17IT3406 OPERATING SYSTEMS

SHORT ANSWER QUESTIONS

OS Short Answer Quesitons

UNIT I

1. **Define OS?**
   A program that acts as an intermediary between a user of a computer and the computer hardware

2. **Goal of Operating system?**
   Execute user programs and make solving user problems easier, Make the computer system convenient to use
   , Use the computer hardware in an efficient manner

3. **What is Firmware?**
   Bootstrap program is loaded at power-up or reboot typically stored in ROM or EPROM.

4. **Define Interrupt?**
   A signal that gets the attention of the CPU and is usually generated when I/O is required. For example, hardware interrupts are generated when a key is pressed or when the mouse is moved. Software interrupts are generated by a program requiring disk input or output.

5. **What is Trap?**
   A *trap* is a software-generated interrupt caused either by an error or a user request

6. **Define Caching?**
   Copying information into faster storage system;

7. **List the factors that affects storage Hierarchy?**
   Size, speed, Cost

8. **Define Multiprocessors systems**
   Also known as parallel systems, tightly-coupled systems. These Systems have two or more processors in close communication, sharing the computer and sometimes the clock, memory and peripheral devices.

9. **Define Asymmetric Multiprocessing**
   Each processor is assigned a specific task. A master processor controls the system, the other processors either look to their master for instruction or have predefined tasks. It defines Master-Slave relationship.

10. **Define Symmetric Multiprocessing**
    SMP means that all processors are peers; Each processor performs all tasks within the OS.Here there is no master-slave relationship exists between processors.

11. **What are the advantages Multiprocessors systems**
    Increased reliability , Economy of scale, Increased throughput

12. **Define Asymmetric clustering**

In this one machine in hot-standby mode while other is running the applications.

13. **Define Symmetric clustering**
    It has multiple nodes running applications, monitoring each other. It is more efficient

14. **List various User Interfaces for OS**
    Command-Line interface (CLI), Graphics User Interface (GUI), Batch Interface

15. **Define System call**
    A System Call is the main way a user program interacts with the Operating System. Programming interface to the services provided by the OS.

16. **List various types of System Calls?**
    Process control, File management, Device management, Information maintenance, Communications

17. **Why System Programs are used?**
    Provides convenient environment for program development and execution.

18. **Define Kernel?**
    A kernel is the central part of an operating system. It manages the operations of the computer and the hardware - most notably memory and CPU time.

19. **Define Process?**
    Program in execution; process execution must progress in sequential fashion.

20. **What are the Contents of process?**
    Program counter ,stack ,data section.

21. **List various states of a Process?**
    New, running, waiting, ready, terminated.

22. **What is PCB?**
    Process Control Block. It contains Process state, Program counter, CPU registers, CPU scheduling information, Memory-management information, Accounting information, I/O status information.

23. **What is Context Switching?**
    The act of Scheduling a process means changing the active PCB pointed to by the CPU.

24. **Importance of Process scheduler?**
    selects among available processes for next execution on CPU.

25. **What is the job of Long-term scheduler (or job scheduler)**?
    It selects which processes should be brought into the ready queue

26. **What is the role fo Short-term scheduler (or CPU scheduler)?**
    Selects which process should be executed next and allocates CPU

27. **Define I/O-bound process?**
    spends more time doing I/O than computations, many short CPU bursts

28. **Define CPU-bound process**?

spends more time doing computations; few very long CPU bursts

29. **Use of fork**?
    It is a system call that creates new process

30. **Why exec system call is used?**
    exec system call is used after a **fork** to replace the process' memory space with a new program

31. **Define Independent process?**
    Execution is deterministic and reproducible. Execution can be stopped/ started without affecting other processes.

32. **Define Cooperating Process?**
    Execution depends on other processes or is time dependent.

33. **Define abort?**
    Parent may terminate execution of children processes.

34. **What is exit system call?**
    Process executes last statement and asks the operating system to delete it

35. **What is meant by cascading termination?**
    Some operating systems do not allow child to continue if its parent terminates all children terminated

36. **List the advantages of process cooperation of Processes or IPC?**
    Information sharing ,Computation speed-up, Modularity, Convenience

UNIT II

1. **Define Thread?**
   Thread is a light weight Process.

2. **Differentiate between thread and process**
   Process creation is heavy-weight while thread creation is light-weight

3. **List Benefits of Multithreading?**
   Responsiveness, Resource Sharing, Economy, Scalability

4. **List different types of threads**
   User threads – M anagement done by user-level threads library
   Kernel threads - Supported by the Kernel

5. **List Multithreading Models?**
   Many-to-One,One-to-One,Many-to-Many

6. **Why Signals are used?**
   Signals are used in UNIX systems to notify a process that a particular event has occurred.

