

DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE, PERAMBALUR

U23AIT43-OPERATING SYSTEM

TWO MARK QUESTIONS WITH ANSWERS

UNIT -1 OPERATING SYSTEM OVERVIEW

1. What is meant by Mainframe Systems?

Mainframe systems are the first computers developed to tackle many commercial and scientific applications. These systems are developed from the batch systems and then multiprogramming system and finally time-sharing systems.

2. What is meant by Batch Systems?

In this, operators batched together jobs with similar needs and ran through the computer as a group. The operators would sort programs into batches with similar requirements and as system become available, it would run each batch.

3. What is meant by Multiprogramming?

Several users simultaneously compete for system resources (i.e) the job currently waiting for I/O will yield the CPU to another job which is ready to do calculations, if another job is waiting. Thus it increases CPU utilization and system throughput.

4. What is meant by Time-sharing Systems?

Time Sharing is a logical extension of multiprogramming. Here, CPU executes multiple jobs by switching among them, but the switches occur so frequently that the users can interact with each program while it is running.

5. What are the Components of a Computer System?

- Application Programs
- System Program
- Operating System
- Computer Hardware

6. What are the advantages of Multiprogramming?

- Increased System Throughput
- Increased CPU utilization

7. What are Multiprocessor System?

Multiprocessor systems have systems more than one processor for communication, sharing the computer bus, the memory, clock & peripheral devices.

8. What are the advantages of multiprocessors?

- Increased throughput
- Economy of scale
- Increased reliability

9. 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 – Store's 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.

10. 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.

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

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

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

- 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.

12. 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

13. How are multiple interrupt dealt with? [An]

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.

14. 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

15. 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.

16. What is meant by symmetric multiprocessing?

In Symmetric multiprocessing, each processor runs an identical copy of the operating system and these copies communicate with one another as needed.

17. What is meant by Asymmetric Multiprocessing?

In Asymmetric multiprocessing, each processor assigned a specific task. A master processor controls the system and the other processors either look to the master for instruction or have predefined tasks. This master processor also schedules and allocates work to the slave

18. What are Operating Services?

Normally, an operating system provides certain services to programs and to the users of those programs. Some of them are:

- Program Execution.
- I/O operations
- File-system manipulation
- Communications
- Error Detection

19. What is System Programs?

System programs provide a convenient environment for program development and execution. Some of these programs are user interfaces to system calls and others are more complex.

Some of them are:

- File Management
- Status Information
- File modification
- Programming Language support
- Program loading, execution and communication.

20. What is meant by System Calls?

The System Calls acts as a interface to a running program and the Operating system. These system calls available in assembly language instructions.

21. 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.

22. List the Services of operating system function.

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

23. 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.

24. Define system call.

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

24. Do timesharing differ from Multiprogramming? If so, How?

Time Sharing: here, OS assigns some time slots to each job. Here, each job is executed according to the allotted time slots.

Job1: 0 to 5 Job2: 5 to 10 Job3: 10 to 15

Multi-Tasking: in this operating system, jobs are executed in parallel by the operating system. But, we can achieve this multi-tasking through multiple processors (or) multicore CPU only.

CPU1: Job1 CPU2: Job2 CPU3: Job3

25. Why API s need to be used rather than system calls?

System calls are much slower than APIs (library calls) since for each system call, a context switch has to occur to load the OS (which then serves the system call). Most details of OS interface hidden from programmer by API Managed by run-time support library (Set of functions built into libraries included with compiler.)

26. Describe the actions taken by a thread library to context switch between user-level threads.

The user-level threads are known only within a given process. To context switch, we only need to save the thread-specific context: the program counter, CPU registers, and the thread-specific stack pointer

27. What is the purpose of system programs?

System programs can be thought of as bundles of useful system calls. They provide basic functionality to users so that users do not need to write their own programs to solve common problems.

28. What are the advantages of peer-to-peer systems over client-server systems?

- It is easy to install and so is the configuration of computers on this network, all the resources and contents are shared by all the peers, unlike server-client architecture where Server shares all the contents and resources.
- P2P is more reliable as central dependency is eliminated. Failure of one peer

doesn't affect the functioning of other peers. In case of Client –Server network, if server goes down whole network gets affected.

