Assignment - #1(Basic OS, Types and process management)

Operating System

1. During the booting process, which program is responsible for loading the operating system?
A. BIOS
B. Bootloader
C. Kernel
D. More than one of the above
E. None of the above

2. What does the Dual-Mode operation of an OS ensure?
A. Faster processing
B. Security and protection
C. Efficient memory management
D. More than one of the above
E. None of the above

3. Which of the following is NOT a service provided by an OS?
A. File management
B. Network management
C. Hardware manufacturing
D. More than one of the above
E. None of the above

4. The primary purpose of the BIOS during the boot process is to:
A. Initialize hardware
B. Load the operating system
C. Manage processes
D. More than one of the above
E. None of the above

5. The kernel is responsible for which of the following?
A. Process management
B. Memory management
C. File system control
D. More than one of the above
E. None of the above

6. Which component handles user interaction in an OS?
A. Kernel
B. Shell
C. File system
D. More than one of the above
E. None of the above

7. A system call is primarily used for:
A. Hardware debugging
B. Communication between user and kernel
C. Error reporting
D. More than one of the above
E. None of the above

8. Which of these is NOT a type of operating system structure?
A. Monolithic
B. Microkernel
C. Macroprocessor
D. More than one of the above
E. None of the above

9. Bootstrapping refers to:
A. Hardware initialization
B. Self-starting the OS
C. Loading the kernel into memory
D. More than one of the above
E. None of the above

10. Which OS service is responsible for managing memory allocation?
A. Process Scheduling
B. Memory Management
C. Input/Output Control
D. More than one of the above
E. None of the above

11. What is the purpose of system calls in an OS?
A. Enable direct user access to hardware
B. Provide an communication between user programs and OS
C. Manage input/output operations
D. More than one of the above
E. None of the above

12. Which of the following is a valid step in the booting process?
A. POST (Power-On Self Test)
B. Loading of system libraries
C. Execution of user programs
D. More than one of the above
E. None of the above

13. Which of the following best describes the purpose of Dual-Mode operation?
A. To increase processing power
B. To provide separate modes for users and OS operations
C. To allow multiple users on a single system
D. More than one of the above
E. None of the above

14. Which service is provided by an OS for resource sharing?
A. Synchronization
B. Networking
C. File Sharing
D. More than one of the above
E. None of the above

15. When does the OS transition from user mode to kernel mode?
A. During system calls
B. When hardware interrupts occur
C. When a program crashes
D. More than one of the above
E. None of the above

16. Which of the following occurs during process scheduling?
A. Allocation of CPU to a process
B. Swapping processes in and out of memory
C. Termination of background processes
D. More than one of the above
E. None of the above

17. In OS operations, which task is primarily handled by the I/O subsystem?
A. Device communication
B. File management
C. Process scheduling
D. More than one of the above
E. None of the above

18. What is a major advantage of layered OS architecture?
A. Improved system performance
B. Simplified debugging and testing
C. Direct access to hardware
D. More than one of the above
E. None of the above

19. What triggers an interrupt in an OS?
A. Completion of an I/O operation
B. Occurrence of an error
C. User program requests
D. More than one of the above
E. None of the above

20. In the booting process, what happens immediately after the bootloader is executed?
A. Hardware initialization
B. Kernel loading into memory
C. Starting the file system
D. More than one of the above
E. None of the above

21. What differentiates a microkernel from a monolithic kernel?
A. Separation of core functionalities
B. Faster execution times
C. Reduced system calls
D. More than one of the above
E. None of the above

22. Which of the following is an example of a real-time operating system?
A. VxWorks
B. Windows 10
C. Linux
D. More than one of the above
E. None of the above

23. Which OS type is best suited for controlling machinery in industrial automation?
A. Network OS
B. Real-time OS
C. Batch OS
D. More than one of the above
E. None of the above

24. A distributed operating system is characterized by:
A. Centralized resource management
B. Independent execution of tasks across multiple nodes
C. Real-time task execution
D. More than one of the above
E. None of the above

25. Which type of operating system processes jobs without requiring user interaction during execution?
A. Real-time OS
B. Batch OS
C. Time-sharing OS
D. More than one of the above
E. None of the above

26. What is a key feature of a time-sharing operating system?
A. High throughput
B. Multiple programs executed simultaneously
C. Time slices allocated to users
D. More than one of the above
E. None of the above

27. Which of the following is a feature of an embedded operating system?
A. Low resource consumption
B. General-purpose applications
C. High scalability
D. More than one of the above
E. None of the above

28. What is the primary goal of a network operating system?
A. Allow users to run programs on a local machine
B. Manage shared resources across a network
C. Provide a graphical user interface
D. More than one of the above
E. None of the above

29. What is a process in an operating system?
A. A program in execution
B. A static set of instructions
C. A hardware resource
D. More than one of the above
E. None of the above