7. **What is Thread Cancellation ?**
   Terminating a thread before it has finished.Thread to be canceled is target thread

8. **What is Asynchronous cancellation?**
Terminates the target thread immediately.

9. **What is Deferred cancellation?**
Allows the target thread to periodically check if it should be cancelled

10. **Why multiprogramming is used?**
Maximum CPU utilization obtained with multiprogramming

11. **Differentiate between preemptive and non preemptive scheduling?**
Preemptive scheduling the CPU is allocated to the processes for the limited time. While in Non-preemptive scheduling, the CPU is allocated to the process till it terminates or switches to waiting state.

12. **What is Dispatch latency?**
Time it takes for the dispatcher to stop one process and start another running

13. **Define Throughput?**
No of processes that complete their execution per time unit

14. **Define Turnaround time?**
Amount of time to execute a particular process

15. **Define Waiting time?**
Amount of time a process has been waiting in the ready queue

16. **Define Response time?**
Amount of time it takes from when a request was submitted until the first response is produced, not output (for time-sharing environment)

17. **Optimization Criteria for Scheduling Algorithm?**
Max CPU utilization,Max throughput,Min turnaround time ,Min waiting time ,Min response time

18. **Define Convoy effect?**
short process behind long process.This is seen in FCFS scheduling algorithm.

19. **Starvation?**
Low priority processes may never execute.This problem is occurred in Priority Scheduling Alg.

20. **Define Aging?**
As time progresses increase the priority of the process.This is the solution for Starvation.

21. **Define Race Condition?**
A race condition occurs when two or more threads or processes can access shared data and they try to change it at the same time.

22. **Define Critical Section Problem?**
A Critical Section is a code segment that accesses shared variables and has to be executed as an atomic action. It means that in a group of cooperating processes, at a given point of time, only one process must be executing its critical section.

23. **Solution to the Critical Section Problem?**

    Mutual Exclusion, Progress, Bounded Waiting.

24. **What is Atomic?**
    non-interruptable

25. **Define Semaphore?**

26. **What are two standard operations of Semaphore?**
    wait() P() Decrement ; and signal() V() Increment;

27. **Types of Semaphores?**
    Counting semaphore – integer value can range over an unrestricted domain
    Binary semaphore – integer value can range only between 0 and 1;Also known as **mutex locks**

28. **Define block Operation?**
    Place the process invoking the operation on the appropriate waiting queue

29. **Define wakeup Operation?**
    remove one of processes in the waiting queue and place it in the ready queue

30. **Define Priority Inversion?**
    It is a Scheduling problem when lower-priority process holds a lock needed by higher-priority process.
    Solved using priority-inheritance protocol.

31. **List Classical Problems of Synchronization?**
    Bounded-Buffer Problem, Readers and Writers Problem, Dining-Philosophers Problem

UNIT III & IV

1.What is Deadlocks ?

A process request for some resources. If the resources are not available at that time , the process enters a waiting state . The resources was held by other processes .The waiting process may never able to get the resource. This situation is called deadlock.

2. What are the necessary conditions for deadlocks?

• Mutual exclusion: only one process at a time can use a resource. If another process requests the same resource, the requesting process must wait until the resource is released.

• Hold and wait: Processes currently holding resources granted earlier , can request for new resources , that are currently held by other.

• No preemption: a resource can be released by the process holding it only after that process has competed its task.

- Circular wait: The circular chain of two or more processes must exist such that each of them is waiting for a resource held by next member.

3. What is a Resource Allocation graph?

A set of vertices V and a set of edges E.

- V is partitioned into two types:

– P = {P1 , P2 , …, Pn }, the set consisting of all the processes in the system

– R = {R1 , R2 , …, Rm}, the set consisting of all resource types in the system

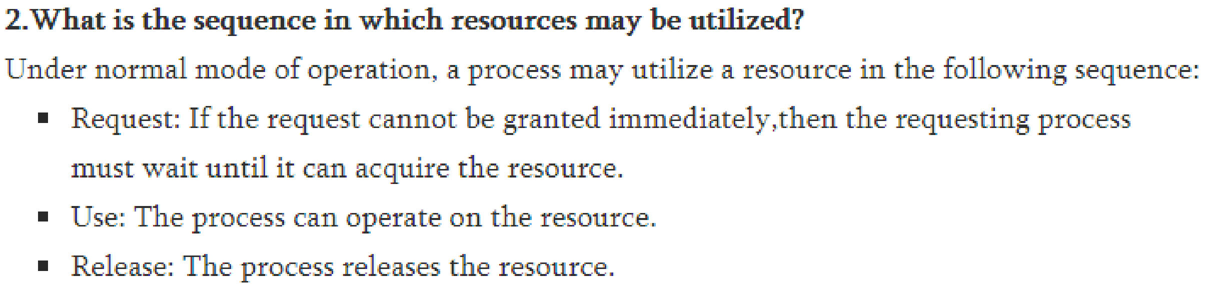
- request edge – directed edge Pi → Rj

- assignment edge – directed edge Rj → Pi

4. What is a safe state?

A state is safe if the system can allocate resources to each process (up to its maximum) in some order and still avoid a deadlock. More formally, a system is in a safe state only if there exists a safe sequence.

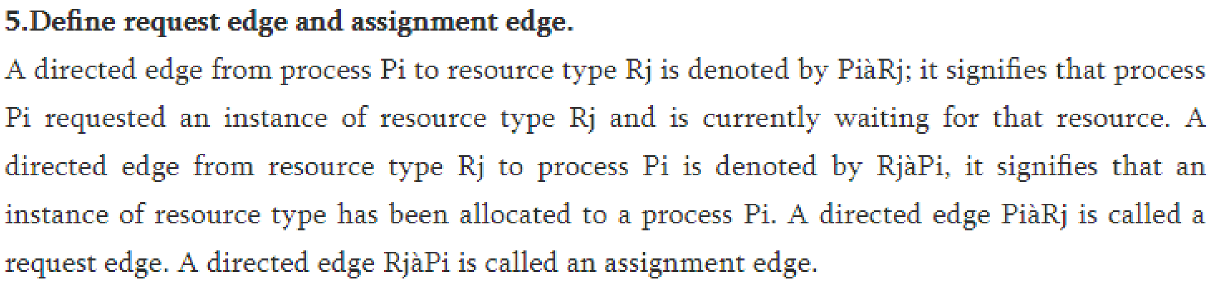
5. What is a safe sequence?



2.What is the sequence in which resources may be utilized?

Under normal mode of operation, a process may utilize a resource in the following sequence:

- Request: If the request cannot be granted immediately,then the requesting process must wait until it can acquire the resource.
- Use: The process can operate on the resource.
- Release: The process releases the resource.



5.Define request edge and assignment edge.

A directed edge from process Pi to resource type Rj is denoted by PiàRj; it signifies that process Pi requested an instance of resource type Rj and is currently waiting for that resource. A directed edge from resource type Rj to process Pi is denoted by RjàPi, it signifies that an instance of resource type has been allocated to a process Pi. A directed edge PiàRj is called a request edge. A directed edge RjàPi is called an assignment edge.

6.What are the methods for handling deadlocks?

The deadlock problem can be dealt with in one of the three ways:

a. Use a protocol to prevent or avoid deadlocks, ensuring that the system will never enter a deadlock state.

b. Allow the system to enter the deadlock state, detect it and then recover.

c. Ignore the problem all together, and pretend that deadlocks never occur in the system.

7.Define deadlock prevention.

Deadlock prevention is a set of methods for ensuring that at least one of the four necessaryconditions like mutual exclusion, hold and wait, no preemption and circular wait cannot hold. By ensuring that that at least one of these conditions cannot hold, the occurrence of a deadlock can be prevented.

8.Define deadlock avoidance.

An alternative method for avoiding deadlocks is to require additional information about how resources are to be requested.Each request requires the system consider the resources currently available, the resources currently allocated to each process, and the future requests and releases of each process, to decide whether the could be satisfied or must wait to avoid apossible future deadlock.

9.What are a safe state and an unsafe state?

A state is safe if the system can allocate resources to each process in some order and still avoid a deadlock. A system is in safe state only if there exists a safe sequence. A sequence of processes <P1,P2,….Pn> is a safe sequence for the current allocation state if, for each Pi, the resource that Pi can still request can be satisfied by the current available
resource plus the resource held by all the Pj, with j system state is said to be unsafe.

10.What is banker's algorithm?

Banker's algorithm is a deadlock avoidance algorithm that is applicable to a resource-allocation system with multiple instances of each resource type.The two algorithms used for its implementation are:

a. Safety algorithm: The algorithm for finding out whether or not a system is in a safe state.

b. Resource-request algorithm: if the resulting resourceallocation is safe, the transaction is completed and process Pi is allocated its resources. If the new state is unsafe Pi must wait and the old resource-allocation state is restored.