- There is no need for full-time System Administrator. Every user is the administrator of his machine. User can control their shared resources.
- The over-all cost of building and maintaining this type of network is comparatively very less.

29. Compare and contrast DMA and cache memory.

- DMA is a hardware device that can move to/from memory without using CPU instructions.
- For instance, a hardware device (lets say, your PCI sound device) wants audio to play back. You can either:
 - Write a word at a time via a CPU mov instructions.
 - Configure the DMA device. You give it a start address, a destination, and the number of bytes to copy. The transfer now occurs while the CPU does something else instead of spoon feeding the audio device.
- DMA can be very complex (scatter gather, etc), and varies by bus type and system.

30. Write the difference between Batch systems and Time sharing systems.

- A batch is a sequence of jobs. This batch is submitted to batch processing operating systems, and output would appear some later time in the form of a program or as program error. To speed up processing similar jobs are batched together.
- The major task of batch operating systems is to transfer control automatically from one job to next. Here the operating is always in the memory.
- Time sharing or multi-tasking is a logical execution of multiprogramming. Multiple jobs are executed by the CPU switching between them. Here the computer system provides on line communication between the user and the system.
- Here the CPU is never idle. Time shared operating system allows many users to share the computer simultaneously.
- Time sharing systems requires some sort of memory management and protection.

PART-B

1. Explain Operating System Structure and components.
2. Discuss multiprocessor systems in detail?
3. Explain in detail the types of system calls provided by a typical operating system.
4. Explain the purpose of system calls and discuss the calls related to device management and communications in brief.
5. Explain in detail about Evolution of operating system?
6. Explain in detail about Computer system overview
7. Write short notes on operating system services and components.
8. Write in detail about the system call and system program.
9. Explain in detail about Batch system and multiprogramming system

UNIT -2 PROCESS MANAGEMENT

1. Define Process.

Process is defined as

Program in execution

A synchronous activity.

The "animated spirit" of a procedure

The "locus of control of a procedure in execution which is manifested by the existence of a "process control block" in the operating system

That entity to which processors are assigned the dispatch able unit

2. What are the different process states available?

Running, if it currently has the CPU

Ready, if it could use a CPU if one were available

Blocked, if it is waiting for some event to happen before it can proceed

3. What is meant by Dispatching?

The Process of assignment of the CPU to the first process on the ready list is called as Dispatching.

4. What is FPCB?

FPCB is a data structure containing certain important information about the process including the following:

Current state of the process

Unique identification of the process

A pointer to the process's parent

A pointer to the process's child

The process's priority

Pointers to locate the process's memory and to allocated resources.

5. How is Blocked state different from others?

The Blocked state is different from others because the others are initiated by entities external to the process.

6. What are the different operations that can be performed on a process?

1) Create a process

2) Destroy a process

- 3) Change a process's priority
- 4) Wakeup a process
- 5) Enable a process to communicate with others
- 6) Suspend a process
- 7) Resume a process
- 8) Block a process

7. What is meant by Creating a Process?

Creating a process involves many operations including

- 1) Name the process
- 2) Insert it in the system's known processes list
- 3) Determine the process's initial priority
- 4) Create the process control block
- 5) Allocate the process's initial resources

8. What is means by Resuming a Process?

Resuming a process involves restarting it from the point at which it was suspended.

9. What is meant by Suspending a Process?

Suspending is often performed by the system to remove certain processes temporarily to reduce the system load during a peak loading situation.

10. What is meant by Context Switching?

When an interrupt occurs, the operating system saves the status of the interrupted process routes control to the appropriate first level interrupt handler.

11. What is meant by PSW?

Program Status Words (PSW) controls the order of instruction execution and contains various information about the state of a process. There are three types of PSW's namely

- Current PSW
- New PSW
- Old PSW

12. Define Mutual Exclusion.

Each process accessing the shared data excludes all others from doing simultaneously called as Mutual Exclusion.

13. What is meant by Co-operating process?

If a process can affect or be affected by the other processes executing in the system, that process which shares data with other process is called as Co-operating process.

14. What is meant by Interrupt?

An Interrupt is an event that alters the sequence in which a processor executes instructions. It is generated by the hardware of the computer System.

