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DEPARTMENT OF INFORMATION TECHNOLOGY

U23CST43 - OPERATING SYSTEMS

PART A – 2 MARK QUESTION WITH ANSWER

UNIT I – INTRODUCTION

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods.

1. List and briefly define the four main elements of a computer?

- Processor – Controls the operation of the computer & performs its data processing functions
- Main memory – Stores data & programs.it is volatile.
- I/O modules – Move data between the computer & its external environment such as disks, communication equipment & terminals.
- System Bus – Provides for communication among processors, main memory & I/O modules.

2. Define the two main categories of processor register?

Two categories are

User- visible registers: - It Enable the machine or assembly language programmer to minimize main memory references by optimizing register use. Control & Status registers: - Registers used by the processor to control the operation of the processor.

3. In general terms, what are the four distinct actions that machine instruction can specify?

- Processor – Memory
- Processor –I/O
- Data Processing
- Control

4. What is an Interrupt?

- Interrupt are provided primarily as way to improve processor utilization.
- It is a mechanism by which other modules(I/O, Memory) may interrupt the normal sequencing of the processor.

Classes of interrupts:-

- Program

- Timer
- I/O
- Hardware failure

5. How are multiple interrupt dealt with?

Two approaches can be taken to dealing with interrupts

- Disabled Interrupt – Processor ignores any new interrupt request signal.
- Define Priority for interrupt – It allows an interrupt of higher priority.

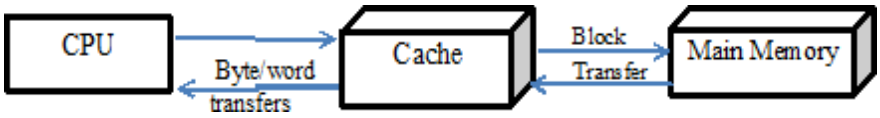
6. What characteristics distinguish the various elements of a memory hierarchy?

Characteristics are

1. Cost Per bit
2. Capacity
3. Access Time
4. Frequency of access to the memory by the processor

7. What is Cache Memory?

1. Cache memory is invisible to the OS
2. It interacts with other memory management hardware
3. Cache contains a copy of a portion of main memory .



8. List and briefly define 3 Techniques of I/O operation?

- Programmed I/O
- Interrupt Driven I/O
- Direct memory access

9. What is the distinction b/w spatial locality & temporal locality?

Temporal locality refers to the reuse of specific data and/or resources within relatively small time durations.

Spatial locality refers to the use of data elements within relatively close storage locations.

Sequential locality, a special case of spatial locality, occurs when data elements are arranged and accessed linearly, e.g., traversing the elements in a one- dimensional array.

10. Define Locality of Reference

Locality of reference, also known as the principle of locality, is the phenomenon of the same value or related storage locations being frequently accessed.

There are two basic types of reference locality.

- Temporal locality refers to the reuse of specific data and/or resources within relatively small time durations.
- Spatial locality refers to the use of data elements within relatively close storage locations.

- Sequential locality, a special case of spatial locality, occurs when data elements are arranged and accessed linearly, e.g., traversing the elements in a one- dimensional array.

11. What is an operating system? (NOV/DEC 2013)

An operating system is a program that manages the computer hardware. it act as an intermediate between a user's of a computer and the computer hardware. It controls and coordinates the use of the hardware among the various application programs for the various users.

12. What are the 3 objective of an OS Design?

- Convenience – An OS makes a computer more convenient to use
- Efficiency -- An OS allows the system resources to be used in efficient manner
- Ability to Evolve – An OS Constructed in such a way as to permit the effective development, testing & introducing new function.

13. List the Services of operating system function. (NOV/DEC 2013)

1. Program development
2. Program execution
3. User Interface
4. I/O Operations
5. File system Manipulation
6. Communication
7. Error Detection
8. Resource allocation
9. Accounting
10. Security

14. Define Kernel

The kernel is a software code that resides in the central core of a operating system. It has complete control over the system.

15. Define system call. (MAY/JUNE 2009, APRIL/MAY 2019)

System Call provides the interface between running program and the OS User can request any services from OS through System Call.

Categories of system call:-

- File management
- Process Management
- Inter process Communication
- I/O Device Management
- Information Processing & Maintenance

16. What is System Programs? (APRIL/MAY 2011)

System programs provides an convenient environment to the user for developing and executing the programs.

Categories:-

1. File management
2. Status Information

3. File Modification
4. Programming language support
5. Program loading & execution
6. Communication

17. What is Boot strapping?

The boot program is stored on disk with predetermined address called boot sector. The boot program then loads the operating system into memory to startup the computer this arrangement is known as bootstrapping.

18. Difference b/w Monolithic & Microlithic.

Monolithic	**Micro lithic**
Kernel size is large	Kernel size is small
OS is Complex to design	OS is easy to Design Implement & Install
Request may be serviced faster	Request may be serviced slower
All OS services are included in the Kernel	Kernel Provides only IPC and low level Device management services

19. What is Multiprogramming? (MAY/JUNE 2013)

Multi Programming increases CPU Utilization by organizing jobs so that the CPU always has one to execute.

