1. Dual mode of operating system has
    a) 1 mode
    b) 2 modes
    c) 3 modes
    d) 4 modes

2. Virtual memory is
    a) an extremely large main memory
    b) an extremely large secondary memory
    c) an illusion of an extremely large memory
    d) a type of memory used in super computers

3. Page fault occurs when
    a) the page is corrupted by application software
    b) the page is in main memory
    c) the page is not in main memory
    d) one tries to divide a number by 0

4. Concurrent processes are processes that
    a) do not overlap in time
    b) overlap in time
    c) are executed by a processor at the same time
    d) none of the above

5. The page replacement policy that sometimes leads to more page faults when the size of the memory is increased is
    a) FIFO
    b) LRU
    c) SJF
    d) none of the above

6. Dijkstra's banking algorithm solves the problem of
    a) deadlock avoidance
    b) deadlock recovery
    c) mutual exclusion
    d) context switching

7. 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 above

8. Critical region is
    a) a part of the operating system which is not allowed to be accessed by any process
    b) a set of instructions that access common shared resource which exclude one another in time
    c) the portion of the main memory which can be accessed only by one process at a time
    d) none of the above

9. Necessary conditions for deadlock are
    a) non-preemption and circular wait
    b) Mutual exclusion
    c) both (a) and (b)
    d) none of the above

10. Pre-emptive scheduling, is the strategy of temporarily suspending a running process
    a) before the CPU time slice expires
    b) to allow starving processes to run
    c) when it requests I/O
    d) none of the above

11. The first-fit, best-fit, and the worst-fit algorithm can be used for
    a) contiguous allocation of memory
    b) linked allocation of memory
    c) indexed allocation of memory
    d) all of the above

12. Assume three jobs arrive at approximately the same time, but Job A arrives slightly before Job B, and Job B arrives slightly before job C. Job A requires 400 ms of CPU, Job B is 800 ms, and Job C is 1200 ms. Assume a time-slice of 400 msec. Given a RR scheduler, what is the **turnaround time** of job B?
    a) 400 ms
    b) 800 ms
    c) 1200 ms
    d) 1600 ms

13. Assume three jobs arrive at approximately the same time, but Job A arrives slightly before Job B, and Job B arrives slightly before job C. Job A requires 400 ms of CPU, Job B is 800 ms, and Job C is 1200 ms. Assume a time-slice of 400 msec. Given a FIFO scheduler, what is the **average response time** of the three jobs?

    a) 400 ms
    b) 533.33 ms
    c) 1333.33 ms
    d) 1600 ms

14. Assume three jobs arrive at approximately the same time, but Job A arrives slightly before Job B, and Job B arrives slightly before job C. Job A requires 400 ms of CPU, Job B is 800 ms, and Job C is 1200 ms. Assume a time-slice of 400 msec. Given a RR scheduler, what is the **average response time** of the three jobs?
    a) 400 ms
    b) 533.33 ms
    c) 1333.33 ms
    d) 1600 ms

15. Assume three jobs arrive at approximately the same time, but Job A arrives slightly before Job B, and Job B arrives slightly before job C. Job A requires 400 ms of CPU, Job B is 800 ms, and Job C is 1200 ms. Assume a time-slice of 400 msec. Given a RR scheduler, what is the **waiting time** of job B?
    a) 400 ms
    b) 800 ms
    c) 1200 ms
    d) 2400 ms

16. Assume three jobs arrive at approximately the same time, but Job A arrives slightly before Job B, and Job B arrives slightly before job C. Job A requires 400 ms of CPU, Job B is 800 ms, and Job C is 1200 ms. Assume a time-slice of 400 msec. Given a RR scheduler, what is the **waiting time** of job C?
    a) 400 ms
    b) 800 ms
    c) 1200 ms
    d) 2400 ms

17. Assume three jobs arrive at approximately the same time, but Job A arrives slightly before Job B, and Job B arrives slightly before job C. Job A requires 400 ms of CPU, Job B is 800 ms, and Job C is 1200 ms. Assume a time-slice of 400 msec. Given a FIFO scheduler, what is the **waiting time** of job C?
    a) 400 ms

b) 800 ms
c) 1200 ms
d) 2400 ms

18. Which of the following scheduling algorithms gives minimum average waiting time?
    a) FCFS
    b) SJF
    c) Round-robin
    d) Priorty