15. What is meant by Degree of Multiprogramming? And when it is said to be Stable?

Degree of Multiprogramming means the number of processes in memory. And it is said to be stable when the average rate of the number of process creation is equal to the average

departure rate of processes leaving the system.

16. What is meant by CPU-bound process?

A CPU-bound process generates I/O requests infrequently using more of its time doing computation than an I/O processes. If all processes are CPU-bound, the I/O waiting queue will almost be empty and the devices will go unused and the system will be unbalanced.

17. What is meant by I/O-bound process?

An I/O-bound process spends more of its time doing I/O than it spends doing computations .If all processes are I/O-bound, the ready queue will almost be empty.

18. What is meant by Independent process?

A Process is Independent if it cannot affect or be affected by the other processes executing in the system. Here no process shares its data with other process available.

19. What is meant by Direct Communication?

In Direct communication, each process that wants to communicate must explicitly name the recipient or sender of the communication. In this scheme, the Send & Receive primitives are defined as

send (p , message) - Send a message to process P
receive (p , message) - Receive a message to process p

20. What is meant by Indirect Communication?

In Indirect Communication, the messages are sent to and received from mailboxes or ports. A mailbox is an object into which messages can be placed by processes and from which messages can be removed. In this scheme, the Send & Receive primitives are defined as:

send (A , message) - Send a message to mailbox A.
receive (A , message) - Receive a message from mailbox A.

21. What are benefits of Multiprogramming?

Responsiveness
Resource Sharing
Economy
Utilization of multiprocessor architectures.

22. What are the conditions that must hold for Deadlock Prevention?

Mutual Exclusion Condition
Hold and Wait Condition
No Pre-emption condition
Circular Wait Condition.

23. What are the options for breaking a Deadlock?

Simply abort one or more process to break the circular wait.
Preempt some resources from one or more of the deadlocked processes.

24. What are the algorithms available for Deadlock avoidance?

1) Resource-Allocation Graph Algorithm

- 2) Banker's Algorithm
 - a. Safety Algorithm
 - b. Resource-Request Algorithm

25. What is a Monitor?

A Monitor is characterized by a set of programmer-defined operators. The representation of a Monitor type consists of declaration of variables whose value define the state of an instance of the type, as well as the bodies of procedures or functions that implement operations on the type.

26. What is meant by Counting Semaphore?

A Counting Semaphore is a semaphore whose integer value that can range between 0 & 1.

27. What is meant by Binary Semaphore?

A Binary Semaphore is a semaphore with an integer value that can range between 0 and 1. It can be simpler to implement than a counting semaphore, depending on the underlying hardware architecture.

28. What is meant by Race Condition?

A condition, when several processes access and manipulate the same data on currently and the outcome of the execution depends on the particular order in which the access takes place is called as Race condition.

29. What does a solution for Critical-Section Problem must satisfy?

Mutual Exclusion.
Progress
Bounded Waiting

30. What is meant by Indefinite Blocking or Starvation?

Indefinite Blocking is a situation where process waits indefinitely within the semaphore. This may occur if we add and remove processes from the list associated with a semaphore in LIFO order.

31. What is meant by CPU Scheduler?

When the CPU becomes idle, the operating system must select one of the processes in the ready queue to be executed .This selection process is carried out by the CPU Scheduler.

32. What is meant by CPU Scheduling?

The process of selecting among the processes in memory that are ready to execute and allocates the CPU to one of them is called as CPU Scheduling.

33. What are the types of Scheduling available?

Preemptive Scheduling
Non - preemptive Scheduling
Priority Scheduling

34. What is meant by Priority Scheduling?

The basic idea here is straight toward. Each process is assigned a priority and the run able process with the highest priority is allowed to run.

35. What is Preemptive Scheduling?

A Scheduling discipline is Pre-emptive if the CPU can be taken away before the process completes.

36. What is Non - Preemptive Scheduling?

A Scheduling discipline is non pre-emptive if once a process has been given the CPU, the CPU cannot be taken away from the process.

37. What are the properties of Scheduling Algorithms?

- CPU Utilization
- Throughput
- Turnaround time
- Waiting time
- Response time

38. What is known as Resource Reservation in Real time Scheduling?

The Scheduler either admits the process, guaranteeing that the process will complete on time or rejects the request as impossible. This is known as Resource Reservation.

