idea of moving code up into higher layers even further and remove as much as possible from kernel-mode, leaving a minimal microkernel
- The usual approach is to implement most of the OS in user processes
- To request a service, such as reading a block of a file a user process (Client process) sends the request to a server process, which the does the work and sends back the answer

(2) Explain System Calls and its type
→ An operating system is system software which manages, operates and communicates with the computer hardware software

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The Interface between OS and user program is Defined by the Set of System calls that the OS offers. System call is that Call for the OS to perform some task on behalf of user program.

Types of System Calls

(i) Process Control :-
These System Call deals with process Such as process Creates process termination etc.

(ii) File management
These System Calls are responsible for device manipulation Such as creating a file, reading a file writing a file etc.

(iii) Device Management:
These System Calls are responsible for device Manipulation Such as reading from device buffers, writing Data device

(iv) Information Maintance.

(v) Communication

Q3) Explain System Services and Interface
→ An operating System provide Services to both the user and be program
- It provide program an environment to execute
- It provide users the Service to execute the programs in a Convent Manner

(i) Program execution
A process Includes the Complete execution Context (Code to execute, data to manipulate, Register, OS resource in use)

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(ii) I/O operation
An I/O Subsystem Comprises of I/O devices and their Corresponding Drive Software. Drivers hide the peculiarity of specific hardware device from the users

(iii) file System manipulation
A file represent a collection of related information Computer can store file on the disk for long time Storage purpose. Eg of Storage media include Magnetic tape, Magnetic flux and Optical drivers the CD, DVD.

(iii) Communication
The OS handles routing and Connection Strages and the problem of Contention and Security following are the major activities of an Operating System with respect to communication

(iv) Error handling
Error can occur anytime and anywhere. An error the ~~OS~~ may occur in CPU in I/O devices or in the memory hardware.
The OS Constantly checks for possible error the OS takes an appropriate action to ensure Correct and Consistent Computing

(v) Protection

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(Q4) Process State model and transition?

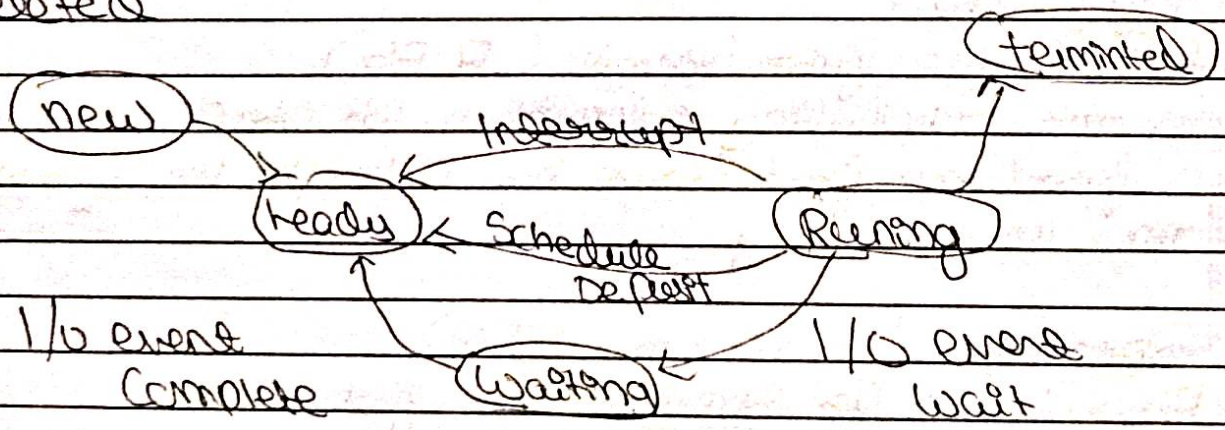
⇒ New (Create) - In this Step, the process is about to be created but not yet created. It is the program which is present in secondary memory that will be picked up by OS to create the process

- Ready - After the creation of a process, the process enter the ready state.

- Run :- The process is chose by CPU for execution and the instruction with in the process are executed by anyone of the available CPU core

- Wait → Whenever the process request access to I/O or needs input from the user or needs access to a critical region. It enters the waiting state

- Terminated - process is killed as well as PCB is deleted



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Q5) Threads and its type
— A thread is a basic unit of CPU utilization
It comprises a thread ID is a program Counter a stack and register set.