Advantage:-

- It increase CPU utilization
- It makes efficient use of the CPU overlapping the demands for the CPU & I/O devices
- Increased throughput.
- Lower response time.

20. Define Real Time System

Real time system is one that must react to input & responds to them quickly. A real time system has well defined, fixed time constants.

21. What does the CPU do when there are no user programs to run? (NOV/DEC 2011)

The CPU will always do processing. Even though there are no application programs running, the operating system is still running and the CPU will still have to process.

22. Describe the actions taken by a kernel to context-switch between processes. (NOV/DEC 2013)

In general, the operating system must save the state of the currently running process and restore the state of the process scheduled to be run next. Saving the state of a process typically includes the values of all the CPU registers in addition to memory allocation. Context switches must also perform many architecture-specific operations, including flushing data and instruction caches.

23. What is multicore processor?

Hardware has been to place multiple processor cores on the same physical chip, resulting in a multicore processor. Each core maintains its architectural state and thus appears to the operating system to be a separate physical processor.

24. What is memory stall?

Researchers have discovered that when a processor accesses memory, it spends a significant amount of time waiting for the data to become available. This situation, known as a memory stall , may occur for various reasons, such as a cache miss.

25. What is Boot strapping?

- The boot program is stored on disk with predetermined address called boot sector.
- The boot program then loads the operating system into memory to startup the computer. This arrangement is known as bootstrapping.

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PART A – 2 MARK QUESTION WITH ANSWER

UNIT II – PROCESS MANAGEMENT

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling, Threads - overview Process Synchronization - The Critical-Section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlocks.

1. Define Process?

A Process can be thought of as a program in execution. A process will need certain resources such as CPU time, memory, files & I/O devices to accomplish its task

2. What is process control block? List out the data field associated with PCB. (APR/MAY2015)

Each process is represented in the operating system by a process control block also called a task control block. (PCB) also called a task control block.

Process state
Process number
Program counter
CPU registers
Memory limits
List of open files
CPU scheduling information
Memory management information
Accounting information
I/O status information

3. What is meant by context switching?

Switching the CPU to another process requires saving the state of the old process and lo ading the savet the state for the new process. This task is known as context switch.

4. Define co- operating process and independent process.

Independent process:

- A process is independent if it cannot affect or be affected by the other processes executing in the system.
- A process that does not share data with any other process is independent.

Cooperating process:

- A process is co-operating if it can affect or be affected by other processes executing in the system.
- Any process that shares data with any other process is cooperating

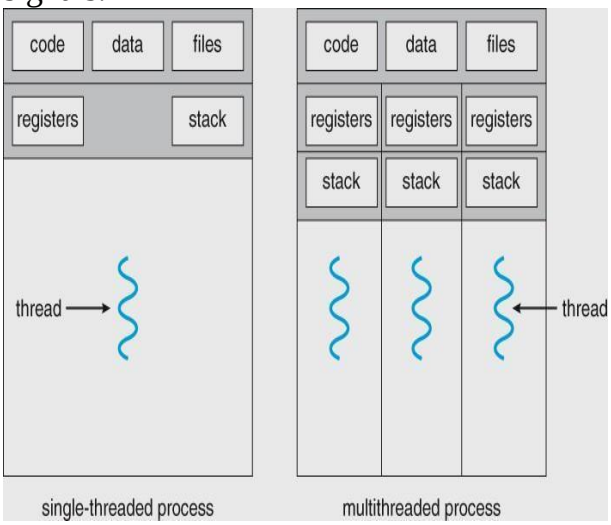
5. What are the benefits of multithreaded programming?

The benefits of multithreaded programming can be broken down into four major categ ories

- Responsiveness
- Resource sharing
- Economy scalability
- Utilization of multiprocessor architectures.

6. What is a thread?

A thread otherwise called a lightweight process (LWP) is a basic unit of CPU utilization, it comprises of a thread id, a program counter, a register set and a stack. It shares with other threads belonging to the same process its code section, data section, and opera ting system resources such as open files and signals.



7. Under What circumstances CPU scheduling decision takes place.

(1) When a process switches from running state to waiting state
(2) When a process switches from running state to ready state.
(3) When a process switches from running state to waiting state to ready state
(4) When a process terminates.