39. What is known as Priority inversion?

The high priority process would be waiting for a lower -priority one to finish. This situation is known as Priority Inversion.

40. What is meant by Dispatch latency?

The time taken by the dispatcher to stop one process and start another running is known as Dispatch Latency.

41. What is meant by Dispatcher?

It is a 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

42. What is meant by First Come, First Served Scheduling?

In this Scheduling, the process that requests the CPU first is allocated the CPU first. This Scheduling algorithm is Non Pre-emptive.

43. What is meant by Shortest Job First Scheduling?

When the CPU is available, it is assigned to the process that has the smallest next CPU burst. This Scheduling algorithm is either Pre-emptive or Non Pre-emptive.

44. What is meant by Priority Scheduling?

A Priority is associated with each process and the CPU is allocated to the process with the highest priority. This is also either Pre-emptive or Non-Pre-emptive.

45. What is meant by Memory-Management Unit?

The run-time mapping from virtual to physical addresses is done by a hardware device called as Memory Management Unit.

46. What is meant by Input Queue?

The Collection of processes on the disk that is waiting to be brought into memory for execution forms the Input Queue.

47. What is Round-Robin Scheduling?

In Round-Robin Scheduling, processes are dispatched FIFO, but are given a limited amount of CPU time. If a process doesn't complete before its CPU time expires, the CPU is Pre-empted and given to the next waiting process. The Pre-empted is then placed at the back of the ready list.

PART-B

1) Explain the FCFS, preemptive and non-preemptive versions of Shortest-Job First and Round Robin (time slice = 2) scheduling algorithms with Gantt charts for the four Processes given. Compare their average turnaround and waiting time.

Process Arrival Time Waiting Time

P1 0 8

P2 1 4

P3 2 9

P4 3 5

2) Discuss how scheduling algorithms are selected for a system. What are the criteria considered? Explain the different evaluation Methods.

3) Write in detail about several CPU scheduling algorithms. [

4) What is critical section? Specify the requirements for a solution to critical section problem.

5) How monitors help in process synchronization.

6) Write in detail about deadlock avoidance.

7) Write in detail about deadlock recovery.

8) Explain the Banker algorithm for deadlock avoidance in detail with an example.

9) Consider the following set of processes, with the length of the CPU – burst time given in Milliseconds:

Process Burst Time Priority

P1 10 3

P2 1 1

P3 2 3

P4 1 4

P5 5 2

The processes are arrived in the order P1, P2, P3, P4, P5, all at time 0.

1. Draw 4 Gantt charts illustrating the execution of these processes using FCFS, SJF Priority and RR (Time Slice = 1) scheduling

2. What is the turnaround time of each process for each of the scheduling?

3. Calculate the waiting time for each of the process

10. Discuss in detail the critical section problem and also write the algorithm for Readers-Writers Problem with semaphores

11) Explain the FCFS, preemptive and non-preemptive versions of Shortest-Job First and Round Robin (time slice = 2) scheduling algorithms with Gantt charts for the four Processes given. Compare their average turnaround and waiting time. [Ap] (APR/MAY 2015)

Process Arrival Time Waiting Time

P1 0 10

P2 1 6

P3 2 12

P4 3 15

Discuss how deadlocks could be detected in detail.

12) Show how wait () and signal () semaphore operations could be implemented in multiprocessor environments using the test and set instruction. The solution should exhibit minimal busy waiting. Develop pseudo code for implementing the operations.

13) Discuss about the issues to be considered in the multithreaded program.

14) i) What is a process? Discuss components of process and various states of a process with the help of a process state transition diagram. (8)

ii) Write the difference between user thread and kernel thread. (5)

UNIT-III MEMORY MANAGEMENT

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.

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 5 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

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 a relocatable load format. The main program is loaded into memory and executed. The calling routine checks whether the routine has been loaded. If not, there a relocatable linking loader is called to load the desired program into memory.

6. Define dynamic linking.

Dynamic linking is similar to dynamic loading, rather than 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 satisfies 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. 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.

10. What do you mean by thrashing?

Thrashing is the coincidence of high page traffic and low CPU utilization.

11. 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.