Types of threads:-
(1) User level thread (ULT)
Is implemented in user level library, they are not created using the System Calls
thread Switching doesn't need to call OS and to cause Interrupt to kernel
Kernel Doesn't know about the user level thread and manages them as if they were Slightly threaded processes

(2) Kernel level thread (KLT)
Kernel knows and manages the threads
Instead of thread table in each process, the kernel itself has thread table that keeps track of all the thread in the system.

Q6) Scheduling algorithm
Types are:-
(1) First Come first Served (FCFS)
In this Scheduling algorithm, jobs are executed on a first come, first serve has is irrespective of burst time or priority

(2) Shortest Job Next (SJN)
Also know as Shortest Job first, this

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Scheduling algorithm is both a non-preemptive and preemptive scheduling algorithm. process with the minimum burst time of an instance executes first.

(3) Priority Scheduling
This scheduling algorithm is commonly used in the match system and is a non-preemptive scheduling algorithm.

(4) Shortest Remaining time
This scheduling algorithm is the preemptive version of SRT algorithm. The OS allocates the processes to the job that is closed to completion.

(5) Round Robin (RR)
This scheduling algorithm is preemptive process scheduling algorithm where each process is provided a fixed time to execute. this fixed time is called a quantum. It is used Context Switching to save state of prempted processes.

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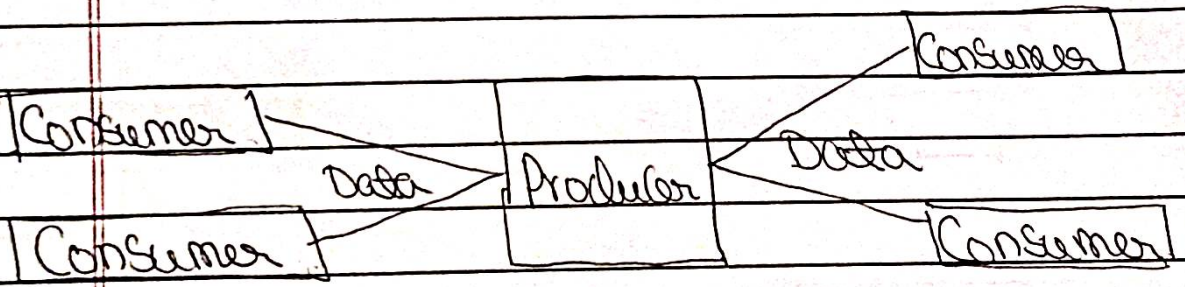
(1) Explain about IPC and Synchronization?

→ Interprocess Communication :- (IPC)

- Inter-process Communication is the activity of sharing Data across multiple and commonly specialized processes using communication protocols.
- Typically, application using IPC are categorized as client and server.
- Client requests Data and the server responds to client requests.
- IPC has ability to communicate between two cooperating process.
- IPC is used in many contexts, such as producer - Consumer problems.



Methods of IPC :

(1) Pipes

- It is simplest of all the IPC
- A pipe enables one way communication between a processes.
- When the process terminates, pipes is removed Automatically.

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(II) FIFO :- First In First Out (Also called Named pipes)
- A FIFO enables unidirectional communication between a processes.

(III) Message Queue
- It is used in implementation of message passing IPC.
- Message Queue will remain, even if the process have ~~exit~~ existed.
- It can be unidirectional or bidirectional.

(IV) Shared Memory
- It includes a memory segment which is shared by two or more processes.
- When a process creates a memory segment for IPC from its logical Address Space other process can attach that available space for communication.
- Shared memory is one of the most simplest and logical implementation of IPC.