30. Which component stores all the information about a process?
A. Memory table
B. Process Control Block (PCB)
C. Scheduling queue
D. More than one of the above
E. None of the above

31. What is the state of a process that is waiting for an event to occur?
A. Ready
B. Running
C. Waiting
D. More than one of the above
E. None of the above

32. Which of the following describes a thread?
A. A lightweight process
B. A unit of CPU utilization
C. Executes independently of other threads
D. More than one of the above
E. None of the above

33. What does the arrival time in scheduling represent?
A. Time when the process is created
B. Time when the process enters the ready queue
C. Time when the process completes execution
D. More than one of the above
E. None of the above

34. Which metric is calculated as the difference between exit time and arrival time?
A. Waiting time
B. Response time
C. Turnaround time
D. More than one of the above
E. None of the above

35. What is dispatch latency?
A. Time taken to switch from one process to another
B. Time to schedule a process
C. Time to allocate resources
D. More than one of the above
E. None of the above

36. In which scheduling queue are processes that are waiting for I/O stored?
A. Ready queue
B. Device queue
C. Job queue
D. More than one of the above
E. None of the above

37. Which scheduler selects a process for execution from the ready queue?
A. Long-term scheduler
B. Medium-term scheduler
C. Short-term scheduler
D. More than one of the above
E. None of the above

38. How is waiting time calculated?
A. Turnaround time - Burst time
B. Arrival time - Exit time
C. Burst time + Response time
D. More than one of the above
E. None of the above

39. What is the role of the long-term scheduler?
A. Select processes for execution from the ready queue
B. Regulate the degree of multiprogramming
C. Assign processes to the CPU
D. More than one of the above
E. None of the above

40. Which state transition occurs when a process moves from the running state to the waiting state?
A. Scheduling
B. Block
C. Preemption
D. More than one of the above
E. None of the above

41. What is the response time in process scheduling?
A. The time from process arrival to the first response
B. The total time a process takes to complete execution
C. The time spent in the ready queue
D. More than one of the above
E. None of the above

42. Which scheduler is involved in temporarily removing processes from memory to reduce system load?
A. Long-term scheduler
B. Medium-term scheduler
C. Short-term scheduler
D. More than one of the above
E. None of the above

43. What is throughput in the context of process scheduling?
A. The total number of processes executed in a unit of time
B. The time spent by the CPU executing processes
C. The total waiting time for all processes
D. More than one of the above
E. None of the above

44. When does a process enter the "ready" state?
A. When it has completed execution
B. When it is waiting for I/O
C. When it is prepared to run but waiting for CPU allocation
D. More than one of the above
E. None of the above

45. Which of the following statements about the job queue is true?
A. It contains all processes in the system
B. It only includes processes waiting for I/O
C. It is used for processes that are ready to run
D. More than one of the above
E. None of the above

46. What happens during preemption in process scheduling?
A. A running process is paused and moved back to the ready queue
B. A process is moved from waiting to running
C. A process is terminated
D. More than one of the above
E. None of the above

47. How is CPU utilization typically maximized?
A. By increasing the number of processes in the system
B. By reducing idle CPU time
C. By prioritizing I/O-bound processes
D. More than one of the above
E. None of the above

48. Which of the following can affect dispatch latency?
A. Context-switching overhead
B. Priority inversion
C. System load
D. More than one of the above
E. None of the above

49. Which process state transition occurs during process termination?
A. Running → Waiting
B. Running → Terminated
C. Waiting → Terminated
D. More than one of the above
E. None of the above

50. In round-robin scheduling, what determines the time slice for each process?
A. Process priority
B. Fixed quantum assigned by the scheduler
C. Process burst time
D. More than one of the above
E. None of the above

51. What is the purpose of the ready queue?
A. To hold processes waiting for I/O
B. To store processes ready for execution
C. To manage terminated processes
D. More than one of the above
E. None of the above

52. What is a key feature of multilevel queue scheduling?
A. All processes are treated equally
B. Different queues for processes with similar characteristics
C. Only foreground processes are scheduled
D. More than one of the above
E. None of the above

53. How is burst time defined?
A. Time spent in the waiting queue
B. Time taken for CPU execution
C. Time from arrival to termination
D. More than one of the above
E. None of the above

54. In First-Come-First-Serve (FCFS) scheduling, what is the primary criterion for CPU allocation?
A. Process priority
B. Arrival time
C. Shortest burst time
D. More than one of the above
E. None of the above

55. Given three processes with arrival times and burst times as follows:

Process	Arrival Time	Burst Time
P1	0 ms	5 ms
P2	2 ms	3 ms
P3	4 ms	1 ms

Calculate the turnaround time for P2 using FCFS.
A. 3 ms
B. 8 ms
C. 6 ms
D. More than one of the above
E. None of the above

