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Introduce

1. What is operating system?

- a) collection of programs that manages hardware resources
- b) system service provider to the application programs
- c) link to interface the hardware and application programs
- d) all of the mentioned

2. To access the services of operating system, the interface is provided by the

- a) System calls
- b) API
- c) Library
- d) Assembly instructions

3. RR scheduling is most suitable for _____

- (a) time shared OS
- (b) distributed OS
- (c) real time OS
- (d) an Ordinary OS

4. Which one of the following is not true?

- a) kernel is the program that constitutes the central core of the operating system
- b) kernel is the first part of operating system to load into memory during booting
- c) kernel is made of various modules which can not be loaded in running operating system
- d) kernel remains in the memory during the entire computer session

5. Which one of the following is not a real time operating system?

- a) VxWorks
- b) Windows CE
- c) RTLinux
- d) Palm OS

6. The OS X has _____

- a) monolithic kernel
- b) hybrid kernel
- c) microkernel
- d) monolithic kernel with modules

7. If a process fails, most operating system write the error information to a _____

- a) log file
- b) another running process
- c) new file
- d) none of the mentioned

8. By operating system, the resource management can be done via _____

- a) time division multiplexing
- b) space division multiplexing
- c) both time and space division multiplexing
- d) none of the mentioned

9. The main function of the command interpreter is _____

- a) to get and execute the next user-specified command
- b) to provide the interface between the API and application program
- c) to handle the files in operating system
- d) none of the mentioned

10. Which one of the following error will be handle by the operating system?

- a) power failure
- b) lack of paper in printer
- c) connection failure in the network
- d) all of the mentioned

11. The degree of multiprogramming is _____

- a) the number of processes executed per unit time
- b) the number of processes in the ready queue
- c) the number of processes in the I/O queue
- d) the number of processes in memory

12. The objective of multiprogramming is to _____

- a) Have some process running at all times
- b) Have multiple programs waiting in a queue ready to run
- c) To minimize CPU utilization
- d) None of the mentioned

13. The request and release of resources are _____

- a) command line statements
- b) interrupts
- c) system calls
- d) special programs

14. Multithreaded programs are _____

- a) lesser prone to deadlocks
- b) more prone to deadlocks
- c) not at all prone to deadlocks
- d) none of the mentioned

15. With multiprogramming, _____ is used productively.

- a) time
- b) space
- c) money
- d) all of the mentioned

16. Which of the following works by dividing the processor's time?

- a) single task operating system
- b) multitask operating system
- c) kernel
- d) applications

17. Which of the following decides which task can have the next time slot?

- a) single task operating system
- b) applications
- c) kernel
- d) software

18. Which of the following provides time period for the context switch?

- a) timer
- b) counter
- c) time slice
- d) time machine

19. With multitasking operating systems, which interrupt provides system clock in the context switching?

- a) software interrupt
- b) hardware interrupt
- c) peripheral
- d) memory

20. Which can control the memory usage?

- a) operating system
- b) applications
- c) hardware
- d) kernel

21. Which routing technique is used in distributed system?

- a) fixed routing
- b) virtual routing
- c) dynamic routing
- d) all of the mentioned

22. In distributed systems, link and site failure is detected by____

- a) polling
- b) **handshaking**
- c) token passing
- d) all of the mentioned

23. Internet provides _____ for remote login.

- a) **telnet**
- b) http
- c) ftp
- d) html

24. The capability of a system to adapt the increased service load is called_____

- a) **scalability**
- b) tolerance
- c) capacity
- d) security

25. In which type of streaming multimedia file is delivered to the client, but not shared?

- a) **real-time streaming**
- b) progressive download
- c) compression
- d) loading

26. Which one of the following is the characteristic of a multimedia system?

- a) high storage
- b) high data rates
- c) **both high storage and high data rates**
- d) none of the mentioned

27. Multimedia system require hard real time scheduling_____

- a) **to ensure critical tasks will be serviced within timing deadlines**
- b) to deliver the media file to the client
- c) to minimize the delay
- d) for security

28. Which one of the following resource is not necessarily required on a file server?

- a) secondary storage
- b) processor
- c) network
- d) **monitor**

29. The delay that occur during the playback of a stream is called_____

- a) stream delay
- b) playback delay
- c) **jitter**
- d) event delay

30. In the world wide web, a _____ is needed to gain access to the remote files, and separate operations are used to transfer files.

- a) laptop
- b) plugin
- c) **browser**
- d) player

Process / Thread

1. Consider a set of n tasks with known runtimes r_1, r_2, \dots, r_n to be run on a uniprocessor machine. Which of the following processor scheduling algorithms will result in the maximum throughput ?

- (a) Round-Robin
- (b) FCFS
- (c) Shortest Job First
- (d) Multilevel Queue

2. CPU Scheduling is the basis of _____ operating system

- (a) Batch
- (b) Real time
- (c) Multiprogramming
- (d) Monoprogramming

3. A thread

- (a) is a lightweight process where the context switching is low
- (b) is a lightweight process where the context switching is high
- (c) is used to speed up paging
- (d) none of the above

4. The Hardware mechanism that enables a device to notify the CPU is called _____.

- (a) Polling
- (b) Interrupt
- (c) System Call
- (d) None of the above

5. The number of processes completed per unit time is known as _____.

- (a) Output
- (b) Throughput
- (c) Efficiency
- (d) Capacity

6. _____ Techniques can be used to resolve conflicts, such as competition for resources, and to synchronize processes so that they can cooperate.

- (a) Busy Waiting
- (b) Mutual Exclusion
- (c) Deadlock
- (d) Starvation

7. The process related to process control, file management, device management, information about system and communication that is requested by any higher level language can be performed by _____.

- (a) Editors
- (b) Compilers
- (c) System Call
- (d) Caching

8. Which of the following statement is not true?

- (a) Multiprogramming implies multitasking
- (b) Multi-user does not imply multiprocessing
- (c) Multitasking does not imply multiprocessing
- (d) Multithreading implies multi-user

9. With the round robin, CPU scheduling in a time-shared system _____.

- (a) Using extremely small time slices improve performance
- (b) Using very large time slice degenerates in to first come first served algorithm
- (c) Using extremely small time slices degenerate in to last in first out algorithm
- (d) Using medium sized time slices leads to shortest request time first algorithm

10. Advantages of multiprogramming are

- (i) Turnaround time for short jobs is improved greatly in multiprogramming
(ii) Increased throughput
(iii) Decreased Resources Utilization
- (a) only i is true (b) only ii is true (c) ii & iii are true (d) i & ii are true

11. Consider the two statements

- (i) Scheduling can be defined as a set of policies and mechanisms which controls the order in which the work to be done is completed
(ii) Time slicing is a scheduling mechanism/way used in time sharing systems
- (a) (i)-true, (ii)-true (b) (i)-true, (ii)-false
(c) (i)-false, (ii)-true (d) (i)-false, (ii)-false

12. Using Priority Scheduling algorithm, find the average waiting time for the following set of processes given with their priorities in the order: Process : Burst Time : Priority respectively.

P1 : 10 : 3 ,

P2 : 1 : 1 ,

P3 : 2 : 4 ,

P4 : 1 : 5 ,

P5 : 5 : 2.

- (a) 8.2 (b) 7.8 (c) 6.4 (d) 5.2

13. Which command is used to make all files and sub-directories in the directory (progs) executable by all users?

- (a) **chmod -R a+x progs** (b) chmod -R 222 progs
(c) chmod -l a+x progs (d) chmod -x a+x progs

14. The command pwd gives

- (a) Password in encrypted form (b) Password in decrypted form
(c) **Present working directory** (d) None

15. A solution to the critical section problem must satisfy which requirements?

- (a) Bounded waiting, monitor and relative speed
(b) Semaphores, monitor and prevention of deadlock
(c) Signal, wait and continue
(d) **Mutual exclusion, progress and bounded waiting**

16. When you start up the computer the boot up storage at which the BIOS versions manufacturer and data are displayed on the monitor is called

- a. Bootstrap b. Kernel loading
c. System configuration **d. Power on self test (POST)**

17. Several processes access and manipulate the same data concurrently and the outcome of the execution depends on the particular order in which the access takes place, is called a(n) _____.

- (a) Shared memory segments (b) **Race condition**
(c) Entry section (d) Process synchronization

18. A semaphore _____.

- (a) can be modified simultaneously by multiple threads

- (b) is accessed through only one standard operation
- (c) is essentially an integer variable**
- (d) cannot be used to control access to a thread's critical sections

19. Consider the following statements with respect to user-level threads and kernel-supported threads (i) Context switch is faster with kernel-supported threads

(ii) For user-level threads, a system call can block the entire process

(iii) Kernel-supported threads can be scheduled independently

(iv) User-level threads are transparent to the kernel

Which of the above statements are true?

- (a) (ii), (iii) and (iv) only
- (b) (i) and (ii) only
- (c) (i) and (iii) only
- (d) (ii) and (iii) only**

Explanation:

(I) It is false, context switch is not faster in support of kernel threads.

(II) A system call can truly block the user level threads, since they don't have permission to do that. (III) True since kernel supported threads have their independent memory & resources.