* Process Synchronization
- Each process executes its own operations on shared variables sequentially, as specified by its own program. Nevertheless, Different processes may execute their operations on the same shared variable concurrently that is, operation execution of different processes may overlap. And they may affect one another

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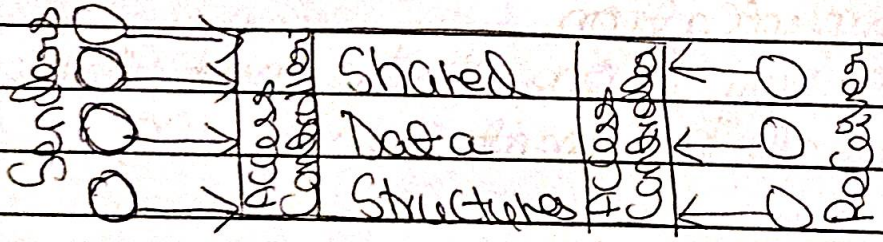
- Each operation on a Shared variable, when executed indivisibly, transform the variables from one Consistent value to another. However, when the operations are executed Concurrently on a Shared variables, the Consistency of its values may not the guaranteed.
- The behaviors of operation execution on Shared variables must be predictable for effective Ipc.
- This, operation executions on Shared variables may not be Coordinated to ensure their Consistency Semantics.
- Coordination to Accesses to Shared variables is called Synchronization.
- Synchronization Solution Coordinates Accesses from Processes to Shared variables.



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Q3] Contiguous Allocation

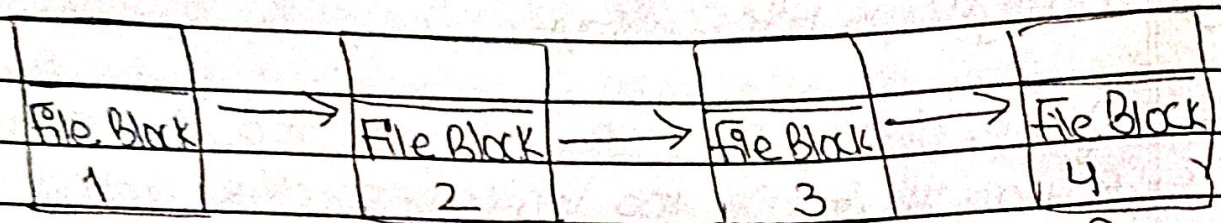
→ If the blocks are allocated to the file in such a way that all the logical blocks of the file get the contiguous physical block in the hard disk then such allocation scheme is known as contiguous allocation.

File Name	Start	length	Allocated Blocks
abc.txt	0	3	0,1,2
Video.mp4	4	2	4,5
Ltp.docx	9	3	9,10,11

Advantages
- It is simple to implement
- We will get Excellent read performance.
- Support Random Access into files

Disadvantages
- The disk will become fragmented
- It may be difficult to have a file grow

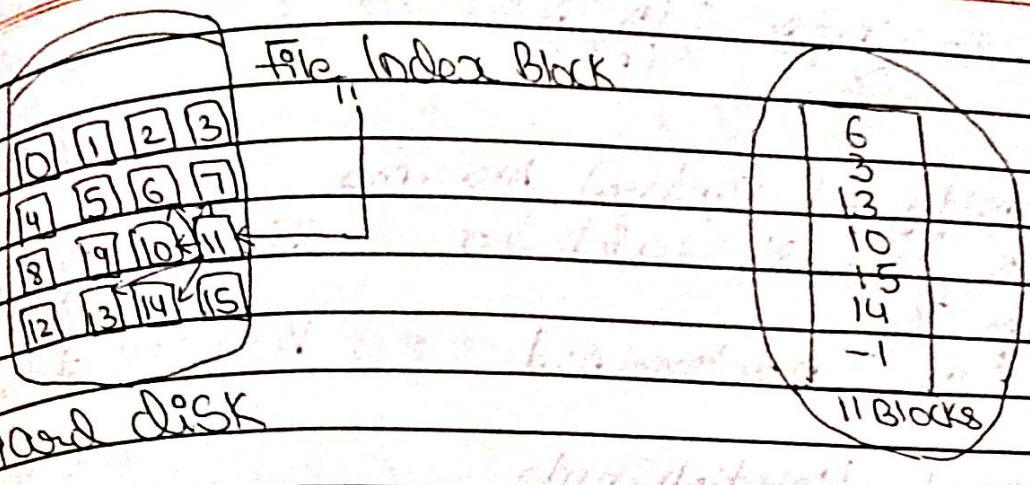
* Linked list Allocation
It solves all the problem of contiguous allocation. In linked list allocation, each file is considered as the linked list of disk blocks. However, the disks blocks allocated to a particular file need not to be contiguous on the disk. Each disk block allocated to a file contain a pointer which points to the next disk block allocated to the same file.