56. Which of the following is a drawback of FCFS scheduling?
A. Starvation of processes with longer burst times
B. The convoy effect
C. Complex to implement
D. More than one of the above
E. None of the above

57. In Shortest Job First (SJF) scheduling, which process gets selected for execution?
A. The process with the shortest arrival time
B. The process with the shortest burst time
C. The process with the highest priority
D. More than one of the above
E. None of the above

58. Consider the following processes for SJF scheduling:

Process	Arrival Time	Burst Time
P1	0 ms	6 ms
P2	2 ms	4 ms
P3	4 ms	2 ms

Which process is executed first?
A. P1
B. P2
C. P3
D. More than one of the above

59. In Priority Scheduling, how is the CPU allocated?
A. Based on arrival time
B. Based on the priority of the process
C. Based on the shortest burst time
D. More than one of the above
E. None of the above

60. What is the primary purpose of Interprocess Communication (IPC)?
A. To facilitate data sharing between processes
B. To synchronize processes for efficient execution
C. To enable communication between operating system modules
D. More than one of the above
E. None of the above

61. Which mechanism is commonly used for IPC in distributed systems?
A. Shared memory
B. Message passing
C. Sockets
D. More than one of the above
E. None of the above

62. In shared memory IPC, what is a critical issue?
A. Security of shared data
B. Synchronization between processes
C. Data consistency
D. More than one of the above
E. None of the above

63. What is the primary disadvantage of using shared memory for IPC?
A. It is slower than message passing
B. It requires additional synchronization mechanisms
C. It cannot be used between processes on different machines
D. More than one of the above
E. None of the above

64. In message passing IPC, which is true?
A. It avoids the need for shared memory
B. It is generally slower than shared memory
C. It can be used in distributed systems
D. More than one of the above
E. None of the above

65. Which condition must hold in the critical section problem?
A. Mutual exclusion
B. Progress
C. Bounded waiting
D. More than one of the above
E. None of the above

66. What is the role of semaphores in process synchronization?
A. Preventing race conditions
B. Enforcing mutual exclusion
C. Managing producer-consumer problems
D. More than one of the above
E. None of the above

67. Which of the following are types of semaphores?
A. Binary semaphore
B. Counting semaphore
C. Mutex
D. More than one of the above
E. None of the above

68. What does a monitor in process synchronization ensure?
A. Mutual exclusion
B. Automatic condition synchronization
C. Simplified access to shared resources
D. More than one of the above
E. None of the above

69. Which IPC mechanism is best suited for unrelated processes?
A. Shared memory
B. Message passing
C. Pipes
D. More than one of the above
E. None of the above

70. Which is true for a critical section?
A. Only one process can execute it at a time
B. It ensures data consistency
C. It can lead to deadlocks if not implemented correctly
D. More than one of the above
E. None of the above

71. What problem does the bounded buffer solve using semaphores?
A. Deadlock
B. Starvation
C. Producer-consumer synchronization
D. More than one of the above
E. None of the above

72. What is a counting semaphore used for?
A. Mutual exclusion
B. Resource management
C. Preventing deadlocks
D. More than one of the above
E. None of the above

73. Which IPC mechanism does not require process synchronization?
A. Shared memory
B. Message passing
C. Pipes
D. More than one of the above
E. None of the above.

74. What is the effect of a "wait()" operation in a semaphore?
A. Decreases the semaphore value by 1
B. Increases the semaphore value by 1
C. Checks if the semaphore value is 0
D. More than one of the above
E. None of the above

75. What is the effect of the "signal()" operation in a semaphore?
A. Increases the semaphore value by 1
B. Decreases the semaphore value by 1
C. Wakes up a process waiting on the semaphore
D. More than one of the above
E. None of the above

76. In the readers-writers problem, which of the following is true?
A. Multiple readers can read simultaneously
B. Writers have exclusive access to the shared resource
C. Starvation can occur if not handled correctly
D. More than one of the above
E. None of the above

77. What is the primary objective of the dining philosophers problem?
A. Deadlock prevention
B. Mutual exclusion
C. Avoiding starvation
D. More than one of the above
E. None of the above

78. Which synchronization construct simplifies the implementation of the dining philosophers problem?
A. Counting semaphores
B. Monitors
C. Binary semaphores
D. More than one of the above
E. None of the above

79. What problem arises if a semaphore value becomes negative?
A. Deadlock
B. A process is blocked and waits for a signal
C. Starvation
D. More than one of the above
E. None of the above

80. In the context of monitors, what is a condition variable used for?
A. Mutual exclusion
B. Synchronization of processes
C. Avoiding deadlocks
D. More than one of the above
E. None of the above

81. Which condition can lead to deadlock in process synchronization?
A. Circular waiting
B. Hold and wait
C. Mutual exclusion
D. More than one of the above
E. None of the above

82. Which of the following synchronization problems can be solved using monitors?
A. Dining philosophers
B. Readers-writers
C. Bounded buffer
D. More than one of the above
E. None of the above