11. Recovery from deadlock state

Answer : When a deadlock exists, several alternatives are available.

1. One possibility is to inform the operator that a deadlock has occurred and to let the operator deal with the deadlock manually.

2. The system recovers from the deadlock automatically.

There are two options for breaking a deadlock.

A) Process Termination: Aborting processes to eliminate the deadlock. There are two methods:

1) Abort all deadlocked processes.

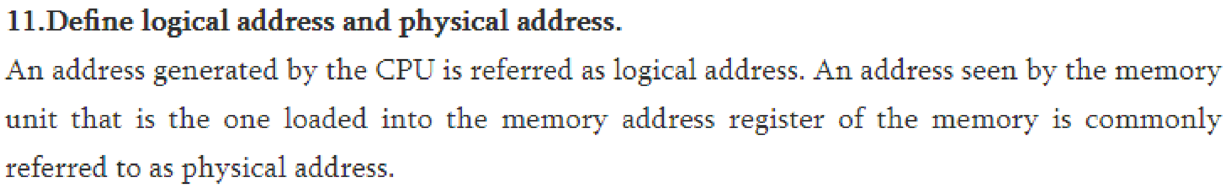
2) Abort one process at a time until the deadlock cycle is eliminated.

B) Resource Preemption: preempt: some resources from processes and give these resources to other processes until the deadlock cycle is broken. three issues need to be addressed:

1) Selecting a victim. Which resources and which processes are to be preempted?

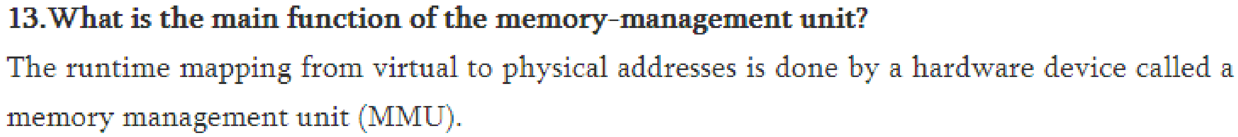
2) Rollback. If we preempt a resource from a process, what should be done with that process?

3) Starvation. How do we ensure that starvation will not occur, guarantee that resources will not always be preempted from the same process?



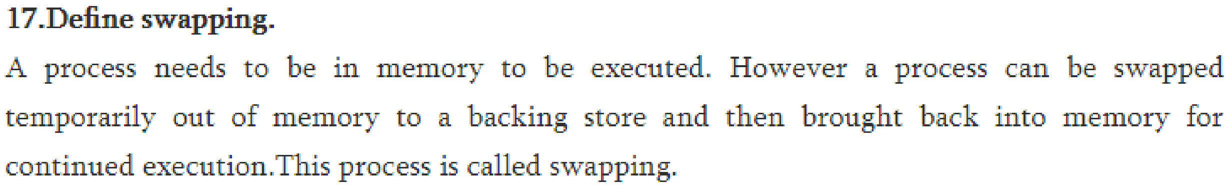
11.Define logical address and physical address.

An address generated by the CPU is referred as logical address. An address seen by the memory unit that is the one loaded into the memory address register of the memory is commonly referred to as physical address.



13.What is the main function of the memory-management unit?

The runtime mapping from virtual to physical addresses is done by a hardware device called a memory management unit (MMU).



17.Define swapping.

A process needs to be in memory to be executed. However a process can be swapped temporarily out of memory to a backing store and then brought back into memory for continued execution.This process is called swapping.

18. What is Belady's anamoly effect? Which page replacement algorithm suffers from belady's anamoly effect?

A. Bélády's anomaly is the phenomenon in which increasing the number of page frames results in an increase in the number of page faults for certain memory access patterns.

This phenomenon is commonly experienced when using the first-in first-out (FIFO) page replacement algorithm.

19. What is the use of dirty bit?

When a block of memory is to be replaced, its corresponding dirty bit is checked to see if the block needs to be written back to secondary memory before being replaced or if it can simply be removed. Dirty bits are used by the CPU cache and in the page replacement algorithms of an operating system.

20. What is Paging?

Paging is a memory management scheme which allows a process to be stored in a memory in a non-contiguous manner. Storing process in a non-contiguous manner solves the problem of external fragmentation.