8. What are the various scheduling criteria for CPU scheduling?

The various scheduling criteria are

- CPU utilization
- Throughput
- Turnaround time
- Waiting time
- Response time

9. Write down the definition of TestAndSet() Instruction.

```
boolean TestAndSet (boolean &target)
{
boolean rv = *target;
*target = true;
return rv;
}
```

10. Define busy waiting and spinlock.

Busy waiting:-

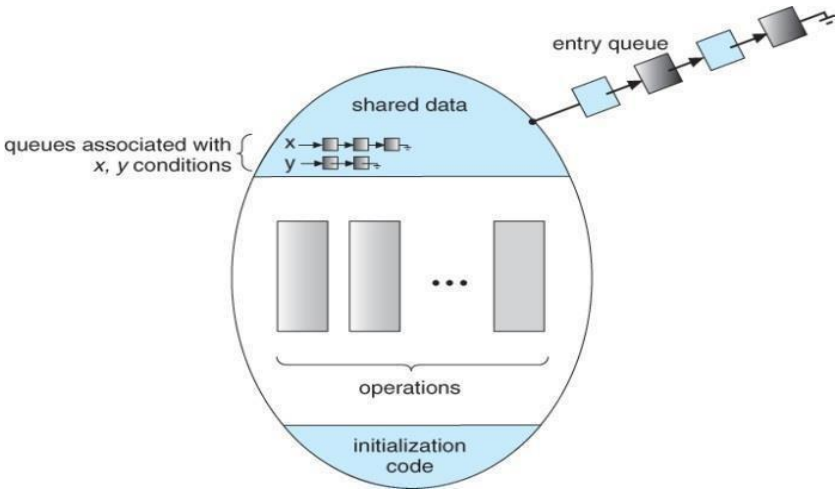
When a process is in its critical section, any other process that tries to enter its critical section must loop continuously in the entry code. This is called as busy waiting.

Spinlock:-

Busy waiting waster CPU cycles that some other process might be able to use productively. This type of semaphore is also called a spinlock because the process ―spin‖ while waiting for the lock.

11. What is mean by monitors?

A high level synchronization construct. A monitor type is an ADT which presents set of programmer define operations that are provided mutual exclusion within the monitor.



12. What are the characterizations of deadlock?

1. Mutual exclusion: only one process at a time can use a resource.

2. Hold and wait: a process holding at least one resource is waiting to acquire additional resources held by other processes.

3. No preemption: a resource can be released only voluntarily by the process holding it, after that process has completed its task.

4. Circular wait: there exists a set {*P*0, *P*1, …, *P*0} of waiting processes such that *P*0 is waiting for a resource that is held by *P*1, *P*1 is waiting for a resource that is held by *P*2, …, *Pn*–1 is waiting for a resource that is held by *P*n, and *P*0 is waiting for a resource that is held by *P*0.Deadlock can arise if four conditions hold simultaneously.

13. Differentiate a Thread form a Process. (NOV/DEC 2012)

Threads

- Will by default share memory
- Will share file descriptors
- Will share file system context
- Will share signal handling

Processes

- Will by default not share memory
- Most file descriptors not shared
- Don't share file system context
- Don't share signal handling

14. What are the difference b/w user level threads and kernel level threads? (MAY/JUNE 2012) (MAY/ JUNE 2016) (NOV/DEC 2015) User threads

User threads are supported above the kernel and are implemented by a thread library at the user level. Thread creation & scheduling are done in the user space, without kernel intervention. Therefore they are fast to create and manage blocking system call will cause the entire process to block

Kernel threads

Kernel threads are supported directly by the operating system .Thread creation, scheduling and management are done by the operating system. Therefore they are slower to create & manage compared to user threads. If the thread performs a blocking system call, the kernel can schedule another thread in the application for execution

15. What is the use of fork and exec system calls?

Fork is a system call by which a new process is created. Exec is also a system call, which is used after a fork by one of the two processes to place the process memory space with a new program.

16. Define thread cancellation & target thread.

The thread cancellation is the task of terminating a thread before it has completed. A thread that is to be cancelled is often referred to as the target thread. For example, if multiple threads are concurrently searching through a database and one thread returns the result, the remaining threads might be cancelled.

17. What are the different ways in which a thread can be cancelled?

Cancellation of a target thread may occur in two different scenarios:

• **Asynchronous cancellation:** One thread immediately terminates the target thread is called asynchronous cancellation.

• **Deferred cancellation:** The target thread can periodically check if it should terminate, allowing the target thread an opportunity to terminate itself in an orderly fashion.

18. Define PThreads

PThreads refers to the POSIX standard defining an API for thread creation and synchronization. This is a specification for thread behavior, not an implementation.

19. What is critical section problem?

Consider a system consists of 'n' processes. Each process has segment of code called a critical section, in which the process may be changing common variables, updating a table, writing a file. When one process is executing in its critical section, no other process can be allowed to execute in its critical section.

20. What are the requirements that a solution to the critical section problem must satisfy?

The three requirements are

- Mutual exclusion
- Progress & Bounded waiting

21. Define mutual exclusion. (MAY/JUNE 2013)

Mutual exclusion refers to the requirement of ensuring that no two process or threads are in their critical section at the same time.

i.e. If process P_i is executing in its critical section, then no other processes can be executing in their critical sections.

22. Define entry section and exit section.

The critical section problem is to design a protocol that the processes can use to cooperate. Each process must request permission to enter its critical section.

Entry Section: The section of the code implementing this request is the entry section.

Exit Section: The section of the code following the critical section is an exit section.