(IV) False since user level threads might need support of kernel threads.

20. Response time refers to the amount of time _____ .

- (a) that CPU utilization is minimized
- (b) to execute a particular process
- (c) a process has been waiting in the ready queue
- (d) it takes from when a request was submitted until the first action is produced**

21. A thread does not share with its peer threads its _____

- (a) code section
- (b) data section
- (c) semaphore**
- (d) operating-system resources

22. A system has two types of resources, R1 and R2, both of which have two instances of their respective resource types. There are four processes competing for resources.

Assume that the following system state exists:

P1 : R1 is requested, R2 is allocated

P2 : R1 is allocated

P3 : R1 is allocated, R2 is requested

P4 : R2 is allocated

The system state _____ .

- (a) contains a cycle, and it is deadlocked
- (b) contains a cycle but it is not deadlocked**
- (c) contains no cycles and is not deadlocked
- (d) contains no cycles and is deadlocked

23. What is result of below program

```
#include<stdio.h>
```

```
#include <sys/types.h>
```

```
#include <unistd.h>
```

```
int main() {
```

```
fork(); printf("Hello "); fork(); printf("World ");
```

```
return 0;
}
```

- (a) Hello World Hello World Hello World Hello World
- (b) Hello World Hello World Hello World
- (c) Hello Hello World Hello Hello World
- (d) Hello Hello Hello Hello World World World World

24. Consider Peterson's algorithm for mutual exclusion between two concurrent processes i and j. The program executed by process i is shown below.

```
repeat
    flag[i]=true;
    turn=j;
    while(p) do no-op;
    Enter critical section, perform actions, then
    exit critical section
    Flag[i]=false;
    Perform other non-critical section actions.
```

Until false;

For the program to guarantee mutual exclusion, the predicate P in the while loop should be

- (a) flag [j]= true and turn =j
- (b) flag [j]=true and turn =j
- (c) flag [i]=true and turn=j
- (d) flag [i]=true and turn=i

Explanation: While loop if true predicate then the program enters into critical region. This program enters into critical region of flag [i]=true act as semaphore, & true =j, the requirement of resource is by some other process.

25. Which combination of the following features will suffice to characterize an OS as a multi-programmed OS?

- (i) More than one program may be loaded into main memory at the same time for execution.
- (ii) If a program waits for certain events such as I/O, another program is immediately scheduled for execution.
- (iii) If the execution of a program terminates, another program is immediately scheduled for execution.

- (a) i
- (b) i and ii
- (c) i and iii
- (d) i, ii and iii

Explanation: more than one program can run on single CPU, when one is blocked.

- (i) Is true and a characteristic of multi-programmed
- (ii) Is true & also characterise a multi-programmed OS
- (iii) Is true but no necessary for this type this happens in all OS, even in batch processor.

26. A zombie process is _____

- (a) a process that has completed execution but still has an entry in the process table
- (b) a process that is still executing, but whose parent has died
- (c) a process that cannot leave the system
- (d) a process that always accepts its children's return codes

27. The Producer-Consumer problem is related to _____ .

- (a) the handling of process state queues
- (b) the scheduling of process states
- (c) the allocation of resources to process states
- (d) Both A and C are correct answers.

28. In a time-sharing environment, consider a system that supports 25 users each using a common text editor of size 110 KB and 35KB of data space for each user. What is the total space required for shared paging scheme?

- (a) 3625 KB
- (b) 2750 KB
- (c) 985 KB
- (d) 1085 KB

Ans. $(25 \times 35 + 110)$

29. Monitors provide the synchronization mechanism for _____

- (a) Concurrency-control scheme
- (b) Sharing abstract data types
- (c) Blocking a condition variable
- (d) All of the above

30. Peterson's solution to the critical-section problem

- (a) Only satisfies mutual exclusion and progress requirements
- (b) Is a hardware synchronization using locks
- (c) Is a software-based solution
- (d) All of the above

31. A process must be holding at least one resource and waiting to acquire additional resources that are currently being held by other processes is called a(n) _____.

- (a) deadlock state
- (b) starvation
- (c) circular wait
- (d) hold and wait

32. The _____ consists of all processes whose memory images are in the backing store or in memory and are ready to run.

- a) wait queue
- b) ready queue
- c) cpu
- d) secondary storage

33. A Process Control Block(PCB) does not contain which of the following_____

- a) Code
- b) Stack
- c) Bootstrap program
- d) Data

34. The state of a process is defined by _____

- a) the final activity of the process
- b) the activity just executed by the process
- c) the activity to next be executed by the process
- d) the current activity of the process

35. Which of the following is not the state of a process?

- a) Ready
- b) Old
- c) Block
- d) Running

36. The Process Control Block is ____

- a) Process type variable
- b) **Data Structure**
- c) A secondary storage section
- d) A Block in memory

37. The entry of all the PCBs of the current processes is in ____

- a) Process Register
- b) Program Counter
- c) **Process Table**
- d) Process Unit

38. A single thread of control allows the process to perform ____

- a) **only one task at a time**
- b) multiple tasks at a time
- c) only two tasks at a time
- d) all of the mentioned

39. Inter process communication

- a) allows processes to communicate and synchronize their actions when using the same address space
- b) **allows processes to communicate and synchronize their actions without using the same address space**
- c) allows the processes to only synchronize their actions without communication
- d) none of the mentioned

40. Message passing system allows processes to ____

- a) **communicate with one another without resorting to shared data**
- b) communicate with one another by resorting to shared data
- c) share data
- d) name the recipient or sender of the message

41. An IPC facility provides at least two operations ____

- a) write & delete message
- b) delete & receive message
- c) send & delete message
- d) **receive & send message**

42. Messages sent by a process ____

- a) have to be of a fixed size
- b) have to be a variable size
- c) **can be fixed or variable sized**
- d) None of the mentioned

43. In indirect communication between processes P and Q, ____

- a) there is another process R to handle and pass on the messages between P and Q
- b) there is another machine between the two processes to help communication
- c) **there is a mailbox to help communication between P and Q**
- d) none of the mentioned

44. The link between two processes P and Q to send and receive messages is called ____

- a) message-passing link
- b) synchronization link
- c) **communication link**
- d) all of the mentioned

45. In the non blocking send ____

- a) **the sending process sends the message and resumes operation**
- b) the sending process keeps sending until the message is received
- c) the sending process keeps sending until it receives a message
- d) none of the mentioned

46. The Zero Capacity queue _____

- a) is referred to as a message system with buffering
- b) is referred to as a message system with no buffering**
- c) is referred to as a link
- d) none of the mentioned

47. The number of resources requested by a process _____

- a) must always be less than the total number of resources available in the system
- b) must always be equal to the total number of resources available in the system
- c) must not exceed the total number of resources available in the system**
- d) must exceed the total number of resources available in the system

48. Which of the followings is true?

- (A) On per-thread basis, the OS maintains only CPU register state
- (B) The OS does not maintain a separate stack for each thread
- (C) On per-thread basis, the OS does not maintain virtual memory state**
- (D) On per thread basis, the OS maintains only scheduling and accounting information.

49. Concurrent access to shared data may result in _____

- a) data consistency
- b) data insecurity
- c) data inconsistency**
- d) thrashing

50. Write ahead logging is a way _____

- a) to ensure atomicity
- b) to keep data consistent
- c) that records data on stable storage
- d) all of the mentioned**

51. A locking protocol is one that _____

- a) governs how locks are acquired
- b) governs how locks are released
- c) governs how locks are acquired and released**
- d) governs how locks are killed

52. A collection of instructions that performs a single logical function is called _____

- a) transaction**
- b) operation
- c) function
- d) register

53. The bounded buffer problem is also known as _____

- a) Readers – Writers problem
- b) Dining – Philosophers problem
- c) Producer – Consumer problem**
- d) None of the mentioned

54. In the bounded buffer problem, there are the empty and full semaphores that _____

- a) count the number of empty and full buffers**
- b) count the number of empty and full memory spaces
- c) count the number of empty and full queues
- d) none of the mentioned

55. The dining – philosophers problem will occur in case of _____

- a) 5 philosophers and 5 chopsticks**
- b) 4 philosophers and 5 chopsticks
- c) 3 philosophers and 5 chopsticks
- d) 2 philosophers and 5 chopsticks

56. A semaphore_____

- a) is a binary mutex
- b) must be accessed from only one process
- c) can be accessed from multiple processes**
- d) none of the mentioned

57. The two kinds of semaphores are_____

- a) mutex & counting
- b) binary & counting**
- c) counting & decimal
- d) decimal & binary

58. A mutex_____

- a) is a binary mutex
- b) must be accessed from only one process**
- c) can be accessed from multiple processes
- d) None of the mentioned

59. Semaphores are mostly used to implement_____

- a) System calls
- b) IPC mechanisms**
- c) System protection
- d) None of the mentioned

60. Spinlock _____

- a) is a lock which causes a thread trying to acquire it to simply wait in a loop**
- b) is intended to provide mutual exclusion only
- c) is used in aging
- d) is used in case lock time is very long

61. At a particular time of computation the value of a counting semaphore is 7. Then 20 P operations and 15 V operations were completed on this semaphore. The resulting value of the semaphore is _____

- a) 5
- b) 2**
- c) 8
- d) 13

Explanation: P represents Wait and V represents Signal. P operation will decrease the value by 1 every time and V operation will increase the value by 1 every time.