19. Which of the following scheduling policy is well suited for a time-shared operating system?
    a) Shortest job first
    b) Round robin
    c) FCFS
    d) Elevator

20. If a physical address is 32 bits and each page is 8KB, the top ……. bits exactly designate the physical page number.
    a) 10
    b) 13
    c) 19
    d) 32

21. The …….. occurs when high priority jobs must wait for lower priority jobs.
    a) convoy effect
    b) BLOCKED state
    c) critical-section problem
    d) race condition

22. A situation where 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 ……...
    a) convoy effect
    b) disorder problem
    c) critical-section problem
    d) race condition

23. Assume you have architecture with 1KB address spaces and 16KB of physical memory. Assume you are performing dynamic relocation with a base-and-bounds register. The base register contains 0x37d (decimal 893) and the bounds register contains 506 (decimal). Translate the virtual address 0x2e7 (decimal: 743) into physical addresses.
    a) 0x2e7 (decimal: 743)
    b) 0x577 (decimal:1399)
    c) 0x664 (decimal: 1636)

d) Segmentation Violation

24. Assume you have architecture with 1KB address spaces and 16KB of physical memory. Assume you are performing dynamic relocation with a base-and-bounds register. The base register contains 0x37d (decimal 893) and the bounds register contains 506 (decimal). Translate the virtual address 0x01ef (decimal: 495) into physical addresses.
    a) 0x01ef (decimal: 495)
    b) 0x3E9 (decimal:1001)
    c) 0x56C (decimal:1388)
    d) Segmentation Violation

25. In a time-sharing operating system, when the time slot given to a process is completed, the process goes from the RUNNING state to the
    a) BLOCKED state
    b) READY state
    c) SUSPENDED state
    d) TERMINATED state

26. Suppose that a process is in "BLOCKED" state waiting for some I/O service. When the device is completed, it goes to the
    a) BLOCKED state
    b) READY state
    c) SUSPENDED state
    d) TERMINATED state

27. The running process issues an I/O request to the disk. The process goes to the
    a) BLOCKED state
    b) READY state
    c) SUSPENDED state
    d) TERMINATED state

28. The running process completes. The process goes to the
    a) BLOCKED state
    b) READY state
    c) SUSPENDED state
    d) TERMINATED state

29. A small computer has 4 page frames. A process makes the following list of page references: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6. How many page faults using FIFO algorithm?
    a) 8
    b) 10

c) 12
d) 14

30. A small computer has 4 page frames. A process makes the following list of page references: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6. How many page faults using least-recently-used (LRU) algorithm?
    a) 8
    b) 10
    c) 12
    d) 14

31. A small computer has 4 page frames. A process makes the following list of page references: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6. How many page faults using optimal page replacement algorithm?
    a) 8
    b) 10
    c) 12
    d) 14

32. 'Aging' is
    a) keeping track of cache contents
    b) keeping track of what pages are currently residing in the 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.

33. If there are 32 pages, each of size 1 Kbytes, then the logical address should have
    a) 10 bits
    b) 14 bits
    c) 15 bits
    d) 16 bits

34. Memory protection is normally done by the
    a) processor and the associated hardware
    b) operating system
    c) compiler
    d) user program

35. Which of the following page replacement algorithms suffers from Belady's anomaly?
    a) Optimal
    b) Least-Recently-Used (LRU)
    c) FIFO
    d) Best

36. Thrashing
    a) reduces page I/O
    b) decreases the degree of multiprogramming
    c) implies excessive page I/O
    d) improves the system performance

37. Deadlock may occur
    a) if there are more than two processes competing for resource R1
    b) if process P1 is holding resource R1, and process P2 is holding resource R2
    c) if process P1 is holding resources R1 and R2, and process P2 is waiting for resources R1 and R2
    d) if process P1 is holding a resource R2 and is waiting for resource R1 and process P2 is holding a resource R1 and is waiting for a resource R2

38. Mutual exclusion problem occurs:
    a) between two disjoint processes that do not interact
    b) among processes that share resources
    c) among processes that do not use the same resource
    d) among threads that do not use the same resource

39. An operating system contains 3 user processes each requiring 2 units of resource R. The minimum number of units of R such that no deadlock will ever occur is
    a) 3
    b) 4
    c) 5
    d) 6

40. Why are page sizes powers of 2?
    a) The page number is determined by the n most significant bits of the virtual address. So the page size is 2^n.
    b) It doesn't have to be but manufacturers only make memory in those sizes.
    c) The displacement within the page is determined by the n least significant bits of the virtual address. So the page size is 2^n.
    d) Pages need to be repeatedly able to be halved.