83. In process synchronization, what is starvation?
A. A process waiting indefinitely for a resource
B. Mutual exclusion violation
C. Deadlock caused by circular waiting
D. More than one of the above
E. None of the above

84. How can deadlock be avoided in process synchronization?
A. Using a resource allocation graph
B. Ensuring no circular waiting
C. Avoiding hold-and-wait conditions
D. More than one of the above
E. None of the above

85. What does a semaphore value of zero indicate?
A. No processes are waiting for the semaphore
B. At least one process is waiting for the semaphore
C. The resource associated with the semaphore is unavailable
D. More than one of the above
E. None of the above

86. Which operation decrements the semaphore value?
A. Signal()
B. Wait()
C. Post()
D. More than one of the above
E. None of the above

87. A Counting Semaphore was initialized to 12. then 10P (wait) and 4V (Signal) operations were computed on this semaphore. What is the result?
A. 6
B. 10
C. 4
D. More than one of the above
E. None of the above

88. Given below some processes P1, P2, P3 with Arrival Times and Burst Times . Calculate the average Turnaround Time (TAT) and Waiting Time (WT) using first come first serve Scheduling..

Process	Arrival Time	Burst Time
P1	0 ms	5 ms
P2	0 ms	3 ms
P3	0 ms	8 ms

A. Average TAT = 9.66 ms and Average WT = 4.33 ms
B. Average TAT = 8.66 ms and Average WT = 3.33 ms
C. Average TAT = 8.33 ms and Average WT = 3.33 ms
D. More than one of the above
E. None of the above

89. Given below some processes P1, P2, P3 with Arrival Times and Burst Times . Calculate the average Turnaround Time (TAT) and Waiting Time (WT) using first come first serve Scheduling.

Process	Arrival Time	Burst Time
P1	0 ms	5 ms
P2	1 ms	3 ms
P3	2 ms	8 ms

A. Average TAT = 9.66 ms and Average WT = 4.33 ms
B. Average TAT = 8.67 ms and Average WT = 3.33 ms
C. Average TAT = 8.33 ms and Average WT = 3.33 ms
D. More than one of the above
E. None of the above

90. Given below some processes P1, P2, P3 and P4 with Burst Times. Order the processes by Burst Time for execution. Calculate average TAT and WT using Shortest job first Scheduling.

Process	Burst Time
P1	8 ms
P2	4 ms
P3	1 ms
P4	6 ms

A. Execution Order: P3 → P2 → P4 → P1 and Average TAT = 9.6 ms and Average WT = 4.33 ms
B. Execution Order: P3 → P2 → P4 → P1 and Average TAT = 9.67 ms and Average WT = 3.33 ms
C. Execution Order: P3 → P2 → P4 → P1 and Average TAT = 9.0 ms and Average WT = 4.25 ms
D. More than one of the above
E. None of the above

91. Given below some processes P1, P2, P3 and P4 with arrival time and Burst Times. Order the processes by Burst Time for execution. Calculate average TAT and WT using Shortest job first Scheduling.

Process	Arrival Time	Burst Time
P1	0	8 ms
P2	1	4 ms
P3	4	1 ms
P4	3	6 ms

A. Execution Order: P3 → P2 → P4 → P1 and Average TAT = 9.6 ms and Average WT = 4.33 ms
B. Execution Order: P3 → P2 → P4 → P1 and Average TAT = 10.25 ms and Average WT = 5.5 ms
C. Execution Order: P1 → P3 → P2 → P4 and Average TAT = 10.25 ms and Average WT = 5.5 ms
D. More than one of the above
E. None of the above

92. If the time quantum in a Round Robin (RR) scheduling algorithm is too large, the scheduling behavior will most likely resemble:
A) First Come First Serve (FCFS) scheduling
B) Shortest Job First (SJF) scheduling
C) Preemptive Priority scheduling
D) More than one of the above
E) None of the above

93. Given below some processes P1, P2, P3 with Burst Times and 3ms time quantum. Find out the order of the processes completion and turnaround time of P2 using Round robin scheduling.

Process	Burst Time
P1	10 ms
P2	6 ms
P3	8 ms

A. Completion Order: P2 → P3 → P1 and TAT of P2 = 24 ms
B. Completion Order: P3 → P2 → P1 and TAT of P2 = 14 ms
C. Completion Order: P2 → P3 → P1 and TAT of P2 = 16 ms
D. More than one of the above
E. None of the above

94. Given below some processes P1, P2, P3 with Arrival time and Burst Times and 3ms time quantum. Find out the order of the processes completion and turn around time of P2 using Round robin scheduling.