Historically, wait() was called **P** (for **Dutch** “Proberen” meaning to try) and signal() was called **V** (for **Dutch** “Verhogen” meaning to increment)

62. The main disadvantage of spinlocks is that _____

- a) they are not sufficient for many process
- b) they require busy waiting**
- c) they are unreliable sometimes
- d) they are too complex for programmers

63. The signal operation of the semaphore basically works on the basic _____ system call.

- a) continue()
- b) wakeup()**
- c) getup()
- d) start()

Explanation: semaphore → stop and wake

64. If the semaphore value is negative,_____

- a) its magnitude is the number of processes waiting on that semaphore
- b) it is invalid
- c) no operation can be further performed on it until the signal operation is performed on it
- d) none of the mentioned

65. The code that changes the value of the semaphore is_____

- a) remainder section code
- b) non – critical section code
- c) critical section code
- d) none of the mentioned

66. Spinlocks are_____

- a) CPU cycles wasting locks over critical sections of programs
- b) Locks that avoid time wastage in context switches
- c) Locks that work better on multiprocessor systems
- d) All of the mentioned

67. The real difficulty with SJF in short term scheduling is_____

- a) it is too good an algorithm
- b) knowing the length of the next CPU request
- c) it is too complex to understand
- d) none of the mentioned

68. A solution to the problem of indefinite blockage of low – priority processes is_____

- a) Starvation
- b) Wait queue
- c) Ready queue
- d) Aging

69. Preemptive Shortest Job First scheduling is sometimes called_____

- a) Fast SJF scheduling
- b) EDF scheduling – Earliest Deadline First
- c) HRRN scheduling – Highest Response Ratio Next
- d) SRTN scheduling – Shortest Remaining Time Next

70. An SJF algorithm is simply a priority algorithm where the priority is_____

- a) the predicted next CPU burst
- b) the inverse of the predicted next CPU burst
- c) the current CPU burst
- d) anything the user wants

71. ‘Aging’ is _____

- a) keeping track of cache contents
- b) keeping track of what pages are currently residing in memory
- c) keeping track of how many times a given page is referenced
- d) increasing the priority of jobs to ensure termination in a finite time

72. Which of the following statements are true ?

- i) Shortest remaining time first scheduling may cause starvation
 - ii) Preemptive scheduling may cause starvation
 - iii) Round robin is better than FCFS in terms of response time
- a) i only b) i and iii only c) ii and iii only d) i, ii and iii

73. Which of the following scheduling algorithms gives minimum average waiting time ?

- a) FCFS
- b) SJF**
- c) Round – robin
- d) Priority

74. CPU scheduling is the basis of _____

- a) multiprocessor systems
- b) multiprogramming operating systems**
- c) larger memory sized systems
- d) none of the mentioned

75. The switching of the CPU from one process or thread to another is called _____

- a) process switch
- b) task switch
- c) context switch
- d) all of the mentioned**

76. Turnaround time is _____

- a) the total waiting time for a process to finish execution
- b) the total time spent in the ready queue
- c) the total time spent in the running queue
- d) the total time from the completion till the submission of a process**

77. Scheduling is done so as to _____

- a) increase the throughput
- b) decrease the turnaround time
- c) increase CPU utilization
- d) all**

78. The dispatcher _____

- a) is the module that gives control of the CPU to the process selected by the short-time scheduler
- b) is the module that gives control of the CPU to select from among the processes that are ready to execute
- c) involves in function of switching context
- d) all**

79. Waiting time is _____

- a) the total time in the blocked and waiting queues
- b) the total time spent in the ready queue**
- c) the total time spent in the running queue
- d) the total time from the completion till the submission of a process

80. Response time is _____

- a) the total time taken from the submission time till the completion time
- b) the total time taken from the submission time till the first response is produced**
- c) the total time taken from submission time till the response is output
- d) none of the mentioned

Memory Management

1. Page fault occurs when

- (A) When a requested page is in memory
- (B) When a requested page is not in memory**
- (C) When a page is corrupted
- (D) When an exception is thrown

2. Assume that there are 3 page frames which are initially empty. If the page reference string is 1, 2, 3,

4, 2, 1, 5, 3, 2, 4, 6, the number of page faults using the optimal replacement policy is _____.

- (A) 5
- (B) 6
- (C) 7**
- (D) 8

3. Consider the virtual page reference string

1, 2, 3, 2, 4, 1, 3, 2, 4, 1

On a demand paged virtual memory system running on a computer system that main memory size of 3 pages frames which are initially empty. Let LRU, FIFO and OPTIMAL denote the number of page faults under the corresponding page replacements policy. Then

- (A) $\text{OPTIMAL} < \text{LRU} < \text{FIFO}$
- (B) $\text{OPTIMAL} < \text{FIFO} < \text{LRU}$**
- (C) $\text{OPTIMAL} = \text{LRU}$
- (D) $\text{OPTIMAL} = \text{FIFO}$

4. A virtual memory system uses First In First Out (FIFO) page replacement policy and allocates a fixed number of frames to a process. Consider the following statements:

P: Increasing the number of page frames allocated to a process sometimes increases the page fault rate.

Q: Some programs do not exhibit locality of reference.

Which one of the following is TRUE?

- (A) Both P and Q are true, and Q is the reason for P
- (B) Both P and Q are true, but Q is not the reason for P.**
- (C) P is false, but Q is true
- (D) Both P and Q are false

5. Which of the following page replacement algorithms suffers from Belady's anomaly?

- (A) FIFO**
- (B) LRU
- (C) Optimal Page Replacement
- (D) Both LRU and FIFO

6. A CPU generates 32-bit virtual addresses. The page size is 4 KB. The processor has a translation look-aside buffer (TLB) which can hold a total of 128 page table entries and is 4-way set associative. The minimum size of the TLB tag is:

- (A) 11 bits
- (B) 13 bits
- (C) 15 bits**
- (D) 20 bits

7. Thrashing occurs when _____

- (A) When a page fault occurs
- (B) Processes on system frequently access pages not memory**
- (C) Processes on system are in running state
- (D) Processes on system are in waiting state

8. A computer system supports 32-bit virtual addresses as well as 32-bit physical addresses. Since the virtual address space is of the same size as the physical address space, the operating system designers decide to get rid of the virtual memory entirely. Which one of the following is true?

- (A) Efficient implementation of multi-user support is no longer possible
- (B) The processor cache organization can be made more efficient now
- (C) Hardware support for memory management is no longer needed**
- (D) CPU scheduling can be made more efficient now

9. Which of the following statements is false?

- a) Virtual memory implements the translation of a program's address space into physical memory address space
- b) Virtual memory allows each program to exceed the size of the primary memory
- c) Virtual memory increases the degree of multiprogramming
- d) Virtual memory reduces the context switching overhead**

10. Consider a machine with 64 MB physical memory and a 32-bit virtual address space. If the page size is 4KB, what is the approximate size of the page table? (GATE 2001)

- (a) 16 MB
- (b) 8 MB
- (c) 2 MB**
- (d) 24 MB

11. Where does the swap space reside?

- (A) RAM
- (B) Disk**
- (C) ROM
- (D) On-chip cache

12. Consider a virtual memory system with FIFO page replacement policy. For an arbitrary page access pattern, increasing the number of page frames in main memory will

- (A) always decrease the number of page faults
- (B) always increase the number of page faults
- (C) sometimes increase the number of page faults**
- (D) never affect the number of page faults

13. Which of the following statements is false?

- (A) Virtual memory implements the translation of a program's address space into physical memory address space
- (B) Virtual memory allows each program to exceed the size of the primary memory
- (C) Virtual memory increases the degree of multiprogramming
- (D) Virtual memory reduces the context switching overhead**

14. The optimal page replacement algorithm will select the page that

- (A) Has not been used for the longest time in the past.
- (B) Will not be used for the longest time in the future.**
- (C) Has been used least number of times.
- (D) Has been used most number of times.

15. Which of the following is not a form of memory?

- (A) instruction cache (B) instruction register
(C) instruction opcode (D) translation lookaside buffer

16. A computer system supports 32-bit virtual addresses as well as 32-bit physical addresses. Since the virtual address space is of the same size as the physical address space, the operating system designers decide to get rid of the virtual memory entirely. Which one of the following is true?

- (a) Efficient implementation of multi-user support is no longer possible
(b) The processor cache organization can be made more efficient now
(c) Hardware support for memory management is no longer needed
(d) CPU scheduling can be made more efficient now

17. The process of assigning load addresses to the various parts of the program and adjusting the code and data in the program to reflect the assigned addresses is called

- (A) Assembly (B) Parsing (C) Relocation (D) Symbol resolution

18. Consider a machine with 64 MB physical memory and a 32-bit virtual address space. If the page size is 4KB, what is the approximate size of the page table?