12. 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 that will be needed.

Example: - Solaris uses pre paging.

13. Define logical address and physical address.

An address generated by the CPU is referred to 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

14. 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).

15. 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.

16. 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.

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 the various page replacement algorithms used for page replacement?

- FIFO page replacement
- Optimal page replacement
- LRU page replacement
- LRU approximation page replacement
- Counting based page replacement
- Page buffering algorithm.

19. 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.

20. How does the system detect thrashing?

Thrashing is caused by under allocation of the minimum number of pages required by a process, forcing it to continuously page fault. The system can detect thrashing by evaluating the level of CPU utilization as compared to the level of multiprogramming. It can be eliminated by reducing the level of multiprogramming.

21. Name two differences between logical and physical addresses.

A logical address does not refer to an actual existing address; rather, it refers to an abstract address in an abstract address space. Contrast this with a physical address that refers to an actual physical address in memory. A logical address is generated by the CPU and is translated into a physical address by the memory management unit(MMU). Therefore, physical addresses are generated by the MMU.

22. Why page are sizes always powers of 2?

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.

23. What is the purpose of paging the page tables

A page table is the data structure used by a virtual memory system in a computer operating system to store the mapping between virtual addresses and physical addresses. Virtual addresses are used by the accessing process, while physical addresses are used by the hardware, or more specifically, by the RAM subsystem.

24. What is the difference between a user-level instruction and a privilege instruction? Which of the following instruction should be privileged and only allowed to execute in kernel mode?[An]

- (a) Load a value from a memory address to a general-purpose register
- (b) Set a new value in the program counter (PC) register
- (c) Turn off interrupts (APR/MAY 2017)

Privileged instruction

- A privileged instruction is a processor op-code (assembler instruction) which can only be executed in "supervisor" (or Ring-0) mode. These types of instructions tend to be used to access I/O devices and protected data structures from the windows kernel.

User Level instruction

- User-level is generic and can run on any operating system.
- ✓ Load a value from a memory address to a general-purpose register (User Level Instruction)
- ✓ Set a new value in the program counter (PC) register (User Level Instruction)
- ✓ Turn off interrupts (privilege Instruction)

25. Will optimal page replacement algorithm suffer from Belady's anomaly? Justify your answer (APR/MAY 2017)[An]

In computer storage, Belady'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.

26. Define external 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 memory request cannot be satisfied as the memory available is in a non-contiguous manner. Either first-fit or best-fit memory allocation strategy will cause external fragmentation.

PART-B

1. Describe the hierarchical paging technique for structuring page tables.
2. What is the cause for thrashing? How does the system detect thrashing? Once it detects, what can the system do to eliminate this problem?
3. Write in detail about Segmentation.
4. Write in detail about Segmentation with Paging.
5. Explain the segmentation with paging implemented in OS/2 32-bit IBM system. Describe the following algorithms:
 - a. First fit
 - b. Best Fit
 - c. Worst Fit

6. Explain how paging supports virtual memory. With a neat diagram explain how logical address is translated into physical address.
7. Explain the principles of segmented and paging implemented in memory with a diagram.
8. Explain the segmentation with paging implemented in MULTICS system
9. Explain the various page table structures in detail.

10. Write short notes on LRU, FIFO and clock replacement strategies?

11. Explain any four-page replacement algorithms in detail?

12.(i) Why page sizes are always powers of 2?

(ii) Consider the following segment table:

Segment Base Length

i. 0 0219 600

ii. 1 2300 14

iii. 2 090 100

iv. 3 1327 580

v. 4 1952 96

13. What are the physical addresses for the following logical addresses? 0430

110

2500

400

4112

14. What is thrashing? Explain the working set model in detail.

15. Given memory partitions of 100KB, 500KB, 200KB, 300KB and 600KB (in order), how would each of the first-fit, best-fit and worst-fit algorithms place processes of 212KB, 417KB, 12KB and 426KB (in order)? Which algorithm makes the most efficient use of memory?

16.(i) Explain in briefly and compare, fixed and dynamic memory partitioning schemes.

(ii) Explain FIFO, optimal and LRU page replacement algorithms with an example reference Strings. Mention the merits and demerits of each of the above algorithms.