For implementing paging the physical and logical memory spaces are divided into the same fixed-sized blocks. These fixed-sized blocks of physical memory are called frames, and the fixed-sized blocks of logical memory are called pages.

21. What is segmentation?

Segmentation is a memory management scheme that supports user view of memory where logical address space is a collection of segments that has segment name and length.

The process is divided into the variable size segments and loaded to the logical memory address space. The logical address space is the collection of variable size segments. Each segment has its name and length. For the execution, the segments from logical memory space are loaded to the physical memory space.

22. Differentiate between internal fragmentation and external fragmentation.

Internal fragmentation occurs when the memory is divided into fixed sized blocks. Whenever a process request for the memory, the fixed sized block is allocated to the process. In case the memory assigned to the process is somewhat larger than the memory requested, then the difference between assigned and requested memory is the internal fragmentation.

External fragmentation occurs when there is a sufficient amount of space in the memory to satisfy the memory request of a process. But the process’s memory request cannot be satisfied as the memory available is in a non-contiguous manner.

23. What is page fault?

Page fault occurs when you refer to a page that is not in physical memory.

24. List the technique for free space management.

1. Bit Vector

2. Linked List

3. Grouping

4. Counting

24. What is starvation?

Indefinite waiting or blocking is called starvation.

25. What is the difference between logical address and physical address?

The fundamental difference between logical and physical address is that logical address is generated by CPU during a program execution whereas, the physical address refers to a location in the memory unit.

Address generated by CPU while a program is running is referred as Logical Address. The set of all logical addresses generated by a programs perspective is called Logical Address Space.

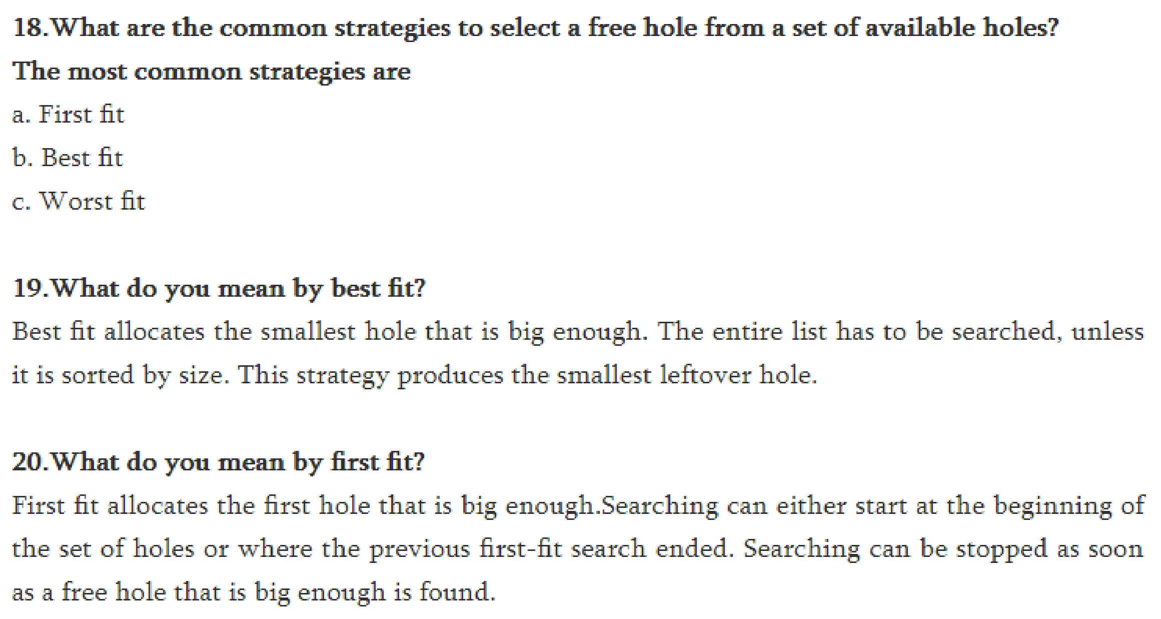
Physical Address identifies a physical location in a memory. The set of all physical addresses corresponding to the logical addresses in a Logical address space is called Physical Address Space.

26. What is aging?

Aging is a technique to avoid starvation in a scheduling system. It works by adding an aging factor to the priority of each request. The aging factor must increase the priority as time passes and must ensure that a request will eventually be the highest priority request (after it has waited long enough).

27. What is MMU?

MMU (Memory-Management Unit) computes the physical address for the corresponding logical address. MMU also uses logical address computing physical address. The logical address is mapped to the physical address using a hardware called Memory-Management Unit



18.What are the common strategies to select a free hole from a set of available holes?