- (a) 16 MB (b) 8 MB (c) 2 MB (d) 24 MB

19. Increasing the RAM of a computer typically improves performance because:

- (a) Virtual memory increases (b) Larger RAMs are faster
(c) Fewer page faults occur (d) Fewer segmentation faults occur

20. Consider the following code fragment:

```
if (fork() == 0)
{ a = a + 5; printf("%d,%d\n", a, &a); }
else { a = a - 5; printf("%d, %d\n", a, &a); }
```

Let u, v be the values printed by the parent process, and x, y be the values printed by the child process. Which one of the following is TRUE?

- (a) $u = x + 10$ and $v = y$ (b) $u = x + 10$ and $v \neq y$
(c) $u + 10 = x$ and $v = y$ (d) $u + 10 = x$ and $v \neq y$

21. A process executes the code

```
fork ();
fork ();
fork ();
```

The total number of child processes created is

- (A) 3 (B) 4 (C) 7 (D) 8

22. consider the 3 processes, P1, P2 and P3 shown in the table

Process	Arrival time	Time unit required
---------	--------------	--------------------

P1	0	5
P2	1	7
P3	3	4

The completion order of the 3 processes under the policies FCFS and RRS (round robin scheduling with CPU quantum of 2 time units) are

- (A) FCFS: P1, P2, P3 RR2: P1, P2, P3
 (B) FCFS: P1, P3, P2 RR2: P1, P3, P2
 (C) FCFS: P1, P2, P3 RR2: P1, P3, P2
 (D) FCFS: P1, P3, P2 RR2: P1, P2, P3

23. An operating system uses Shortest Remaining Time first (SRT) process scheduling algorithm. Consider the arrival times and execution times for the following processes:

Process	Execution time	Arrival time
P1	20	0
P2	25	15
P3	10	30
P4	15	45

What is the total waiting time for process P2?

- (A) 5 (B) 15 (C) 40 (D) 55

24. If there are 32 segments, each of size 1Kb, then the logical address should have :

- a) 12 bits b) 13 bits c) 14 bits d) 15 bits

Explanation: To specify a particular segment, 5 bits are required. To select a particular byte after selecting a segment, 10 more bits are required → 15bits

25. Consider the following statements about user level threads and kernel level threads. Which one of the following statement is FALSE?

- (A) Context switch time is longer for kernel level threads than for user level threads.
 (B) User level threads do not need any hardware support.
 (C) Related kernel level threads can be scheduled on different processors in a multi-processor system.
 (D) Blocking one kernel level thread blocks all related threads.

26. The minimum number of page frames that must be allocated to a running process in a virtual memory environment is determined by _____

- a) the instruction set architecture b) page size
 c) physical memory size d) number of processes in memory

Explanation: Each process needs minimum number of pages based on instruction set architecture. Example IBM 370: 6 pages to handle MVC (storage to storage move) instruction

27. A system uses FIFO policy for page replacement. It has 4 page frames with no pages loaded to begin with. The system first accesses 2018 distinct pages in some order and then accesses the same 2018 pages but now in the reverse order. How many page faults will occur?

- a) 4030 **b) 4032** c) 4034 d) 4046

Explanation: Access to 2018 pages will cause 2018 page faults. When these pages are accessed in reverse order, the first four accesses will not cause page fault. All other access to pages will cause page faults. So total number of page faults will be $2018 + 2014$.

28. Paging is a memory management scheme that _____.

- (a) Permits the logical address space of a process to be noncontiguous
(b) Avoids external fragmentation and the need for compaction
(c) Solves the considerable problem of fitting memory chunks of fixed sizes onto the backing store
(d) All of the above

29. Base register holds the _____.

- (a) Smallest legal logical memory address
(b) Smallest legal physical memory address
(c) Lowest order logical memory address
(d) None of the above

30. Suppose we are operating with execution-time binding and the physical address generated is 305. The relocation register is set to 99. What is the corresponding logical address?

- (a) 404 **(b) 206** (c) 509 (d) 305

31. Which of the following dynamic storage-allocation algorithms results in the largest leftover hole in memory?

- (a) first fit (b) best fit **(c) worst fit** (d) None of the above

32. A cycle in resource allocation graph _____ leads to a deadlock.

- (a) Always **(b) May not** (c) Must (d) None of the above

33. Which of the following methods of binding instructions and data to memory is performed by most general-purpose operating systems?

- (a) interrupt binding (b) compile time binding
(c) execution time binding (d) load time binding

34. Which of the following is true of compaction?

- (a) It can be done at assembly, load, or execution time.
(b) It is used to solve the problem of internal fragmentation.
(c) It cannot shuffle memory contents.
(d) It is possible only if relocation is dynamic and done at execution time

35. The purpose of a Memory Management Unit is to _____.

- (a) perform run-time mapping from virtual to physical addresses**
(b) ensure protection of the memory space allocated to every process

- (c) Both a and b are correct responses
- (d) None of these responses is correct

35. In a dynamically linked library, ____.

- (a) loading is postponed until execution time
- (b) system language libraries are treated like any other object module
- (c) more disk space is used than the option of using a statically-linked library
- (d) a stub is included in the image for each library-routine reference

36. The virtual memory is ____

- (a) An extremely large main memory
- (b) An extremely large secondary memory
- (c) An illusion of extremely large main memory
- (d) A type of memory used in super computer

37. All of the following are TRUE regarding virtual memory EXCEPT

- (a) Any amount of RAM can be allocated to virtual memory
- (b) The setting for the amount of hard disk drive space to allocate virtual memory can be manually change
- (c) This temporary storage is called the swap file or page file
- (d) Virtual memory is the physical space o the hard drive

38. Input transfers are done in advance and output transfers are done after sometimes in which of these technique?

- (a) Spooling
- (b) Buffering
- (c) Swapping
- (d) Paging

39. In a paged memory, the page hit ratio is 0.35. The required to access a page in secondary memory is equal to 100 ns. The time required to access a page in primary memory is 10 ns. The average time required to access a page is ____

- a) 3.0 ns
- b) 68.0 ns
- c) 68.5 ns
- d) 78.5 ns

40. In paged memory systems, if the page size is increased, then the internal fragmentation generally ____

- a) becomes less
- b) becomes more
- c) remains constant
- d) none of the mentioned

41. Physical memory is broken into fixed-sized blocks called ____

- a) frames
- b) pages
- c) backing store
- d) none of the mentioned

42. If the size of logical address space is 2 to the power of m, and a page size is 2 to the power of n addressing units, then the high order ____ bits of a logical address designate the page number, and the ____ low order bits designate the page offset.

- a) m, n
- b) n, m
- c) m – n, m
- d) m – n, n

43. The page table registers should be built with ____

- a) very low speed logic
- b) very high speed logic
- c) a large memory space
- d) none of the mentioned

44. For larger page tables, they are kept in main memory and a ____ points to the page table.

- a) page table base register
- b) page table base pointer
- c) page table register pointer
- d) page table base

45. If the offset is legal:

- a) it is used as a physical memory address itself
- b) it is subtracted from the segment base to produce the physical memory address
- c) it is added to the segment base to produce the physical memory address
- d) none of the mentioned

46. When the entries in the segment tables of two different processes point to the same physical location _____

- a) the segments are invalid
- b) the processes get blocked
- c) segments are shared
- d) all of the mentioned

47. A multilevel page table is preferred in comparison to a single level page table for translating virtual address to physical address because _____

- a) it reduces the memory access time to read or write a memory location
- b) it helps to reduce the size of page table needed to implement the virtual address space of a process
- c) it is required by the translation lookaside buffer
- d) it helps to reduce the number of page faults in page replacement algorithms

48. The base register is also known as the _____

- a) basic register
- b) regular register
- c) relocation register
- d) delocation register

49. Swapping requires a _____

- a) motherboard
- b) keyboard
- c) monitor
- d) backing store

50. The backing store is generally a _____

- a) fast disk
- b) disk large enough to accommodate copies of all memory images for all users
- c) disk to provide direct access to the memory images
- d) all of the mentioned

51. The _____ time in a swap out of a running process and swap in of a new process into the memory is very high.

- a) context – switch
- b) waiting
- c) execution
- d) all of the mentioned

52. Swap space is allocated _____

- a) as a chunk of disk
- b) separate from a file system
- c) into a file system
- d) all of the mentioned

53. Swapping _____ be done when a process has pending I/O, or has to execute I/O operations only into operating system buffers.

- a) must
- b) can
- c) must never
- d) maybe

54. The major part of swap time is _____ time.

- a) waiting
- b) transfer
- c) execution
- d) none of the mentioned

55. Operating System maintains the page table for ____

- a) each process b) each thread c) each instruction d) each address

56. Which of the following is TRUE ?

- a) Overlays are used to increase the size of physical memory
b) Overlays are used to increase the logical address space
c) When overlays are used, the size of a process is not limited to the size of the physical memory
d) Overlays are used whenever the physical address space is smaller than the logical address space

57. Each entry in a Translation lookaside buffer (TLB) consists of ____

- a) key b) value c) bit value d) constant

58. If a page number is not found in the TLB, then it is known as a ____

- a) TLB miss b) Buffer miss c) TLB hit d) All of the mentioned

59. Contiguous allocation has two problems _____ and _____ that linked allocation solves.

- a) external – fragmentation & size – declaration
b) internal – fragmentation & external – fragmentation
c) size – declaration & internal – fragmentation
d) memory – allocation & size – declaration

60. Let the page fault service time be 11ms in a computer with average memory access time being 21ns. If one page fault is generated for every 10^6 memory accesses, what is the effective access time for the memory?