Process	Arrival time	Burst Time
P1	0	10 ms
P2	7	6 ms
P3	3	8 ms

A. Completion Order: P2 → P3 → P1 and TAT of P2 = 24 ms
B. Completion Order: P3 → P2 → P1 and TAT of P2 = 23 ms
C. Completion Order: P2 → P3 → P1 and TAT of P2 = 16 ms
D. More than one of the above
E. None of the above

95. Given below some processes P1, P2, P3 with Arrival time and Burst Times. Find out the order of the processes completion and turn around time of P2 using Shortest remaining time first scheduling.

Process	Arrival time	Burst Time
P1	0	10 ms
P2	2	6 ms
P3	4	8 ms

A. Completion Order: P2 → P3 → P1 and TAT of P2 = 24 ms
B. Completion Order: P3 → P2 → P1 and TAT of P2 = 23 ms
C. Completion Order: P2 → P1 → P3 and TAT of P2 = 6 ms
D. More than one of the above
E. None of the above

Answer With Explanation

1. Answer: B. Bootloader
Explanation: The bootloader is a program that loads the operating system into memory. BIOS initializes hardware but doesn't load the OS.

2. Answer: B. Security and protection
Explanation: Dual-Mode operation separates user and kernel modes to protect the system from unauthorized access and faulty programs.

3. Answer: C. Hardware manufacturing
Explanation: An OS manages hardware but does not manufacture it.

4. Answer: A. Initialize hardware
Explanation: The BIOS performs hardware initialization and checks before passing control to the bootloader.

5. Answer: D. More than one of the above
Explanation: The kernel manages core functions like process management, memory management, and file system operations.

6. Answer: B. Shell
Explanation: The shell is the interface that allows users to interact with the OS, either through commands or graphical elements.

7. Answer: B. Communication between user and kernel
Explanation: System calls provide a programming interface for user programs to request OS services.

8. Answer: C. Macroprocessor
Explanation: Macroprocessor is unrelated to OS structures; valid structures include monolithic, microkernel, and layered.

9. Answer: D. More than one of the above
Explanation: Bootstrapping involves initializing the OS and loading the kernel into memory.

10. Answer: B. Memory Management
Explanation: Memory management ensures efficient allocation and deallocation of memory spaces to processes, manages virtual memory, and optimizes overall memory utilization.

11. Answer: B. Provide an communication between user programs and OS
Explanation: System calls are a critical OS feature that abstracts complex operations (e.g., file access, process creation) into simpler, high-level commands for user programs.

12. Answer: A. POST (Power-On Self Test)
Explanation: During booting, POST checks the hardware components to ensure they function correctly. Loading libraries and executing user programs occur later, after the OS is up and running.

13. Answer: B. To provide separate modes for users and OS operations
Explanation: Dual-Mode operation ensures that user applications cannot directly interfere with system-critical processes, thus safeguarding the OS and hardware.

14. Answer: D. More than one of the above
Explanation: Synchronization, networking, and file sharing are services provided by the OS to enable efficient resource utilization across multiple users or processes.

15. Answer: D. More than one of the above
Explanation: The OS transitions to kernel mode during system calls or hardware interrupts to handle critical operations safely. Program crashes may also invoke kernel operations.

16. Answer: D. More than one of the above
Explanation: Process scheduling involves allocating the CPU to processes, handling multitasking, and sometimes managing memory through swapping to ensure fairness and efficiency.

17. Answer: A. Device communication
Explanation: The I/O subsystem facilitates communication between hardware devices and the operating system, managing data transfer and device control.

18. Answer: B. Simplified debugging and testing
Explanation: Layered architecture allows each layer to be tested and debugged independently, enhancing reliability and maintainability, though it may slightly impact performance.

19. Answer: D. More than one of the above

Explanation: Interrupts are generated by events such as I/O completion, errors, or user requests, prompting the OS to take immediate action.

20. Answer: B. Kernel loading into memory

Explanation: Once the bootloader completes its job, it loads the kernel into memory, enabling the OS to take control of the system.

21. Answer: A. Separation of core functionalities

Explanation: Microkernels separate core functionalities like device drivers and IPC, running them in user space, while monolithic kernels manage everything in the kernel space.

22. Answer: A. VxWorks

Explanation: VxWorks is a real-time operating system designed for embedded systems, ensuring timely responses to critical tasks. Windows 10 and Linux are general-purpose OSs, not real-time systems.

23. Answer: B. Real-time OS

Explanation: Real-time operating systems are designed for applications that require immediate response, such as machinery control in automation.

24. Answer: B. Independent execution of tasks across multiple nodes

Explanation: Distributed operating systems manage a group of interconnected computers, enabling resource sharing and independent task execution across nodes.

25. Answer: B. Batch OS

Explanation: Batch operating systems process a group of tasks (batch) without direct user intervention, often used in early computing systems.

26. Answer: D. More than one of the above

Explanation: Time-sharing systems allow multiple users or programs to use the CPU by allocating time slices, ensuring efficient utilization and high throughput.