17. Consider the following page reference string

1,2,3,4,2,1,5,6,2,1,3,7,6,3,2,1,3,6.

How many page faults would occur for the following replacement algorithms, assuming one, two, three and four frames?

i) LRU replacement

ii) FIFO replacement

iii) Optimal replacement

18.(i) Consider the following page reference string:

i. 2, 1, 0, 3, 4, 0, 0, 0, 2, 4, 2, 1, 0, 3, 2.

How many page faults would occur if the working set policy were used with a window size of 4? Show when each page fault would occur clearly.

(ii) What is meant by thrashing? Discuss in detail.

19. Explain the concept of demand paging in detail with neat diagram

20. Why are translation look-aside buffers important? Explain the details stored in a TLB table entry?

21. Consider the following page reference string :

1,2,3,4,2,1,5,6,1,2,3,7,6,3,2,1,2,3,6. How Many page faults would occur for the LRU, FIFO, LFU and optimal page replacement algorithms, assuming two and five frames?

22. Explain the concept of demand paging and the performance issue of short process. Explain the issue of demand.

23. With a neat sketch, explain how logical address is translated into physical address using paging mechanism?

24. Write short notes on Memory Mapped Files

UNIT -4 STORAGE MANAGEMENT

1. What is known as Dynamic loading?

With Dynamic loading, a routine is not loaded until it is called. All routines are kept on disk in a re-locatable load format. The main program is loaded into memory and is executed. When a routine needs to call another routine, the calling routine first checks to see whether the another routine has been loaded. If not, the re-locatable linking loader is called to load the desired routine into memory and to update the program's address tables to reflect this change. Then, Control is passed to the newly loaded routine.

2. What is meant by Swapping?

It is a process of bringing in each process in its entirety, running it for a while and then putting it back on the disk.

3. What is the advantage of Dynamic Loading?

The advantage of Dynamic Loading is that an unused routine is never loaded. (i.e) when large amounts of code are needed to handle infrequently occurring cases, such as error routines. Here although program size may be large, the portion that is used may be much smaller and better memory space utilization.

4. What is known as Dynamic Linking?

In this Dynamic Linking, a stub is included in the image for each library-routine reference. This Stub is a small piece of code that indicates how to locate the appropriate memory-resident library routine or how to load the library if the routine is not already present.

5. What is meant by External Fragmentation and Internal Fragmentation?

External Fragmentation exists when enough total memory space exists to satisfy a request, but it is not contiguous and storage is fragmented into a large number of small holes.

The memory allocated to a process may be slightly larger than the requested memory. The difference between these two numbers is called as Internal Fragmentation.

6. What is meant by Paging? Give its advantages.

Paging is a Memory-management scheme that permits the physical -address space of a process to be Non-contiguous.

Advantages:

Avoids the considerable problem of fitting the varying -sized memory chunks onto the baking store □

Fragmentation problems are also prevalent baking store, except that access is much slower, so compaction is impossible. □

7. What is TLB and Hit-Ratio?

Translation Lookaside Buffer (TLB) is a small, special and fast cache which is associated with high speed memory.

The Percentage of times that a particular page number is found in the Translation Lookaside Buffer (TLB) is called as Hit- Ratio.

8. What is meant by Segmentation?

Segmentation is a memory-management scheme that supports the user-view memory. Blocks of different size is called as Segments and its associative virtual storage Organization is called as Segmentation.

9. What is meant by Memory Compaction?

When swapping creates multiple holes in memory, it is possible to combine them all into one big one by moving all the processes downward as far as possible.

10. What is meant by overlay?

The idea of overlays is to keep in memory only those instructions and data that are needed at any given time. So, to enable a process to be larger than the amount of memory allocated to it.

11. What is meant by Demand Paging?

Whenever the CPU tries to fetch the first instruction, it gets a page fault causing the OS to bring in the page containing that instruction. Thus the pages are loaded only on demand is called as Demand Paging.

12. What is meant by Locality of reference?

During any phase of execution, the page references only a relative small fraction of its pages. This reference of fraction of all pages is called as Locality of Reference.

13. What are the principal events of Process Creation?

System Initialization. □

Execution of a System call by a running process.

A user request to create a new process.