- (A) 21ns (B) 32n (C) 23ns (D) 35ns

Explanation:

Let p be the page fault rate

Effective Memory Access Time = $p * (\text{page fault service time}) + (1 - p) * (\text{Memory access time})$
 $= (1/(10^6)) * 11 * (10^6) \text{ ns} + (1 - 1/(10^6)) * 21 \text{ ns} = 32 \text{ ns (approx)}$

61. Which of the following need not necessarily be saved on a context switch between processes?

- (a) General purpose registers (b) Translation look-aside buffer
(c) Program counter (d) All

62. The essential content(s) in each entry of a page table is / are ____

- (A) Virtual page number
(B) Page frame number
(C) Both virtual page number and page frame number
(D) Access right information

63. Let see a system

- 32 bit virtual addresses
- 1KB page size,

the use of one-level page tables is not practical because of _____

- a) the large amount of internal fragmentation
- b) the large amount of external fragmentation
- c) the large memory overhead in maintaining page tables**
- d) the large computation overhead in the translation process

64. Paging increases the _____ time.

- a) waiting
- b) execution
- c) context – switch**
- d) routing

65. The offset 'd' of the logical address must be _____

- a) greater than segment limit
- b) between 0 and segment limit**
- c) between 0 and the segment number
- d) greater than the segment number

66. When the entries in the segment tables of two different processes point to the same physical location _____

- a) the segments are invalid
- b) the processes get blocked
- c) segments are shared**
- d) all of the mentioned

67. Each entry in a segment table has a _____

- a) segment base**
- b) segment peak
- c) segment value
- d) segment body

File system

1. Among following statement, the best way to extend the file size in contiguous allocation is _____

- a) adding an extent (another chunk of contiguous space)
- b) adding an index table to the first contiguous block
- c) adding pointers into the first contiguous block
- d) none

2. Directory is similar to

- (a) File
- (b) Folder
- (c) Item
- (d) None of above

3. What is the meaning of "Hibernate" in Windows XP/Windows 7?

- (a) Restart the Computer in safe mode
- (b) Restart the Computer in hibernate mode
- (c) Shutdown the Computer terminating all the running applications
- (d) Shutdown the Computer without closing the running applications

4. The file system "NTFS" stands for

- (a) New Type File System
- (b) Never Terminated File System
- (c) New Technology File System
- (d) Non Terminated File System

5. Unicode standard is

- (a) Keyboard layout
- (b) Software
- (c) Font
- (d) Character encoding system

6. To create a file, it _____

- a) allocates the space in file system
- b) makes an entry for new file in directory
- c) allocates the space in file system & make an entry for new file in directory
- d) none of above

7. A mounting of file system is _____

- a) crating of a filesystem
- b) deleting a filesystem
- c) attaching portion of the file system into a directory structure
- d) removing portion of the file system into a directory structure

8. The sequential file access method can be explained as _____

- a) random access according to the given byte number
- b) read bytes one at a time, in order
- c) read/write sequentially by record
- d) read/write randomly by record

9. Which one of following cause file system fragmentation?

- a) unused space or single file are not contiguous
- b) used space is not contiguous
- c) unused space is non-contiguous
- d) multiple files are non-contiguous

10. In the UNIX system, it uses a (an) _____ stored at or near the beginning of a file to indicate its file format

- a) identifier b) extension c) virtual number **d) magic number**

11. When the index of large files itself becomes too large to be kept in memory, _____

- a) index is called **b) an index is created for the index file**
c) secondary index files are created d) all of above

12. The file system uses

- a file descriptor with 8 direct block addresses,
- 1 indirect block address
- 1 doubly indirect block address.
- 128 bytes for size of each disk block
- 8 bytes for size of each disk block address.

The maximum possible file size in this file system is

- (A) 32 Kbytes **(B) 35 Kbytes** (C) 280 Bytes (D) 24 Kbytes

Explanation:

Total number of possible addresses stored in a disk block = $128/8 = 16$

Maximum number of addressable bytes due to direct address block = $8*128$

Maximum number of addressable bytes due to 1 single indirect address block = $16*128$

Maximum number of addressable bytes due to 1 double indirect address block = $16*16*128$

The maximum possible file size = $8*128 + 16*128 + 16*16*128 = 35KB$

13. Each _____ has its own index block.

- a) partition b) address **c) file** d) all

14. Which one of follow is not true?

- a) FAT partitions cannot extend beyond 2TB
b) Files stored to a FAT partition can exceed 4GB
c) Windows cannot format a disc larger than 32 GB to FAT32, but Mac OS X can
d) The FAT is short for File Allocation Table

15. Which one of follow is true?

- a) NTFS partitions can extend up to about 16 million TB
b) Files stored to NTFS partitions can be as large as the partition
c) NTFS is short for New Technology File System
d) All

16. Which one of follow is not true?

- a) Maximum volume for HFS is about 16 million TB**
b) Files stored to HFS+ partitions can be as large as the partition
c) HFS is developed by Apple for MacOS
d) HFS is short for Hierarchical File System

17. The process of dividing a disk into sectors that the disk controller can read and write, before a disk can store data is known as _____

- a) partitioning b) swap space creation
c) low-level formatting d) none of the mentioned

18. Management of metadata information is done by_____
a) file-organisation module
b) **logical file system**
c) basic file system
d) application programs

19. A file control block contains the information about_____
a) file ownership
b) file permissions
c) location of file contents
d) **all of the mentioned**

20. When a process closes the file_____
a) per-process table entry is not removed
b) **system wide entry's open count is decremented**
c) FAT entry is removed
d) none of the mentioned

21. If the block of free-space list is free then bit will_____
a) **1**
b) 0
c) any of 0 or 1
d) -1

22. Which table contains the information about each mounted volume?
a) mount table
b) system-wide open-file table
c) per-process open-file table
d) **all of the mentioned**

23. To create a new file application program calls_____
a) basic file system
b) **logical file system**
c) file-organisation module
d) none of the mentioned

24. File type can be represented by_____
a) file name
b) **file extension**
c) file identifier
d) none of the mentioned

25. Mapping of file is managed by_____
a) **file metadata**
b) page table
c) virtual memory
d) file system

26. A relative block number is an index relative to_____
a) **the beginning of the file**
b) the end of the file
c) the last written position in file
d) none of the mentioned

27. The index contains_____
a) names of all contents of file
b) pointers to each page
c) **pointers to the various blocks**
d) all of the mentioned

28. To organise file systems on disk,_____
a) they are split into one or more partitions
b) **information about files is added to each partition**
c) they are made on different storage spaces
d) all of the mentioned

29. An absolute path name begins at the_____
a) leaf
b) user
c) current directory
d) **root**

30. In UNIX, a link is _____

- a) a directory entry
- b) a pointer to another file or subdirectory
- c) implemented as an absolute or relative path name
- d) all of the mentioned**

31. The deletion of a soft link, _____ the original file

- a) deletes
- b) affects
- c) does not affect**
- d) none of the mentioned

32. _____ tend to represent a major bottleneck in system performance.

- a) CPUs
- b) Disks**
- c) Programs
- d) I/O

33. In UNIX, even an 'empty' disk has a percentage of its space lost to _____

- a) programs
- b) inodes**
- c) virtual memory
- d) stacks

34. With _____ a requested page and several subsequent pages are read and cached.

- a) write ahead
- b) read ahead**
- c) free-behind
- d) add-front

35. _____ writes occur in the order in which the disk subsystem receives them, and the writes are not buffered.

- a) Asynchronous
- b) Regular
- c) Synchronous**
- d) Irregular

36. In asynchronous writes, the data is stored in _____

- a) the cache**
- b) the file
- c) the spool
- d) none of above

37. In UNIX, exactly which operations can be executed by group members and other users is definable by _____

- a) the group's head
- b) the file's owner**
- c) the file's permissions
- d) all of the mentioned

38. Domain name system provides _____

- a) host-name-to-network-address translations for the entire internet**
- b) network-address-to-host-name translations for the entire internet
- c) binary to hex translations for the entire internet
- d) all of the mentioned

39. Distributed naming services/Distributed information systems have been devised to _____

- a) provide information about all the systems
- b) provide unified access to the information needed for remote computing**
- c) provide unique names to all systems in a network
- d) all of the mentioned

I/O - Disk

1. _____ is when the head causes a damage for magnetic surface

- (a) disk crash
- (b) head crash
- (c) magnetic damage
- (d) all of the mentioned

2. The host controller _____

- a) is built at the end of each disk
- b) controls the transmission of packets on the bus
- c) all of above
- d) none of above

3. Hard disk has

- 16 recording surfaces (0-15) having 16384 cylinders (0-16383)
- each cylinder contains 64 sectors (0-63)
- data storage capacity in each sector is 512 bytes.
- data are organized cylinder-wise and the addressing format is .