27. Answer: A. Low resource consumption

Explanation: Embedded operating systems, like those in IoT devices, are optimized for minimal resource usage and specific, real-time tasks.

28. Answer: B. Manage shared resources across a network

Explanation:

A network OS handles network resources, enabling sharing of files, printers, and applications among connected systems.

29. Answer: A. A program in execution

Explanation: A process is an instance of a program in execution. It includes the program code, data, and resources required for execution. Unlike a static program, a process is dynamic.

30. Answer: B. Process Control Block (PCB)

Explanation:

The PCB contains crucial information such as process state, program counter, CPU registers, memory allocation, and scheduling information.

31. Answer: C. Waiting

Explanation: A process transitions to the waiting state when it is unable to proceed until an external event (e.g., I/O completion) occurs.

32. Answer: D. More than one of the above

Explanation: Threads are lightweight processes and units of CPU utilization. While they share resources like memory with other threads in the same process, they can execute independently.

33. Answer: B. Time when the process enters the ready queue

Explanation: The arrival time indicates when a process becomes eligible for execution by entering the ready queue.

34. Answer: C. Turnaround time

Explanation: Turnaround time is the total time taken by a process from arrival to completion, including waiting and execution time.

35. Answer: A. Time taken to switch from one process to another

Explanation: Dispatch latency is the time required to stop one process and start another. It includes the time for context switching.

36. Answer: B. Device queue

Explanation: Processes waiting for specific I/O operations are stored in the device queue until the operation is complete.

37. Answer: C. Short-term scheduler

Explanation: The short-term scheduler selects the next process to execute from the ready queue, based on scheduling algorithms.

38. Answer: A. Turnaround time - Burst time
Explanation: Waiting time is the time a process spends in the ready queue, calculated as the difference between turnaround time and burst time.

39. Answer: B. Regulate the degree of multiprogramming
Explanation: The long-term scheduler controls which processes are admitted to the system for processing, affecting the overall load.

40. Answer: B. Block
Explanation: When a process requires an event like I/O, it transitions from the running state to the waiting state (blocking).

41. Answer: A. The time from process arrival to the first response
Explanation: Response time is the time interval from when a process arrives in the ready queue to when it gets its first execution on the CPU. It reflects the system's responsiveness.

42. Answer: B. Medium-term scheduler
Explanation: The medium-term scheduler temporarily removes processes (swapping) to manage the system’s load and improve CPU utilization. It reintroduces processes when resources are available.

43. Answer: A. The total number of processes executed in a unit of time
Explanation: Throughput is a measure of the number of processes that the CPU can handle in a given period. It is crucial for evaluating system performance.

44. Answer: C. When it is prepared to run but waiting for CPU allocation
Explanation: The "ready" state indicates that a process has all necessary resources except the CPU. It waits in the ready queue for CPU scheduling.

45. Answer: A. It contains all processes in the system
Explanation: The job queue holds all the processes in the system, regardless of their states (ready, running, or waiting).

46. Answer: A. A running process is paused and moved back to the ready queue
Explanation: Preemption occurs when a running process is interrupted (e.g., due to a higher-priority process arriving) and placed back in the ready queue.

47. Answer: B. By reducing idle CPU time
Explanation: CPU utilization is optimized by ensuring the CPU is busy executing tasks, minimizing idle time through efficient scheduling.

48. Answer: D. More than one of the above
Explanation: Dispatch latency is influenced by factors such as context-switching time, priority inversion, and the overall system load.

49. Answer: B. Running → Terminated
Explanation: When a process completes its execution, it transitions from the running state directly to the terminated state.

50. Answer: B. Fixed quantum assigned by the scheduler
Explanation: In round-robin scheduling, a fixed time quantum is assigned to processes. Each process gets the CPU for the duration of this time slice before being preempted.

51. Answer: B. To store processes ready for execution
Explanation: The ready queue holds processes that are prepared to execute but are waiting for CPU scheduling.

52. Answer: B. Different queues for processes with similar characteristics
Explanation: In multilevel queue scheduling, processes are divided into different queues based on characteristics like priority or type (foreground/background).

53. Answer: B. Time taken for CPU execution
Explanation: Burst time is the time a process spends utilizing the CPU for its execution.

54. Answer: B. Arrival time
Explanation: FCFS is a non-preemptive scheduling algorithm where the process that arrives first in the ready queue is allocated the CPU first, regardless of its priority or burst time.

55. Answer: C. 6 ms
Explanation: Turnaround Time = Completion Time - Arrival Time.
Completion Time for P2 = Completion Time of P1 + Burst Time of P2 = 5 ms + 3 ms = 8 ms.
Turnaround Time = Completion Time - Arrival Time = 8 ms - 2 ms = 6 ms.

56. Answer: B. The convoy effect
Explanation: The convoy effect occurs when a long process delays all shorter processes behind it in the queue. This can lead to poor CPU utilization and increased average waiting time.