The general structure:

```
do {

    entry section

    critical section

    exit section

    remainder section
    } while(1);
```

23. Give two hardware instructions and their definitions which can be used for implementing mutual exclusion.

TestAndSet

```
boolean TestAndSet (boolean &target)
{
boolean rv = target;
target = true;
return rv;
}
```

Swap

```
void Swap (boolean &a, boolean &b)
{
boolean temp = a;
a = b;
b = temp;
}
```

24. What is semaphore? Mention its importance in operating system. (APRIL/MAY2010, NOV/DEC 2012)

A semaphore 'S' is a synchronization tool which is an integer value that, apart from initialization, is accessed only through two standard atomic operations; wait and signal. Semaphores can be used to deal with the n-process critical section problem. It can be also used to solve various Synchronization problems.

25. How the mutual exclusion may be violated if the signal and wait operations are not executed automatically (MAY/JUNE 2014)

A wait operation atomically decrements the value associated with a semaphore. If two wait operations are executed on a semaphore when its value is1, if the two operations are not performed atomically, then it is possible that both operations might proceed to decrement the semaphore value, thereby violating mutual exclusion

26. Define CPU scheduling.

CPU scheduling is the process of switching the CPU among various processes. CPU scheduling is the basis of multi programmed operating systems. By switching the CPU among processes, the operating system can make the computer more productive.

27. What is preemptive and non-preemptive scheduling? (NOV/DEC 2008, APRIL/MAY2010, MAY /JUNE 2012)

Under non preemptive scheduling once the CPU has been allocated to a process, the process keeps the CPU until it releases the CPU either by terminating or switching to the waiting state. Preemptive scheduling can preempt a process which is utilizing the CPU in between its execution and give the CPU to another process.

28. What is a Dispatcher?

The dispatcher is the module that gives control of the CPU to the process selected by the short-term scheduler. This function involves:

- Switching context.
- Switching to user mode.

- Jumping to the proper location in the user program to restart that program.

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UNIT III – MEMORY MANAGEMENT

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.

1. Why page are sizes always powers of 2?

Recall that paging is implemented by breaking up an address into a page and offset number. It is most efficient to break the address into X page bits and Y offset bits, rather than perform arithmetic on the address to calculate the page number and offset. Because each bit 25 26 position represents a power of 2, splitting an address between bits results
in a page size that is a power of 2.

2. Consider a logical address space of eight pages of 1024 words each, mapped onto a physical memory of 32 frames.[E]

a. How many bits are there in the logical address?
b. How many bits are there in the physical address?
Each page/frame holds 1K; we will need 10 bits to uniquely address each of those
1024 addresses. Physical memory has 32 frames and we need 25 bits to address each frame, requiring in total 5+10=15 bits. A logical address space of 64 pages requires 6 bits to address each page uniquely, requiring 16bits in total.
a. Logical address: 13 bits b. Physical address: 15 bits

3. What is address binding?

The process of associating program instructions and data to physical memory addresses is called address binding, or relocation.

4. **Difference between internal and external fragmentation (NOV/DEC 2013)**

Internal fragmentation is the area occupied by a process but cannot be used by the process. This space is unusable by the system until the process release the space.
External fragmentation exists when total free memory is enough for the new process but it's not contiguous and can't satisfy the request. Storage is fragmented into small holes.

5. Define dynamic loading.

To obtain better memory-space utilization dynamic loading is used. With dynamic loading, a routine is not loaded until it is called. All routines are kept on disk in are locatable load format. The main program is loaded into memory and executed. The calling routine checks whether the routine has been loaded. If not, there locatable linking loader is called to load the desired program into memory.

6. Define dynamic linking.

Dynamic linking is similar to dynamic loading, rather that loading being postponed until execution time, linking is postponed. This feature is usually used with system libraries, such as language subroutine libraries

7. What are overlays? Compare swapping and overlays

To enable a process to be larger than the amount of memory allocated to it, overlays are used. The idea of overlays is to keep in memory only those instructions and data that are needed at a given time. When other instructions are needed, they are loaded into space occupied previously by instructions that are no longer needed.

8. List the strategies for managing free memory in kernel?

1. Buddy System
2. Slab Allocation

Buddy System: - The buddy system allocates memory from a fixed size segment consists of physical contiguous pages. Memory is allocated using power-of-2. This allocation satisfy request in units sized as a power of 2.

Slab Allocation:- A Slab is made up of one or more physically contiguous pages. A cache consists of one or more slabs. The slab allocation uses caches to store kernel Objects.

9. What is virtual memory? Mention its advantages. (NOV/DEC 2012) (MAY/JUNE 2014)

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.

The main visible advantage of this scheme is that programs can be larger than physical memory.

10. Define Demand paging and write advantages.

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.

11. What is the purpose of paging the page tables?

In certain situations the page tables could become large enough that by paging the page tables, one could simplify the memory allocation problem (by ensuring that everything is allocated as fixed-size pages as opposed to variable-sized chunks) and also enable the swapping of portions of page table that are not currently used.

12. What do you mean by thrashing? (APR/MAY 2015) (APR/MAY 2019)
Thrashing is the coincidence of high page traffic and low CPU utilization.