A file of size 42797 KB is stored in the disk and the starting disk location of the file is <1200, 9, 40> (cylinder,surface, sector). What is the cylinder number of the last sector of the file, if it is stored in a contiguous manner?

- (A) 1281
- (B) 1282
- (C) 1283
- (D) 1284

Explanation:

File size is 42797KB= $4279 \times 2^{10} \text{B} = 85594 \times 2^9 \text{B}$.

Now one sector=512B

so file will be stored in 85594 sectors i.e we need to cross 85594 sectors

starting of the file is

number of cylinders to cross= $85594 / 16 \times 64 = 83$ cylinders

remaining sectors to cross= $85594 - (83 \times 16 \times 64) = 602$

number of surfaces to cross=9

so to cross 9 surface we need to cross on more cylinder as file has started at surface 9 and no of surface in cylinder is 16 so

number of cylinder to cross= $83 + 1 = 84$

so cylinder no. $1200 + 84 = 1284$

4. Which one of following interrupts will be handled at the HIGHEST priority?

- (a) Interrupt from CPU temperature sensor (raises interrupt if CPU temperature is too high) .
- (b) Interrupt from Mouse(raises interrupt if the mouse is moved or a button is pressed) .
- (c) Interrupt from Keyboard(raises interrupt when a key is pressed or released) .
- (d) Interrupt from Hard Disk(raises interrupt when a disk read is completed)

5. For a CPU with memory mapped I/O, which one is true?

- (a) I/O protection is ensured by operating system routine(s)
- (b) I/O protection is ensured by a hardware trap
- (c) I/O protection is ensured during system configuration
- (d) I/O protection is not possible

6. An application loads 50 libraries at startup.

Each library requires exactly one disk access for loading.

The seek time to a random location is about 10ms in disk.

Rotational speed of disk is about 3000rpm.

If all 50 libraries are loaded from random locations on the disk, how long does it take to load all libraries? (The time to transfer data from the disk block once the head has been positioned at the start of the block may be neglected)

- (A) 0.50s (B) 1.50s (C) 1.25s (D) 1.00s

Explanation:

Rotation latency = $0.5 \times (60/3000) \times 1000 = 10 \text{ ms}$

Average disk access time = seek time + rotational latency = $10 \text{ ms} + 10 \text{ ms} = 20 \text{ ms}$

For 50 libraries, the average disk access time will be $20 \times 50 \text{ ms} = 1 \text{ s}$

7. Difference between Maskable and NonMaskable Interrupts is

- (i) An Interrupt that can be disabled or ignored by the instructions of CPU are called as Maskable Interrupt.
- (ii) An interrupt that cannot be disabled or ignored by the instructions of CPU are called as Non-Maskable Interrupt.
- (iii) An Interrupt that cannot be disabled or ignored by the instructions of CPU are called as Maskable Interrupt.
- (iv) An interrupt that can be disabled or ignored by the instructions of CPU are called as Non-Maskable Interrupt.

- (a) i & ii (b) iii & iv (c) none of above

8. Consider a disk system with 100 cylinders.

The requests to access the cylinders occur in following sequence:

4, 34, 10, 7, 19, 72, 2, 15, 6, 21

Assuming that the head is currently at cylinder 50, and it takes 1ms to move from one cylinder to adjacent one. What is the time taken to satisfy all requests if and shortest seek time first policy is used?

- (A) 98ms (B) 117ms (C) 232ms (D) 276ms

Explanation:

4, 34, 10, 7, 19, 72, 2, 15, 6, 21

Since shortest seek time first policy is used, head will first move to 34. This move will cause $16 \times 1 \text{ ms}$. After 34, head will move to 20 which will cause $14 \times 1 \text{ ms}$. And so on. So cylinders are accessed in following order 34, 21, 19, 15, 10, 7, 6, 4, 2, 72 and total time will be $(16 + 13 + 1 + 4 + 5 + 3 + 1 + 2 + 2 + 70) \times 1 = 117 \text{ ms}$.

9. Which of the following does not interrupt a running process?

- (a) A device (b) Timer (c) Scheduler process (d) Power failure

10. A CPU generally handles an interrupt by executing an interrupt service routine

- (A) As soon as an interrupt is raised
- (B) By checking the interrupt register at the end of fetch cycle.
- (C) By checking the interrupt register after finishing the execution of the current instruction.
- (D) By checking the interrupt register at fixed time intervals.

Explanation: Hardware detects interrupt immediately, but CPU acts only after its current instruction. This is followed to ensure integrity of instructions.

11. Consider the data given in previous question. The address of the 1039th sector is _____

- (A) (0, 15, 31) (B) (0, 16, 30) (C) (0, 16, 31) (D) (0, 17, 31)

Explanation:

<0,15,31> 0th cylinder 15th surface and 31st sector

So, 0 cylinders passed $0 \times 20 \times 63$

As each cylinder has 20 surfaces and each surface has 63 sectors. + 15 surfaces passed (0-14) 15×63

As each surface has 63 sectors + We are on 31st sector

So, sector no. = $0 \times 20 \times 63 + 15 \times 63 + 31 = 976$ sector.

Which is not equal to 1039.

<0,16,31>

Similarly this represents,

$0 \times 20 \times 63 + 16 \times 63$ (0-15 sectors and each sector has 63 sectors) + 31 sectors on 16th sector

Sector no = $0 \times 20 \times 63 + 16 \times 63 + 31 = 1039$ sector which is equal to 1039.

Hence, option c is correct.

12. Consider a typical disk that rotates at 15000 rotations per minute (RPM) and has a transfer rate of 50×10^6 bytes/sec. If the average seek time of the disk is twice the average rotational delay and the controller's transfer time is 10 times the disk transfer time, the average time (in milliseconds) to read or write a 512 byte sector of the disk is

- a) 6.1 ms b) 6.5 ms c) 6.1 ns d) 6.5 ns

Explanation

Disk latency = Seek Time + Rotation Time + Transfer Time + Controller Overhead

Seek Time? Depends no. tracks the arm moves and seek speed of disk

Rotation Time? depends on rotational speed and how far the sector is from the head

Transfer Time? depends on data rate (bandwidth) of disk (bit density) and the size of request

Disk latency = Seek Time + Rotation Time +
Transfer Time + Controller Overhead

Average Rotational Time = $(0.5) / (15000 / 60) = 2$ milliseconds

[On average half rotation is made]

It is given that the average seek time is twice the average rotational delay

So Avg. Seek Time = $2 \times 2 = 4$ milliseconds.

Transfer Time = $512 / (50 \times 10^6 \text{ bytes/sec})$
= 10.24 microseconds

Given that controller time is 10 times the average transfer time

Controller Overhead = $10 \times 10.24 \text{ microseconds}$
= 0.1 milliseconds

Disk latency = Seek Time + Rotation Time +

$$\begin{aligned}
 & \text{Transfer Time} + \text{Controller Overhead} \\
 &= 4 + 2 + 10.24 * 10^{-3} + 0.1 \text{ milliseconds} \\
 &= 6.1 \text{ milliseconds}
 \end{aligned}$$

13. A graphics card has on board memory of 1 MB. Which of the following modes can the card not support?

- (a) 1600 x 400 resolution with 256 colours on a 17 inch monitor
- (b) 1600 x 400 resolution with 16 million colours on a 14 inch monitor**
- (c) 800 x 400 resolution with 16 million colours on a 17 inch monitor
- (d) 800 x 800 resolution with 256 colours on a 14 inch monitor

Explanation: Monitor size doesn't matter here. Number of bits required to store a 16M colors pixel = $\text{ceil}(\log_2(16 * 1000000)) = 24$
 Number of bytes required for 1600 x 400 resolution with 16M colors = $(1600 * 400 * 24) / 8$
 which is 192000000 (greater than 1MB).

14. Which of the following requires a device driver?

- a) Register
- b) Cache
- c) Main memory
- d) Disk**

15. Consider a machine has 1000KB of main memory. List of jobs arriving in the sequence is as followings

J1 requiring 200KB arrives

J2 requiring 350KB arrives

J3 requiring 300KB arrives

J1 finishes

J4 requiring 120KB arrives

J5 requiring 150KB arrives

J6 requiring 80KB arrives

Between best fit and first fit, which performs better for this sequence?

- (A) First fit**
- (B) Best fit
- (C) Both perform the same
- (D) None

Explanation:

Main memory = 1000K

Job 1 requiring 200 K arrives

Job 2 requiring 350 K arrives

Job 3 requiring 300 K arrives and assuming continuous allocation:

Free memory = $1000 - 850(200 + 350 + 300) = 150 \text{ K}$ (till these jobs first fit and best fit are same)

Since, job 1 finishes, Free memory = 200 K and 150 K

Case 1: First fit

Job 4 requiring 120 K arrives

Since 200 K will be the first slot, so Job 4 will acquire this slot only. Remaining memory = $200 - 120 = 80 \text{ K}$

Job 5 requiring 150 K arrives

It will acquire 150 K slot

Job 6 requiring 80 K arrives

It will occupy 80 K slot, so, all jobs will be allocated successfully.