The most common strategies are

a. First fit

b. Best fit

c. Worst fit

19.What do you mean by best fit?

Best fit allocates the smallest hole that is big enough. The entire list has to be searched, unless it is sorted by size. This strategy produces the smallest leftover hole.

20.What do you mean by first fit?

First fit allocates the first hole that is big enough.Searching can either start at the beginning of the set of holes or where the previous first-fit search ended. Searching can be stopped as soon as a free hole that is big enough is found.

1.What is virtual memory?

Virtual memory is a technique that allows the execution of processes that may not be completely in memory. It is the separation of user logical memory from physical memory. This separation provides an extremely large virtual memory, when only a smaller physical memory is available.

2.What is Demand paging?

Virtual memory is commonly implemented by demand paging. In demand paging, the pager brings only those necessary pages into memory instead of swapping in a whole process. Thus it avoids reading into memory pages that will not be used anyway, decreasing the swap time and the amount of physical memory needed.

3.Define lazy swapper.

Rather than swapping the entire process into main memory, a lazy swapper is used. A lazy swapper never swaps a page into memory unless that page will be needed.

4.What is a pure demand paging?

When starting execution of a process with no pages in memory, the operating system sets the instruction pointer to the first instruction of the process, which is on a nonmemory resident page, the process immediately faults for the page. After this page is brought into memory, the process continues to execute, faulting as necessary until every

page that it needs is in memory. At that point, it can execute with no more faults.This schema is pure demand paging.

9.What are the major problems to implement demand paging?

The two major problems to implement demand paging is developing

a. Frame allocation algorithm

b. Page replacement algorithm

10.What is a reference string?

An algorithm is evaluated by running it on a particular string of memory references and computing the number of page faults. The string of memory reference is called a reference string.

11.What is a file?

A file is a named collection of related information that is recorded on secondary storage. A file contains either programs or data. A file has certain "structure" based on its type.

12.List the various file attributes.

A file has certain other attributes, which vary from one operating system to another, but typically consist of these:Name, identifier, type, location, size, protection, time, date and user identification

13.What are the various file operations?

The six basic file operations are

- Creating a file
- Writing a file
- Reading a file
- Repositioning within a file
- Deleting a file
- Truncating a file

15.What are the different accessing methods of a file?

The different types of accessing a file are:

- Sequential access: Information in the file is accessed sequentially
- Direct access: Information in the file can be accessed without any particular order.
- Other access methods: Creating index for the file, indexed sequential access method (ISAM) etc.

16.What is Directory?

The device directory or simply known as directory records information-such as name, location, size, and type for all files on that particular partition. The directory can be viewed as a symbol table that translates file names into their directory entries.

17.What are the operations that can be performed on a directory?

The operations that can be performed on a directory are

- Search for a file
- Create a file
- Delete a file
- Rename a file
- List directory
- Traverse the file system

18.What are the most common schemes for defining the logical structure of a directory?

The most common schemes for defining the logical structure of a directory

- Single-Level Directory
- Two-level Directory
- Tree-Structured Directories
- Acyclic-Graph Directories
- General Graph Directory

19.Define UFD and MFD.

In the two-level directory structure, each user has her own user file directory (UFD). Each UFD has a similar structure, but lists only the files of a single user. When a job starts the system's master file directory (MFD) is searched. The MFD is indexed by the user name or account number, and each entry points to the UFD for that user.

20.What is a path name?

A pathname is the path from the root through all subdirectories to a specified file. In a two-level directory structure a user name and a file name define a path name.

4.Define seek time and latency time.

The time taken by the head to move to the appropriate cylinder or track is called seek time. Once the head is at right track, it must wait until the desired block rotates under the read-write head. This delay is latency time.

5.What are the allocation methods of a disk space?

Methods of allocating disk space which are widely in use are

a. Contiguous allocation

b. Linked allocation

c. Indexed allocation

6.What are the advantages of Contiguous allocation?

The advantages are

a. Supports direct access

b. Supports sequential access

c. Number of disk seeks is minimal.

7.What are the drawbacks of contiguous allocation of disk space?

The disadvantages are

a. Suffers from external fragmentation

b. Suffers from internal fragmentation

c. Difficulty in finding space for a new file

d. File cannot be extended

e. Size of the file is to be declared in advance

8.What are the advantages of Linked allocation?

The advantages are

a. No external fragmentation

b. Size of the file does not need to be declared