13. How do you limit the effects of thrashing?
To limit the effect of thrashing we can use **local replacement algorithm**. With Local replacement algorithm, if the process starts thrashing, it cannot steal frames from another process and cause the latter to thrash as well. The problem is not entirely solved. Thus the effective access time will increase even for the process that is not thrashing.

14. What do mean by page fault?
Page fault is the situation in which the page is not available whenever a processor needs to execute it.

15. Define TLB.
- Translation Look-Aside Buffer, a table in the processors memory that contains information about the pages in memory the processor has accessed recently
- The TLB enables faster computing because it allows the address processing to take place independent of the normal address-translation pipeline

16. Define Pre paging.
It is an attempt to prevent the high level of initial paging. This strategy is to bring into memory at one time all the pages the will be needed.
Example: - Solaris uses pre paging.

17. 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 as physical address

18. 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).

19. What is difference between demands paging n pure demand paging?
In demand paging, a page is not loaded into main memory until it is needed. In pure demand paging, even a single page is not loaded into memory initially. Hence pure demand paging causes a page fault.

20. Define Copy-on-write.
Copy-on-write finds its main use in virtual memory operating systems; when a process creates a copy of itself, the pages in memory that might be modified by either the process or its copy are marked copy-on-write.

21. Define swapping. (NOV/DEC 2013)

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.

22. 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

23. 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.

24. Define effective access time.

Let p be the probability of a page fault (0£p£1). The value of p is expected to be close to 0; that is, there will be only a few page faults. The effective access time is

Effective access time = (1-p) * ma + p* page fault time. ma: memory-access time

25. What is the basic approach of page replacement?

If no frame is free is available, find one that is not currently being used and free it. A frame can be freed by writing its contents to swap space, and changing the page table to indicate that the page is no longer in memory. Now the freed frame can be used to hold the page for which the process faulted.

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UNIT IV – STORAGE MANAGEMENT

Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage-File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation- File System Structure, Directory Structure, Allocation Methods, Free Space Management, I/O Systems.

1) 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.

2) List the various file attributes. (APRIL/MAY 2011, NOV/DEC 2012) (MAY/JUNE2014) (APRIL/MAY 2015)

A file has certain other attributes, which vary from one operating system to another, but typically consist of these:

- Identifier
- Name
- Type
- Location
- Size
- Protection
- Time
- Date
- User identification

3) What are the various file operations? (NOV/DEC 2012, APRIL/MAY 2015)

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

4) What are all the information's associated with an open file?

Several pieces of information are associated with an open file which may be:

- File pointer
- File open count
- Disk location of the file
- Access rights

5) What are the different accessing methods of a file? (APRIL/MAY 2010)

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.

6) 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.

7) 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

8) What are the most common schemes for defining the logical structure of a directory? (MAY/JUNE 2012)

The most common schemes for defining the logical structure of directory

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

9) 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.

10) 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.

11) What are the various layers of a file system?

The file system is composed of many different levels. Each level in the design uses the feature of the lower levels to create new features for use by higher levels.

i. Application programs ii. Logical file system
iii. File-organization module iv. Basic file system
v. I/O control vi Devices

12) What are the structures used in file-system implementation? (APRIL/MAY 2011)

Several on-disk and in-memory structures are used to implement a file system

On-disk structure include

Boot control block
Partition block
Directory structure used to organize the files
File control block (FCB)

In-memory structure include

In-memory partition table
In-memory directory structure System-wide open file table Per-process open table

13) What are the functions of virtual file system (VFS)?

- It separates file-system-generic operations from their implementation defining a clean VFS interface. It allows transparent access to different types of file systems mounted locally.
- VFS is based on a file representation structure, called a vnode. It contains a numerical value for a network-wide unique file .The kernel maintains one vnode structure for each active file or directory.

14) 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.

15) What are the allocation methods of a disk space?

Methods of allocating disk space which are widely in use are

- Contiguous allocation
- Linked allocation
- Indexed allocation

16) What are the advantages of Contiguous allocation?

The advantages are

- Supports direct access
- Supports sequential access
- Number of disk seeks is minimal.

17) What are the drawbacks of contiguous allocation of disk space?

The disadvantages are

- Suffers from external fragmentation.
- Suffers from internal fragmentation.
- Difficulty in finding space for a new file.

- File cannot be extended.
- Size of the file is to be declared in advance.

18) What are the disadvantages of linked allocation?

The disadvantages are

- Used only for sequential access of files.
- Direct access is not supported.
- Memory space required for the pointers.
- Reliability is compromised if the pointers are lost or damaged

19) What are the advantages of Indexed allocation?

The advantages are

- No external-fragmentation problems.
- Solves the size-declaration problems.
- Supports direct access.

20) How can the index blocks be implemented in the indexed allocation scheme?

The index block can be implemented as follows

- Linked scheme
- Multilevel scheme
- Combined scheme

21) What is garbage collection? (MAY /JUNE 2012)

Garbage Collection (**GC**) is a form of automatic memory management. The garbage collector, or just collector, attempts to reclaim garbage, or memory occupied by objects that are no longer in use by the program.