Initiation of a batch job. □

14. What is meant by Page Fault?

Whenever memory management unit notices that the page is unmapped and causes the CPU to trap to the Operating System. This trap is called as Page Fault.

15. What is meant by Thrashing?

A Program which is causing page faults every few instructions to occur is called as

Thrashing.

16. What is meant by Text File?

A Text File is a sequence of characters organized into lines.

17. What is meant by Source File?

A Source File is a sequence of subroutines and functions, each of which is further organized as declarations followed by executable statements.

18. What is meant by Object File?

An Object file is a sequence of bytes organized into blocks understandable by the system's linker.

19. What is meant by Executable file?

An Executable file is a series of code sections that the loader can bring into memory and execute.

20. What are the Access methods available ?

Sequential Access
Direct Access
Other Access methods

21. What is meant by Page Table?

Page Table is a table which has the ability to mark an entry invalid through a Valid – Invalid bit or special value of protection bits.

PART-B

1) Explain the different disk scheduling algorithms with examples.

2) Explain and compare FCFS, SSTF, C-SCAN and C-LOOK disk scheduling algorithms with examples

3) Write short notes on disk management.

4) Write short notes on file system in Linux.

5) Write an elaborate note on RAID and RAID Levels.

6) Explain the services provided by Kernel I/O subsystem.,

7) Consider the following I/O scenarios on a single-user PC.

- A mouse used with a graphical user interface.
- A tape drive on a multitasking operating system (assume no device preallocation is available)
- A disk drive containing user files.

- A graphics card with direct bus connection, accessible through memory-mapped I/O
- For each of these I/O scenarios, would you design the operating system to use

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

8) Write a brief note on the steps involved in DMA transfer

9) Explain the data structures supported by kernel I/O system

10) Explain the Linked list and indexed file allocation methods with neat diagram. Mention their advantages and disadvantages

UNIT 5-CASE STUDY

1. What are the Components of a Linux System ?

Linux System composed of three main modules. They are :

(i). Kernel (ii). System libraries (iii). System utilities

2. What are the main support for the Linux modules ?.

The Module support under Linux has three components. They are :

- (i). Module Management
- (ii). Driver Registration.
- (iii). Conflict Resolution mechanism.

3. What is meant by Process ?.

A Process is the basic context within which all user-requested activity is serviced within the Operating system.

4. What is meant by Process -ID ?.

Each process has a unique identifier. PID 's are used to specify processes to the operating system when an application makes a system call to signal, modify or wait for another process.

5. What is meant by Personality?.

Process Personalities are primarily used by emulation libraries to request that system call be compatible with certain versions of UNIX.

6. What is meant by Buffer cache ?.

It is the kernel's main cache for block-oriented devices such as disk drives and is the main mechanism through which I/O to these devices is performed.

7. What is the Disadvantage of Static Linking ?.

The main disadvantage of static linking is that every program generated must contain copies of exactly the same common system library functions.

8. What is meant by Kernel in Linux system ?.

Kernel is responsible for maintaining all the important abstractions of the operating system including such things as virtual memory and processes.

9. What is meant by System Libraries?.

System Libraries define a standard set of functions through which applications can interact with the kernel and that implement much of the operating -system functionality that doesn't need the full privileges of kernel code.

10. What is meant by System Utilities?.

System Utilities are system programs that perform individual, specialized management

11. What is meant by Data Striping?

Data Striping means splitting the bits of each byte across multiple disks .It is also called as Bit -level Striping

12. What is meant by Boot Disk ?.

A Disk that has a boot partition is called as Boot Disk.

tasks. Some of the System utilities may be invoked just to initialize and configure some aspect of the system and others may run permanently, handling such tasks as responding to incoming network connections, accepting logon requests from terminals or updating log files.

11. What is the function of Module management ?

The module management allows modules to be loaded into memory and to talk to the rest of the kernel.

12. What is the function of Driver registration?.

Driver Registration allows modules to tell the rest of the kernel that a new driver has become available

13. What is the function of Conflict Resolution mechanism?.

This mechanism allows different device drivers to reserve hardware resources and to protect those resources from accidental use by another driver.

14. What is meant by Device drivers?.

Device drivers include (i) Character devices such as printers, terminals (ii) Block devices (including all disk drives) an network interface devices.