Advantages
- There is no external fragmentation with linked allocation.
- Any free block can be utilized in order to satisfy the file block requests.
- File can continue to grow as long as the free blocks are available.

Disadvantages
- Random Access is not provided.
- Pointers require some space in the disk blocks
- Need to traverse each block.

Indexed Allocation Scheme
- Instead of maintaining a file allocation table of all the disk pointers, Indexed block doesn't hold the file data, but it hold the pointers to all the disk blocks allocated to all the disk blocks allocated to that particular file. Directory entry will only contain the index block address.



Advantages
- Support direct access
- A Bad data block causes the lost of only that block

Disadvantages
- A bad index block could cause the lost of entire file.
- More pointer overhead
- Having an index block for a small file is totally wastage

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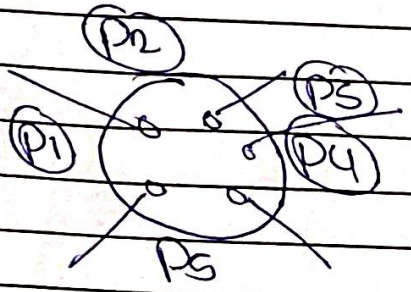
(2) Explain classification problem of Synchronization
1) Philosopher problem

- The DINING Philosophers Problem
This is the Classical problem of Synchronization which says that five philosophers are sitting around a circular table and their job is to think to eat alternatively. A bowl of noodles is placed at the center of table along with five chopstick for each of philosophers.
To eat a philosopher needs both right and left chopstick.



(ii) Reader - Writer problem
This is related to an object such as file that is shared between multiple processes. Some of these processes are readers i.e they only want to read the Data from the object and some of the processes are writers i.e. they want to write the object.
The Reader-writer problem is used to manage Synchronization so that there are no problem with the object Data.

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iii) Consumer – Producer problem

The Producer-Consumer Problem is a classic Synchronization problem in OS.

The problem is defined as follows:-

There is a fixed size buffer and a Producer process, and a Consumer process.

The producer process creates an item and adds it to the shared buffer and Consumer takes items out of the buffer one by one.

The certain condition must be met by Producer and Consumer processes to have consistent data synchronization.

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(4) Explain about
(i) Real-time System
- A Real time OS is an Operating System for real-time application that process Data and events that have Critically Defined time Constrain and events that RTOS is distinct from a time Sharing operating System, such as Unix, which manages the Sharing of System resources with a Scheduler, Data buffers or fixed task prioritization in a multitasking or multiprogramming environment.

(ii) Distributed file System
A Distributed file System as the name Suggest is a file System that is distributed on multiple file Services or multiple location. It allows Program to access files from any network.
The main purpose of the Distributed files System is allow user of Physically Distributed System to Share their Data and resumes by using a Common file System

(iii) Multimedia System
It is responsible for developing a multimedia application. A Multimedia Application is a bundle of different kinds of Data. A Multimedia Computer System is one that can Create, Integrate, Store, retrieve ~~Data~~ Delete Data of type of Media materials.

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(Q5) Explain in detail about RAID Structure

→ Raid or Redundal Array of Independent Disks is a technique which make use of a Combination of multiple media Computer System to one Disk instead of using a single disk for increased performance Data redundancy or both.
RAID is very transparent to the underlying System This means to the host System, it appears as a single big disk presenting itself as a linear Array of blocks

Disk 0	Disk 1	Disk 2	Disk 3
0	1	2	3
4	5	6	7
8	9	10	11
12	13	14	15

RAID-1 (Mirroing)

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

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RAID 4

DISK 0	DISK 1	DISK 2	DISK 3	DISK 4
0	1	2	3	P_0
4	5	6	7	P_1
8	9	10	11	P_2
12	13	14	15	P_3

RAID-5

DISK 0	DISK 1	DISK 2	DISK 3	DISK 4
0	1	2	3	P_0
5	6	7	P_1	4
10	11	P_2	8	9
15	P_3	12	3	14
P_4	16	17	18	19