22) Mention the objectives of File Management System. (APR/MAY 2010)

The system that an operating system or program uses to organize and keep track of files. For example, a hierarchical file system is one that uses directories to organize files into a tree structure.

23) What is the content of a typical file control block? (APR/MAY 2011, APR/MAY 2010)

File permissions
File dates (create, access, write)
File owner, group, ACL
File size
File data blocks

File Control Block (**FCB**) is a file system structure in which the state of an open file is maintained.

24) What are the two types of system directories? (MAY/JUNE 2012)

Device directory, describing physical properties of files.
File directory, giving logical properties of the files.

25) What is meant by polling?(MAY/JUNE 2014)

Polling is the process where the computer waits for an external device to check for its readiness. The computer does not do anything else than checking the status of the device .Polling is often used with low-level hardware. Example: when a printer connected via a parallel port the computer waits until the next character has been received by the printer. These processes can be as minute as only reading 1 Byte. Polling is the continuous (or frequent) checking by a controlling device or process of other devices, processes, queues, etc.

26) State any three disadvantages of placing functionality in a device controller, rather than in the kernel. (MAY/JUNE 2014)

Three advantages:-

a. Bugs are less likely to cause an operating system crash.
b. Performance can be improved by utilizing dedicated hardware and hard-coded algorithms.
The kernel is simplified by moving algorithms out of it.

Three disadvantages:

a. Bugs are harder to fix - a new firmware version or new hardware is needed
b. Improving algorithms likewise require a hardware update rather than just kernel or device driver update
c. Embedded algorithms could conflict with application‘s use of the device, causing decreased performance

27) How free-space is managed using bit vector implementation?

The free-space list is implemented as a bit map or bit vector. Each block is represented by 1 bit. If the block is free, the bit is 1; if the block is allocated, the bit is 0.

28) List the attributes of a file(MAY/JUNE 2014)

Name, Identifier, Type, Location, Size, Protection, Time, Date and User authentication.

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DEPARTMENT OF INFORMATION TECHNOLOGY

U23ITT42 - OPERATING SYSTEMS

PART A – 2 MARK QUESTION WITH ANSWER

UNIT V - VIRTUAL MACHINES AND MOBILE OS

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

1) What is Linux distribution?

A Linux distribution includes all the standard components of the Linux system, plus a set of administrative tools to simplify the initial installation and subsequent upgrading of Linux and manage installation and removal of other packages on the system.

2) What is the use of User mode?

Under Linux, no user code is built into the kernel. Any operating-system-support code that does not need to run in kernel mode is placed into the system libraries and runs in user mode.

3) What are the components of kernel mode

The module support under Linux has four components:

1. The **module-management** system allows modules to be loaded into memory and to communicate with the rest of the kernel.
2. The **module loader and unloader,** which are user-mode utilities, work with the module-management system to load a module into memory.
3. The **driver-registration system** allows modules to tell the rest of the kernel that a new driver has become available.
4. **A conflict-resolution mechanism** allows different device drivers to reserve hardware resources and to protect those resources from accidental use by another driver.

4) What is process Identity?

Each process has a unique identifier. The PID is used to specify the process to the operating system when an application makes a system call to signal, modify, or wait for the process. Additional identifiers associate the process with a process group (typically, a tree of processes forked by a single user command and login session.

5) Define DNS

The Domain Name System (DNS) provides host-name-to-network-address translations for the entire Internet. Before DNS became widespread, files containing the same information were sent via e-mail or ftp between all networked hosts.

6) What is virtualization?

Virtualization, in computing, refers to the act of creating a virtual (rather than actual) version of something, including but not limited to a virtual computer hardware platform, operating system (OS), storage device, or computer network resources.

7) What is pluggable authentication modules

The pluggable authentication modules (PAM) system is based on a shared library that can be used by any system component that needs to authenticate users. An implementation of this system is available under Linux. PAM allows authentication modules to be loaded on demand as specified in a system-wide configuration file. If a new authentication mechanism is added at a later date, it can be added to the configuration file, and all system components will immediately be able to take advantage of it. PAM modules can specify authentication methods, account restrictions, session setup functions, and password-changing functions (so that, when users change their passwords, all the necessary authentication mechanisms can be updated at once).

8) What is the use of firewall manager

The firewall manager maintains a number of separate firewall chains and allows a skbuff to be matched against any chain. Chains are reserved for separate purposes: one is used for forwarded packets, one for packets being input to this host, and one for data generated at this host. Each chain is held as an ordered list of rules, where a rule specifies one of a number of possible firewall-decision functions plus some arbitrary data for matching purposes.

9) Do FAT file system is advantageous? Why?

FAT File System is best for cross-compatibility with other platforms. There are NTFS file system drivers for Linux, but not really for Windows. FAT, however, can be read more or less transparently by both operating systems. There is also a slight speed gain in FAT.

10) What is the responsibility of kernel in Linux operating system?

Kernel is the core part of Linux. It is responsible for all major activities of this operating system. It is consists of various modules and it interacts directly with the underlying hardware. Kernel provides the required abstraction to hide low level hardware details to system or application programs.