57. Answer: B. The process with the shortest burst time
Explanation: SJN selects the process with the shortest burst time for execution to minimize average waiting and turnaround time.

58. Answer: A. P1
Explanation:
At time 0, only P1 is available in the ready queue. It is executed first. In SJN, the shortest burst time is chosen only among processes that have arrived.

59. Answer: B. Based on the priority of the process
Explanation: In Priority Scheduling, the process with the highest priority (smallest priority number) is allocated the CPU first. Lower-priority processes may suffer from starvation if preemption is allowed.

60. Answer: D. More than one of the above
Explanation: IPC enables processes to share data and synchronize their actions. It ensures proper communication and coordination for concurrent processing.

61. Answer: D. More than one of the above
Explanation: Message passing and sockets are widely used in distributed systems as shared memory is not feasible across different machines.

62. Answer: D. More than one of the above
Explanation: Shared memory IPC requires synchronization mechanisms to avoid issues like inconsistent data and ensure the security of the shared region.

63. Answer: D. More than one of the above
Explanation: Shared memory is faster but requires synchronization mechanisms and is limited to processes on the same machine, making it unsuitable for distributed systems.

64. Answer: D. More than one of the above
Explanation: Message passing is slower than shared memory but avoids the need for shared memory and can operate in distributed systems.

65. Answer: D. More than one of the above
Explanation: The critical section problem requires mutual exclusion, progress, and bounded waiting to ensure process synchronization and avoid deadlocks.

66. Answer: D. More than one of the above
Explanation: Semaphores are used for mutual exclusion, preventing race conditions, and solving synchronization issues like producer-consumer problems.

67. Answer: D. More than one of the above
Explanation: Semaphores can be binary (used for mutual exclusion) or counting (used to manage resource pools). Mutex is also a specific form of binary semaphore.

68. Answer: D. More than one of the above
Explanation: Monitors are high-level synchronization constructs that ensure mutual exclusion and condition synchronization automatically, simplifying shared resource management.

69. Answer: B. Message passing
Explanation: Unrelated processes cannot share memory directly. Message passing is the most appropriate IPC mechanism for such scenarios.

70. Answer: D. More than one of the above
Explanation: The critical section ensures mutual exclusion, maintains data consistency, and can cause deadlocks if not implemented carefully.

71. Answer: C. Producer-consumer synchronization
Explanation: Semaphores help solve the producer-consumer problem in bounded buffers by ensuring synchronized access to the shared buffer.

72. Answer: B. Resource management
Explanation: A counting semaphore manages a finite number of identical resources by keeping count of available instances.

73. Answer: B. Message passing
Explanation: Message passing does not require explicit synchronization mechanisms because communication is handled through predefined protocols

74. Answer: A. Decreases the semaphore value by 1
Explanation: The wait() operation decrements the semaphore value by 1. If the value becomes negative, the process waits until the semaphore is signaled.

75. Answer: D. More than one of the above
Explanation: The signal() operation increments the semaphore value by 1. If there are processes waiting on the semaphore, one of them is woken up and allowed to proceed.

76. Answer: D. More than one of the above
Explanation: In the readers-writers problem, multiple readers can read concurrently, but writers need exclusive access. Without proper handling, either readers or writers may experience starvation.

77. Answer: D. More than one of the above
Explanation: The dining philosophers problem aims to ensure mutual exclusion, prevent deadlock, and avoid starvation while allowing philosophers to share limited resources (e.g., chopsticks).

78. Answer: D. More than one of the above
Explanation: Both binary semaphores and monitors can simplify the implementation by managing resource allocation and ensuring mutual exclusion.

79. Answer: B. A process is blocked and waits for a signal
Explanation: When a semaphore value becomes negative, it indicates that the number of waiting processes exceeds the available resources, and blocked processes are waiting for a signal.

80. Answer: B. Synchronization of processes
Explanation: Condition variables in monitors allow processes to wait or signal other processes within the monitor to synchronize their actions.

81. Answer: D. More than one of the above
Explanation: Deadlock occurs when all four conditions—mutual exclusion, hold and wait, no preemption, and circular waiting—are present.

82. Answer: D. More than one of the above
Explanation: Monitors can solve various synchronization problems like dining philosophers, readers-writers, and bounded buffer by providing structured solutions.

83. Answer: A. A process waiting indefinitely for a resource
Explanation: Starvation occurs when a process waits indefinitely for a resource due to other processes being prioritized repeatedly.

84. Answer: D. More than one of the above
Explanation: Deadlock can be avoided by breaking one or more necessary conditions, such as using resource allocation graphs or preventing circular waiting and hold-and-wait situations.

85. Answer: C. The resource associated with the semaphore is unavailable
Explanation: When the semaphore value is zero, it indicates that the resource is fully utilized or unavailable. Processes attempting to acquire the semaphore will be blocked.