41. If the virtual address space has a 9-bit with 3 bits of segment number and 6 bits of offset. How large are segments on this architecture?
    a) 64 bytes
    b) 256 bytes
    c) 512 bytes
    d) 2048 bytes

42. The text segment of a process address space contains:
    a) the statically allocated data associated with the process

b) the dynamically allocated data associated with the process
c) the executable code associated with the process
d) the inter-process communication (IPC) messages for the process

43. In the Banker's algorithm, the content of the matrix Need is ……
a) Allocation – Available
b) Max – Available
c) Max – Allocation
d) Allocation – Max

44. What hardware mechanism is required in order to make virtual memory systems efficient?
a) DMA
b) TLB
c) EROM
d) EEROM

45. In a page memory, the page hit ratio is 0.9. The time required to access a page in secondary memory is equal to 100ns. The time required to access a page in primary memory is 10ns. The average time required to access a page is
a) 9 ns
b) 10 ns
c) 19 ns
d) 90 ns

46. One example of a hardware solution to the critical section problem is:
a) Peterson's Algorithm
b) Banker's Algorithm
c) Test and Set
d) Compare and Shop

47. Kernal mode of the operating system is also called
a) User mode
b) System mode
c) Supervisor mode
d) Data mode

48. Table of pointers for interrupt to be executed contains the
a) interrupts
b) programs
c) addresses
d) compilers

49. To avoid the race condition, the number of processes that may be simultaneously inside their critical section is
a) 0

b) 1
c) 2
d) 4

50. Process is

a) program in High level language kept on disk
b) contents of main memory
c) a program in execution
d) a job in secondary memory

51. What is operating system?

e) collection of programs that manages hardware resources
f) system service provider to the application programs
g) link to interface the hardware and application programs
h) all of the mentioned

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

a) System calls
b) API
c) Library
d) Assembly instruction

53. What is the ready state of a process?

a) when process is scheduled to run after some execution
b) when process is unable to run until some task has been completed
c) when process is using the CPU
d) none of the mentioned

54. What is interprocess communication?

a) communication within the process
b) communication between two process
c) communication between two threads of same process
d) none of the mentioned

55. A set of processes is deadlock if

a) each process is blocked and will remain so forever
b) each process is terminated
c) all processes are trying to kill each other
d) none of the mentioned

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

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

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

a) New
b) Old
c) Waiting
d) Running

58. What is the degree of multiprogramming?

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

59. What is a long-term scheduler?

a) It selects which process has to be brought into the ready queue
b) It selects which process has to be executed next and allocates CPU
c) It selects which process to remove from memory by swapping
d) None of the mentioned

60. If all processes I/O bound, the ready queue will almost always be _____ and the Short term Scheduler will have a _____ to do.

a) full, little
b) full, lot
c) empty, little
d) empty, lot

61. What is a short-term scheduler?

a) It selects which process has to be brought into the ready queue
b) It selects which process has to be executed next and allocates CPU
c) It selects which process to remove from memory by swapping
d) None of the mentioned

62. The context of a process in the PCB of a process does not contain _____

a) the value of the CPU registers
b) the process state
c) memory-management information
d) context switch time

63. When several processes access the same data concurrently and the outcome of the execution depends on the particular order in which the access takes place, is called?

a) dynamic condition
b) race condition
c) essential condition
d) critical condition

64. If a process is executing in its critical section, then no other processes can be executing in their critical section. This condition is called?
    a) mutual exclusion
    b) critical exclusion
    c) synchronous exclusion
    d) asynchronous exclusion

65. Which one of the following is a synchronization tool?
    a) Thread
    b) Pipe
    c) Semaphore
    d) socket

66. When high priority task is indirectly preempted by medium priority task effectively inverting the relative priority of the two tasks, the scenario is called _____
    a) priority inversion
    b) priority removal
    c) priority exchange
    d) priority modification

67. What is 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

68. DMA is used for _____
    a) High speed devices(disks and communications network)
    b) Low speed devices
    c) Utilizing CPU cycles
    d) All of the mentioned

69. In an interrupt driven input/output _____
    a) the CPU uses polling to watch the control bit constantly, looping to see if a device is ready
    b) the CPU writes one data byte to the data register and sets a bit in control register to show that a byte is available
    c) the CPU receives an interrupt when the device is ready for the next byte
    d) the CPU runs a user written code and does accordingly