11) Why Virtualization is required? (Nov/Dec 2015)

Virtualization reduces the number of physical servers, reducing the energy required to power and cool them. Save time. With fewer servers, you can spend less time on the manual tasks required for server maintenance. It's also much faster to deploy a virtual machine than it is to deploy a new physical server.

12) Enumerate the requirements for Linux system administrator. Brief any one. (Nov/Dec 2015)

1. While specific knowledge is a boon, most hiring managers require that you possess basic knowledge about all aspects of Linux. For example, a little knowledge about Solaris, BSD or various flavors of Linux never hurt anyone!
2. Knowledge in at least one of the upper tier scripting language is a must. You have options before you, for instance, Python, Perl, Ruby or more, but you need to make yourself proficient in at least one of them.
3. Experience is welcome, but you at least need to have some hands-on experience of system management, system setup and managing Linux or Solaris based servers as well as configuring them.
4. Knowledge in shell programming and architecture is valued very much in the job market. If you know Buorne or Korn well, you can even score a high-paying salary with minimal experience.
5. Storage technologies like FC, NFS or iSCSI is great, while knowledge regarding backup technologies is a must for a system administrator.

13) State the components of a Linux System? (May/Jun 2016)

- **Kernel:** The kernel is responsible for maintaining all the important abstractions of the operating system, including such things as virtual memory and processes.
- **System libraries:** The system libraries define a standard set of functions through which applications can interact with the kernel. These functions implement much of the operating-system functionality that does not need the full privileges of kernel code.
- **System utilities:** The system utilities are programs that perform individual, specialized management tasks. Some system utilities are invoked just once to initialize and configure some aspect of the system.

14) Define the function of Caching-only servers. (May/Jun 2016)

All DNS servers cache answers to queries they receive from outside their own zone of authority. A cache-only DNS server is not authoritative for any zone. Related Topics: DNS root servers: Root servers are critical to the function of a DNS server that is directly connected to the Internet.

15) What is virtualization? (NOV/DEC 2016)

In computing, virtualization refers to the act of creating a virtual (rather than actual) version of something, including virtual computer hardware platforms, storage devices, and computer network resources.

16) What scheduling algorithm is used in linux operating system to schedule jobs? (NOV/DEC 2016)

The Completely Fair Scheduler (CFS) Algorithm is used in Linux operating system to schedule jobs.

17) Mention any two features of Linux file systems. (APR/MAY 2017**)**

- Portable
- Open Source
- Multi user
- Multi Programming

18) Enlist the advantages of using kernel modules in Linux (APR/MAY 2017)[U]

- Loading and unloading a module is much more flexible and faster than recompiling a kernel and rebooting.
- You can try different options each time you load a module. Most drivers that handle hardware will take options for I/O addresses, IRQ or DMA numbers, plus more esoteric options like full or half duplex. When you have problems getting a card to run correctly, the ability to try different options can save hours.
- Makes it easier to maintain multiple machines on a single kernel base.

19) List the advantages and disadvantage of writing an operating system in high level language such as C. (APR/MAY 2018)

The code can be written faster, is more compact, and is easier to understand and debug. In addition, improvements in compiler technology will improve the generated code for the entire operating system by simple recompilation. Finally, an operating system is far easier to port to move to some other hardware if it is written in a higher- level language

20) What is handle? How does a process obtain a handle? [U] (APR/MAY 2018)

The handle is an integer value in the operating system assigned to the associated process when the process was started. The system uses this handle to keep track of process attributes. An application can obtain a handle to a process that can be used as a parameter to many process- information and control functions.

21. Write short notes on driver registration in Linux. (APR/MAY 2019)

The **driver registration** allows modules to tell the rest of the kernel that a new driver has become available.

22. List out the methods used to recover from the deadlock. (APR/MAY 2019)

We can use a protocol to prevent or avoid deadlocks, ensuring that the system will *never* enter a deadlocked state.

• We can allow the system to enter a deadlocked state, detect it, and recover.

• We can ignore the problem altogether and pretend that deadlocks never occur in the system.

23. What are the Components of a Linux System?

Every OS has component parts, and the Linux OS also has the following components parts:

- Boot loader
- OS Kernel
- Background services
- OS Shell
- Graphics server
- Desktop environment
- Applications.

PART B – QUESTION BANK

UNIT I – INTRODUCTION

1. Describe system calls and system programs in detail with neat sketch. **(ND06, ND12, MJ03, MJ09, MJ13, MJ14, ND15, MJ15, MJ23, ND23)**
2. Explain the various structures of an operating system.
   (MJ10, ND10, MJ18, ND13, ND15, MJ17, ND23)
3. Explain evaluation or types of Operating system
   (MJ11, MJ12, MJ06, MJ047, MJ08, MJ13, ND17, ND23)
4. Explain the concept of multiprocessor and Multicore organization **(M J13, MJ16, MJ17)**
5. Explain Cache memory and its mapping? **(ND17)**
6. Discuss about Direct Memory Access **(MJ15, MJ17)**
7. Discuss about the functionality of System boot with respect to operating system **(MJ15, MJ17)**
8. Explain computer system organization? **(ND15)**
9. Discuss Interrupt and Interrupt handler?
10. With neat sketch discuss computer system overview?