Case 2: Best fit

Job 4 requiring 120 K arrives

It will occupy best fit slot which is 150 K. So, remaining memory = $150 - 120 = 30$ K

Job 5 requiring 150 K arrives

It will occupy 200 K slot. So, free space = $200 - 150 = 50$ K

Job 6 requiring 80 K arrives

There is no continuous 80 K memory free. So, it will not be able to allocate.

So, first fit is better.

16. Consider a disk where blocks 1,3,4,6,8,9,10,11,12,13,17,18,25,26 and 27 are free and the rest of the blocks are allocated. Then the free space bitmap would be _____

- a) 10000110000001110011111100011111...
- b) 11000011000000111001111110001111...
- c) 01111001111110001100000011100000...
- d) 010110101111110001100000011100000...

17. A device with data transfer rate 10 KB/sec is connected to a CPU. Data is transferred byte-wise. Let the interrupt overhead be 4 microsec. The byte transfer time between the device interface register and CPU or memory is negligible. What is the minimum performance gain of operating the device under interrupt mode over operating it under program controlled mode?

- (A) 15 (B) 25 (C) 35 (D) 45

Explanation:

In programmed I/O, CPU does continuous polling,

To transfer 1B CPU polls for 10^{-4} sec = 10^2 micro-sec of processing

In interrupt mode CPU is interrupted on completion of I/O,

To transfer 1B CPU does 4 micro-sec of processing (since transfer time between other components is negligible).

Gain = $10^2 / 4 = 25$

18. Consider a disk drive with the following specifications:

- 16 surfaces,
- 512 tracks/surface,
- 512 sectors/track,
- 1 KB/sector,
- rotation speed 3000 rpm.

The disk is operated in cycle stealing mode whereby whenever one byte word is ready it is sent to memory; similarly, for writing, the disk interface reads a 4 byte word from the memory in each DMA cycle. Memory cycle time is 40 nsec. The maximum percentage of time that the CPU gets blocked during DMA operation is:

- (A) 10 (B) 25 (C) 40 (D) 50

Explanation:

Time takes for 1 rotation = $60/3000$

It reads 512×1024 Bytes in one rotation.

Time taken to read 4 bytes = 153 ns

153 is approximately 4 cycles (160ns)

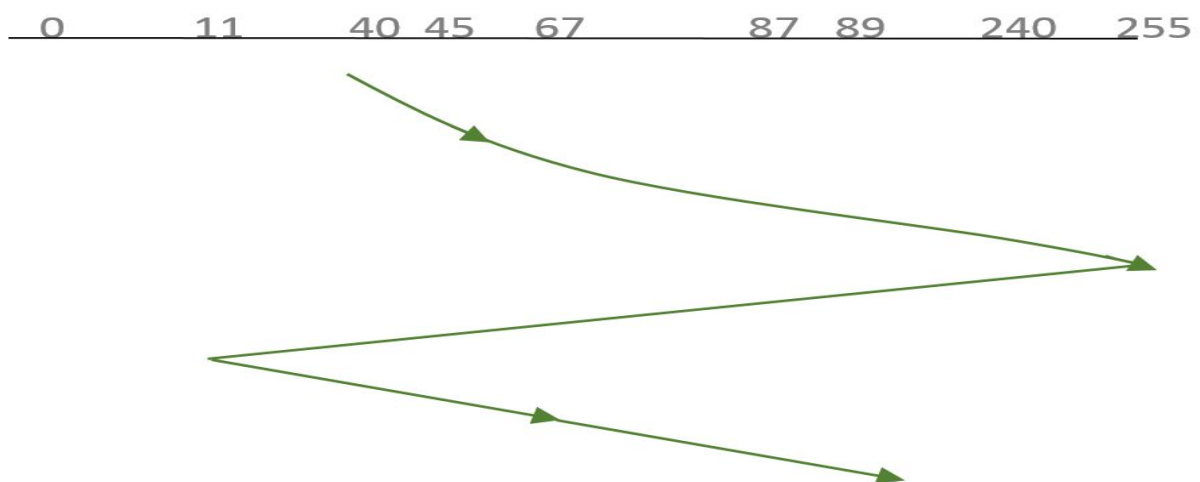
Percentage of time CPU gets blocked = $40 \times 100 / 160 = 25$

19. Consider the situation in which the disk read/write head is currently located at track 45 (of tracks 0-255) and moving in the positive direction. Assume that the following track requests have been made in this order: 40, 67, 11, 240, 87. What is the order in which optimised C-SCAN would service these requests and what is the total seek distance?

- (A) 600 (B) 810 (C) 505 (D) 550

Circular scanning works just like the elevator to some extent. It begins its scan toward the nearest end and works its way all the way to the end of the system. Once it hits the bottom or top it jumps to the other end and moves in the same direction. Keep in mind that the huge jump doesn't count as a head movement.

Disk queue: 40, 67, 11, 240, 87 and disk is currently located at track 45. The order in which optimised C-SCAN would service these requests is shown by the following diagram.



$$\text{Total seek distance} = (67-45) + (87-67) + (240-87) + (255-240) + (255-0) + (11-0) + (40-11) \\ = 22 + 20 + 153 + 15 + 255 + 11 + 29 = 505$$

20. Interrupt mode of data-transfer is used for _____

- (A) 1 & 2
(B) 3. Bulk transfer of several kilo-byte
(C) 1. Short events like mouse action
(D) 2. Key board inputs

21. Consider following disk:

- has 16 surfaces,
- 128 tracks per surface
- 256 sectors per track
- 512 bytes of data are stored in a bit serial manner in a sector

The capacity of the disk pack and the number of bits required to specify a particular sector in the disk respectively are _____

- (A) 256 Mbyte, 19 bits (B) 256 Mbyte, 28 bits
(C) 512 Mbyte, 20 bits (D) 64 Gbyte, 28 bits

Explanation:

Capacity of the disk = 16 surfaces X 128 tracks X 256 sectors X 512 bytes = 256 Mbytes.
To calculate number of bits required to access a sector, we need to know total number of sectors. Total number of sectors = 16 surfaces X 128 tracks X 256 sectors = 2^{19}
So the number of bits required to access a sector is 19.

22. The _____ are reserved for events such as unrecoverable memory errors.

- a) non maskable interrupts
- b) blocked interrupts
- c) maskable interrupts
- d) none of the mentioned

23. The hardware mechanism that allows a device to notify the CPU is called _____

- a) polling
- b) interrupt
- c) driver
- d) controlling

24. The _____ register is written by the host to send output.

- a) status
- b) control
- c) data in
- d) data out

25. An I/O port typically consists of four registers status, control, _____ and _____ registers.

- a) system in, system out
- b) data in, data out
- c) flow in, flow out
- d) input, output

26. A _____ is a collection of electronics that can operate a port, a bus, or a device.

- a) controller
- b) driver
- c) host
- d) bus

27. If one or more devices use a common set of wires to communicate with the computer system, the connection is called _____

- a) CPU
- b) Monitor
- c) Wirefull
- d) Bus

28. Buffering is done to _____

- a) cope with device speed mismatch
- b) cope with device transfer size mismatch
- c) maintain copy semantics
- d) all of the mentioned

29. Caching is _____ spooling.

- a) same as
- b) not the same as
- c) all of the mentioned
- d) none of the mentioned

30. Caching _____

- a) is fast memory
- b) holds a copy of the data
- c) is used instead of main memory
- d) holds output for a device

31. Spooling _____

- a) holds a copy of the data
- b) is fast memory
- c) holds the only copy of the data
- d) holds output for a device

32. I/O _____ in system performance.

- a) is a major factor
- b) is a minor factor
- c) does not matter
- d) none of the mentioned

33. A block device transfers ____

- a) bytes one by one
- b) block of bytes as a unit
- c) with unpredictable response times
- d) all kinds of above

34. In polling, ____

- a) busy – wait cycles wait for I/O from device
- b) interrupt handler receives interrupts
- c) interrupt-request line is triggered by I/O device
- d) all of the mentioned

35. A dedicated device is ____

- a) opposite to a sharable device
- b) same as a sharable device
- c) can be used concurrently by several processes
- d) none of the mentioned

36. For large data transfers, ____ is used.

- a) DMA
- b) programmed I/O
- c) controller register
- d) none of the mentioned

37. The interrupt vector contains ____

- a) the interrupts
- b) the memory addresses of specialized interrupt handlers
- c) the identifiers of interrupts
- d) the device addresses

38. If the number of cycles spent busy – waiting is not excessive, then ____

- a) programmed I/O is more efficient than interrupt driven I/O
- b) interrupt driven I/O is more efficient than programmed I/O
- c) both programmed and interrupt driven I/O are equally efficient
- d) none of the mentioned

39. The kernel data structures include ____

- a) process table
- b) close file table
- c) open file table
- d) all of the mentioned

40. A keyboard is an example of a device that is accessed through a ____ interface.

- a) block stream
- b) set of blocks
- c) character stream
- d) none of the mentioned

41. The ____ determines the cause of the interrupt, performs the necessary processing and executes a return from the interrupt instruction to return the CPU to the execution state prior to the interrupt.