86. Answer: B. Wait()
Explanation: The wait() operation decrements the semaphore value. If the value becomes negative, the process will be blocked until the semaphore is signaled.

87. Answer A: 6
Explanation: Each P(wait) operation decreases the semaphore by 1
Each V(signal) operation increases the semaphore by 1
S = 12 (initial)
After 10 p (wait) and 4V (Signal) operation
S = S -10+4 = 12 – 10 +4 = 6

88. Answer A: Average TAT = 9.66 ms and Average WT = 4.33 ms

- Completion Time (CT):
  P1: 5 ms, P2: 8 ms, P3: 16 ms
- Turnaround Time (TAT) = CT - Arrival Time
  P1: 5 - 0 = 5 ms, P2: 8 - 0 = 8 ms, P3: 16 - 0 = 16 ms
- Waiting Time (WT) = TAT - Burst Time
  P1: 5 - 5 = 0 ms, P2: 8 - 3 = 5 ms, P3: 16 - 8 = 8 ms
  Average TAT = (5 + 8 + 16) / 3 = 9.66 ms
  Average WT = (0 + 5 + 8) / 3 = 4.33 ms

89. Answer A: Average TAT = 9.66 ms and Average WT = 4.33 ms

- Completion Time (CT):
  P1: 5 ms, P2: 8 ms, P3: 16 ms
- Turnaround Time (TAT) = CT - Arrival Time
  P1: 5 - 0 = 5 ms, P2: 8 - 1 = 7 ms, P3: 16 - 2 = 14 ms
- Waiting Time (WT) = TAT - Burst Time
  P1: 5 - 5 = 0 ms, P2: 7 - 3 = 4 ms, P3: 14 - 8 = 6 ms
  Average TAT = (5 + 7 + 14) / 3 = 8.67 ms
  Average WT = (0 + 4 + 6) / 3 = 3.33 ms

90. Answer C: Execution Order: P3 → P2 → P4 → P1 and Average TAT = 9.0 ms and Average WT = 4.25 ms

- Completion Time (CT):
  P3:=1 ms , P2: =5 ms, P4: =11 ms,P1: =19 ms
- Turnaround Time (TAT) = CT - Arrival Time
  P3: = 1 ms, P2: = 5 ms, P4: = 11 ms, P1:= 19 ms
- Waiting Time (WT) = TAT - Burst Time
  P3: = 0 ms, P2: = 1 ms, P4: = 5 ms, P1:= 11 ms
  Average TAT = (1+5 + 11 + 19) / 4 = 9 ms
  Average WT = (0+1 + 5 + 11) / 4 = 4.25 ms

91. Answer C: Execution Order: P1 → P3 → P2 → P4 and Average TAT = 10.25 ms and Average WT = 5.5 ms

- Completion Time (CT):
  P1: =8 ms P3:=9 ms , P2: =13 ms, P4: =19 ms,
- Turnaround Time (TAT) = CT - Arrival Time
  P1: = 8 ms, P3: = 5 ms, P2: = 12 ms, P4:= 16 ms
- Waiting Time (WT) = TAT - Burst Time
  P1: = 0 ms, P3: = 1 ms, P2: = 11 ms, P4:= 10 ms
  Average TAT = (8+5 + 12 + 16) / 4 = 10.25 ms
  Average WT = (0+1 + 11 + 10) / 4 = 5.5 ms

92. Answer: A) First Come First Serve (FCFS) scheduling
Explanation:
In Round Robin scheduling, if the time quantum is too large, processes may run to completion without frequent context switching, effectively behaving like FCFS.

93. Answer A: Completion Order: P2 → P3 → P1 and TAT of P2 = 24 ms

P1	P2	P3	P1	P2	P3	P1	P3	P1

0 3 6 9 12 15 18 21 23 24

Completion Time: P1 = 24 ms, P2 = 15 ms, P3 = 23 ms
TAT: P1 = 24 ms, P2 = 15 ms, P3 = 23 ms
WT: P1 = 14, P2 = 9, P3 = 15

94. Answer B: Completion Order: P3 → P2 → P1 and TAT of P2 = 23 ms

P1	P3	P1	P3	P2	P1	P3	P2	P1

0 3 6 9 12 15 18 20 23 24

Completion Time: P1 = 24 ms, P2 = 23 ms, P3 = 20 ms
TAT: P1 = 24 ms, P2 = 16 ms, P3 = 17 ms
WT: P1 = 14, P2 = 10, P3 = 9

95. Answer C: Completion Order: P2 → P1 → P3 and TAT of P2 = 6 ms

P1	P2	P2	P1	P3

0 2 4 8 16 24

Completion Time: P1 = 16 ms, P2 = 8 ms, P3 = 24 ms
TAT: P1 = 16 ms, P2 = 6 ms, P3 = 20 ms
WT: P1 = 6 ms, P2 = 0 ms, P3 = 12 ms