UNIT II – PROCESS MANAGEMENT

1. Explain Process States and Process Scheduling? **(MJ06, MJ07, MJ09, MJ10, ND06, ND08, ND10, ND12, ND13, ND17, MJ23, MJ24)**
2. Explain about Interposes Communication? **(MJ11, ND06, ND08, MJ09, MJ10)**
3. Explain Threads and Multithreading models? discuss the threading issues which are concerned with multi thread program? **MJ12, MJ08, MJ09, MJ11, MJ12)**
4. Write about the various CPU Scheduling Algorithms? **(MJ08, ND12, MJ11, ND09, ND11, MJ13, MJ10, MJ14, MJ18, ND13, ND17, MJ23, ND23)**

5. What is critical section problem and explain two process solutions and multiple process solutions? **(ND06, ND08, ND10, ND12, MJ06, MJ07, MJ08, MJ9, MJ10, ND11, MJ13)**
6. Write semaphore in details? **(MJ11, ND07, ND09, MJ10, MJ12, MJ06, MJ13, MJ23, MJ24, ND23)**
7. Explain about the characteristics of Deadlock and the methods used to prevent deadlocks? (**MJ10, MJ12, ND09, MJ08, ND23)**
8. Write in detail about deadlock avoidance? **(MJ11, ND12, MJ09, MJ10, MJ12, MJ13, ND13, MJ23, MJ24)**
9. Give an account about deadlock detection and Recovery? **(ND09, MJ08, ND11, MJ10, MJ11, MJ13, ND13)**
10. Explain the implementation of procedure / consumers problem using Monitor? **(ND08, ND09)**

UNIT III – MEMORY MANAGEMENT

1. Explain about contiguous memory allocation? **(MJ09, ND11, MJ10)**
2. Give the basic concepts about paging? **(ND12, MJ08, ND06, MJ9, MJ11, ND11, MJ23, ND23)**
3. Write about the techniques for structuring the page table? **(MJ11, ND11, MJ13, MJ14)**
4. Explain the basic concepts of segmentation? **(MJ110, ND08, ND09, MJ10, ND17, MJ24)**
5. Discuss the hardware support for demand paging and explain how logical address is translated into physical address? **(ND07, ND08, ND10, ND11, ND12, ND07, MJ10, MJ06, MJ14, ND13, MJ24)**
6. Explain the various page replacement strategies **(ND09, ND12, MJ08, MJ10, MJ11, ND08, MJ12, MJ18, ND13, MJ18, MJ16, MJ23)**
7. What are the causes of thrashing? Explain working set model with an example? **(MJ09, MJ13)**
8. Discuss basic concept of memory management?
9. Write short notes on swapping and virtual memory? **(MJ08)**
10. Explain address translation in a combined paging and segmentation scheme? **(MJ12)**

UNIT IV – STORAGE MANAGEMENT

1. Discuss about the various file access methods? **(ND08, MJ12, ND11, ND10, MJ13, MJ14, MJ23)**
2. Explain the various File Directory structure? **(MJ10, MJ12, ND07, ND12, ND10, MJ11, MJ13, MJ14, MJ15)**

3. Explain about Kernel I/O to subsystem in detail? **(ND12, MJ10)**
4. Explain the different disk scheduling algorithm with neat diagram? **(MJ12, ND12, ND06, ND10, ND11, MJ10, MJ13, MJ11, ND13, ND17, MJ23, MJ24)**
5. Write about free space management and recovery? **(MJ11, MJ09, MJ10, MJ12, MJ13, ND10)**
6. Discuss the various level of RAID **(MJ11, MJ12, MJ10, MJ13, MJ15, ND12, ND10, ND13)**
7. Discuss the various methods for file implementation and Directory implementation? **(MJ8, ND07, ND13, MJ23)**
8. Briefly explain the Disk management and swap space management? **(ND06, MJ12)**
9. Explain File allocation methods on Secondary storage device? **(MJ09, MJ10, MJ12, MJ08, MJ11, MJ10, MJ13, ND06, ND08, ND10, ND11, ND12)**
10. Explain about I/O system organization with necessary diagrams? **(MJ10, MJ11, ND10)**

UNIT V - VIRTUAL MACHINES AND MOBILE OS

1. Explain Types of virtual machine in details. **(MJ23, ND23)**
2. Outline the operating system aspects of virtualization in the context of operating system functions scheduling , I/O and memory management. **(MJ23)**
3. Describe the three types of traditional hypervisor **(MJ24)**
4. Discuss about the mobile operating system with suitable example **(MJ24)**
5. Describe four virtualization – like execution environments and explain how they are differ from "true" virtualization **(MJ24)**
6. Explain the architecture of android OS **(ND23)**
7. Explain in detail about iOS and SDK frame work? **(ND16, ND15, MJ17)**
8. Explain Android Architecture Layer? **(MJ17)**