- a) interrupt request line
- b) device driver
- c) interrupt handler
- d) non-maskable interrupt

42. When device A has a cable that plugs into device B, and device B has a cable that plugs into device C and device C plugs into a port on the computer, this arrangement is

called a _____

- a) port connection b) bus chain c) cable connection **d) daisy chain**

43. RAID level 0+1 is used because, RAID level 0 provides _____ whereas RAID level 1 provides _____

- a) performance, redundancy **b) performance, reliability**
c) redundancy, performance d) none of the mentioned

44. RAID level _____ spreads parity and data among all N+1 disks rather than storing data in N disks and parity in 1.

- a) 3 b) 4 **c) 5** d) 6

45. RAID level 5 is also known as _____

- a) bit-interleaved parity organization
b) block-interleaved parity organization
c) block-interleaved distributed parity
d) memory-style ECC organization

46. In RAID level 4, one block read, accesses _____

- a) only one disk** b) all disks simultaneously
c) all disks sequentially d) none of the mentioned

47. A disk that has a boot partition is called a _____

- a) start disk b) end disk **c) boot disk** d) none

48. A performance problem with _____ is the expense of computing and writing parity.

- a) non-parity based RAID levels **b) parity based RAID levels**
c) all RAID levels d) none of the mentioned

49. The overall I/O rate in RAID level 4 is _____

- a) low b) very low c) lumbering **d) high**

50. With RAID, a write of a block has to access _____

- a) the disk on which the block is stored
b) parity disk
c) a parity block
d) all of the mentioned

51. RAID level _____ is also known as block interleaved parity organisation and uses block level striping and keeps a parity block on a separate disk.

- a) 1 b) 2 c) 3 **d) 4**

52. RAID level 3 supports a lower number of I/Os per second, because _____

- a) Every disk has to participate in every I/O request**
b) Only one disk participates per I/O request
c) I/O cycle consumes a lot of CPU time
d) All of the mentioned

53. Defective sectors on disks are often known as _____

- a) good blocks
- b) destroyed blocks
- c) bad blocks
- d) none of the mentioned

54. An unrecoverable error in disk is known as _____

- a) hard error
- b) tough error
- c) soft error
- d) none of the mentioned

55. For most computers, the bootstrap is stored in _____

- a) RAM
- b) ROM
- c) Cache
- d) Tertiary storage

56. Bad sector _____

- a) is a sector that cannot be read after writing
- b) is either inaccessible or unwriteable due to permanent damage
- c) cannot be repaired, but it can be marked as unusable
- d) all of above

57. Spare sectors _____

- a) are not seen by the host OS
- b) are used to copy segments
- c) cannot be used
- d) none of above

58. RAID stands for _____

- a) Redundant Allocation of Inexpensive Disks
- b) Redundant Array of Important Disks
- c) Redundant Allocation of Independent Disks
- d) Redundant Array of Independent Disks

59. If the mean time to failure of a single disk is 200,000 hours, then the mean time to failure of some disk in an array of 100 disks will be _____

- a) 20 hours
- b) 20 days
- c) 200 hours
- d) 2000 hours

60. The solution to the problem of reliability is the introduction of _____

- a) aging
- b) scheduling
- c) redundancy
- d) thrashing

61. A large number of disks in a system improves the rate at which data can be read or written _____

- a) if the disks are operated on sequentially
- b) if the disks are operated on selectively
- c) if the disks are operated in parallel
- d) none of the mentioned

Deadlock / Starvation

1. Which of the following condition is required for deadlock to be possible?

- a) mutual exclusion
- b) a process may hold allocated resources while awaiting assignment of other resources
- c) no resource can be forcibly removed from a process holding it
- d) all of the mentioned

2. What is the reusable resource?

- a) that can be used by one process at a time and is not depleted by that use
- b) that can be used by more than one process at a time
- c) that can be shared between various threads
- d) none of the mentioned

3. A system is in the safe state if _____

- a) the system can allocate resources to each process in some order and still avoid a deadlock
- b) there exist a safe sequence
- c) all of the mentioned
- d) none of the mentioned

4. Which one of the following is the deadlock avoidance algorithm?

- a) round-robin algorithm
- b) banker's algorithm
- c) elevator algorithm
- d) first fit algorithm

5. The circular wait condition can be prevented by _____

- a) using thread
- b) using pipes
- c) defining a linear ordering of resource types
- d) all of the mentioned

6. Which one of the following is a visual mathematical way to determine the deadlock occurrence?

- a) resource allocation graph
- b) starvation graph
- c) inversion graph
- d) binary graph

7. To avoid deadlock _____

- a) there must be a fixed number of resources to allocate
- b) resource allocation must be done only once
- c) all deadlocked processes must be aborted
- d) inversion technique can be used

8. If the resources are always preempted from the same process, _____ can occur.

- a) deadlock
- b) aging
- c) thrashing
- d) starvation

9. To _____ to a safe state, the system needs to keep more information about the states of processes.

- a) roll back the process
- b) abort the process
- c) queue the process
- d) kill process

10. A deadlock can be broken by _____

- a) abort all the process in the system
- b) abort one or more processes to break the circular wait**
- c) preempt all resources from all processes
- d) none of the mentioned

11. Cost factors of process termination include _____

- a) Number of resources the deadlock process is not holding
- b) CPU utilization at the time of deadlock
- c) Amount of time a deadlocked process has thus far consumed during its execution**
- d) All of the mentioned

12. If there is wait cycle for resource allocation graph _____

- a) then a deadlock does not exist
- b) then a deadlock may exist**
- c) then the system is in a safe state
- d) none of above

13. If deadlocks occur frequently, the detection algorithm must be invoked _____

- a) rarely
- b) frequently**
- c) both of mentioned
- d) none of the mentioned

14. The disadvantage of invoking the detection algorithm for every request is _____

- a) overhead of the detection algorithm due to consumption of memory
- b) excessive time consumed in the request to be allocated memory
- c) considerable overhead in computation time**
- d) all of the mentioned

15. A computer system has 6 tape drives, with 'n' processes competing for them. Each process may need 2 tape drives. The maximum value of 'n' for which the system is guaranteed to be deadlock free is _____

- a) 2
- b) 3
- c) 4
- d) 5**

Explanation: Deadlock free condition is: $R \geq P(N-1)+1$, where R is total number of resources, P is the number of processes, and N is the max need of each resource.

$$6 \geq P(2-1)+1 \rightarrow 6 \geq P+1 \rightarrow 5 \geq P \rightarrow \max P=5$$

16. Let see a system has 3 processes sharing 4 resources. If each process needs a maximum of 2 units then, deadlock _____

- a) may occur
- b) can never occur**
- c) has to occur
- d) none of the mentioned

17. For a Hold and wait condition to prevail _____

- a) A process must be not be holding a resource, but waiting for one to be freed, and then request to acquire it
- b) A process must be holding at least one resource and waiting to acquire additional resources that are being held by other processes**
- c) A process must hold at least one resource and not be waiting to acquire additional resources
- d) None of the mentioned

18. Deadlock prevention is a set of methods _____

- a) to ensure that at least one of the necessary conditions cannot hold
- b) to ensure that all of the necessary conditions do not hold
- c) to decide if the requested resources for a process have to be given or not
- d) to recover from a deadlock

19. For non sharable resources like a printer, mutual exclusion _____

- a) must exist
- b) must not exist
- c) may exist
- d) none of the mentioned

20. For sharable resources, mutual exclusion _____

- a) is required
- b) is not required
- c) may be or may not be required
- d) none of the mentioned

21. A deadlock avoidance algorithm dynamically examines the _____ to ensure that a circular wait condition can never exist.

- a) resource allocation state
- b) system storage state
- c) operating system
- d) resources

22. A system is in a safe state only if there exists a _____

- a) safe allocation
- b) safe resource
- c) safe sequence
- d) all of the mentioned

23. If no cycle exists in the resource allocation graph _____

- a) then the system will not be in a safe state
- b) then the system will be in a safe state
- c) all of the mentioned
- d) none of the mentioned

24. The disadvantage of a process being allocated all its resources before beginning its execution is _____

- a) Low CPU utilization
- b) Low resource utilization
- c) Very high resource utilization
- d) None of the mentioned

25. To ensure no preemption, if a process is holding some resources and requests another resource that cannot be immediately allocated to it _____

- a) then the process waits for the resources be allocated to it
- b) the process keeps sending requests until the resource is allocated to it
- c) the process resumes execution without the resource being allocated to it
- d) then all resources currently being held are preempted

26. One way to ensure that the circular wait condition never holds is to _____

- a) impose a total ordering of all resource types and to determine whether one precedes another in the ordering
- b) to never let a process acquire resources that are held by other processes
- c) to let a process wait for only one resource at a time
- d) none

27. The process to be aborted is chosen on the basis of the following factors ____

- a) priority of the process
- b) process is interactive or batch
- c) how long the process has computed
- d) all of the mentioned

28. What will happen if a non-recursive mutex is locked more than once?

- a) Starvation
- b) Deadlock
- c) Aging
- d) Signaling

Explanation: If a thread which had already locked a mutex, tries to lock the mutex again, it will enter into the waiting list of that mutex, which results in deadlock. It is because no other thread can unlock the mutex.