70. The interval from the time of submission of a process to the time of completion is termed as _____
    a) waiting time
    b) turnaround time

c) response time
d) throughput

71. A process is selected from the _____ queue by the _____ scheduler, to be executed.
a) blocked, short term
b) wait, long term
c) ready, short term
d) ready, long term

72. What is Response time?
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

73. With round robin scheduling algorithm in a time shared system _____
a) using very large time slices converts it into First come First served scheduling algorithm
b) using very small time slices converts it into First come First served scheduling algorithm
c) using extremely small time slices increases performance
d) using very small time slices converts it into Shortest Job First algorithm

74. The real difficulty with Shortest Job First (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

75. What is 'Aging'?
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

76. Choose one of the disadvantages of the priority scheduling algorithm?
a) it schedules in a very complex manner
b) its scheduling takes up a lot of time
c) it can lead to some low priority process waiting indefinitely for the CPU
d) none of the mentioned

77. Which of the following scheduling algorithms gives minimum average waiting time?
a) FCFS

b) SJF
c) Round – robin
d) Priority

78. The segment of code in which the process may change common variables, update tables, write into files is known as _____
a) Program
b) critical section
c) non – critical section
d) synchronizing

79. Which of the following conditions must be satisfied to solve the critical section problem?
a) Mutual Exclusion
b) Progress
c) Bounded Waiting
d) All of the mentioned

80. TestAndSet instruction is executed _____
a) after a particular process
b) periodically
c) atomically
d) none of the mentioned

81. 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

82. 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) 6 philosophers and 5 chopsticks

83. Which of the following condition is required for a 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

84. The circular wait condition can be prevented by _____
a) defining a linear ordering of resource types
b) using thread

c) using pipes
d) all of the mentioned

85. Which one of the following is the deadlock avoidance algorithm?
a) banker's algorithm
b) round-robin algorithm
c) elevator algorithm
d) karn's algorithm

Consider the following set of processes, the length of the CPU burst time given in milliseconds.

Process	Burst time
P1	6
P2	8
P3	7
P4	3

86. Assuming the above process being scheduled with the SJF scheduling algorithm.
a) The waiting time for process P1 is 3ms
b) The waiting time for process P1 is 0ms
c) The waiting time for process P1 is 16ms
d) The waiting time for process P1 is 9ms

87. Assuming the above process being scheduled with the SJF scheduling algorithm. The average waiting time is
a) 6ms
b) 6.5ms
c) 7ms
d) 7.5ms

88. Assuming the above process being scheduled with the SJF scheduling algorithm. The average turnaround time is
a) 13 ms
b) 13.5ms
c) 14 ms
d) 14.5ms

89. Consider the following snapshot of a system with five processes (P1, P2, P3, P4, P5) and four resources (R1, R2, R3, R4). There are no current outstanding queued unsatisfied requests.

Currently Available Resources

R1	R2	R3	R4
2	1	2	0

	Current Allocation				Max Need				Still Needs			
Process	**R1**	**R2**	**R3**	**R4**	**R1**	**R2**	**R3**	**R4**	**R1**	**R2**	**R3**	**R4**
P1	0	0	1	2	0	0	3	2	0	0	2	0
P2	2	0	0	0	2	7	5	0	0	7	5	0
P3	0	0	3	4	6	6	5	6	6	6	2	2
P4	2	3	5	4	4	3	5	6	2	0	0	2
P5	0	3	3	2	0	6	5	2	0	3	2	0

(a) Is this system currently deadlocked, or can any process become deadlocked? Why or why not? If not deadlocked, give an execution order
(b) If a request from a process P1 arrives for (0, 4, 2, 0), can the request be immediately granted? Why or why not? If yes, show an execution order.
(c) If a request from a process P2 arrives for (0, 1, 2, 0), can the request be immediately granted? Why or why not? If yes, show an execution order.

Answer:

(a) Using the Banker's algorithm, the system is not deadlocked and will not become deadlocked. The process finishing order is: P1, P4, P5, P2, P3.

(b) No, the request is invalid, as it would exceed the maximum need that P1 specified.

(c) No, the request is valid but if granted, the resulting Currently Available Resources would be (2, 0, 0, 0) and there is no sequence of process executions that would allow the completion of all processes. This is an UNSAFE state.