

# OPERATING SYSTEMS

## PROCESS MANAGEMENT – HARD LEVEL

1. In the Banker's Algorithm, what is the worst-case time complexity for checking system safety with  $n$  processes and  $m$  resource types?  
A)  $O(n)$   
B)  $O(mn^2)$   
C)  $O(n^2m)$   
D)  $O(nm^2)$

**Answer: C**

2. Which scheduling algorithm minimizes average turnaround time optimally (theoretically)?  
A) Priority Scheduling  
B) SJF  
C) Round Robin  
D) Multilevel Feedback Queue

**Answer: B**

3. In a system with preemptive priority scheduling, which situation may lead to *priority inversion*?  
A) Low-priority process holding resource needed by high-priority process  
B) High-priority process preempting medium-priority one  
C) Round Robin time quantum too large  
D) Deadlock avoidance

**Answer: A**

4. Which of the following is used to solve *priority inversion*?  
A) Aging  
B) Priority Inheritance Protocol  
C) Banker's Algorithm  
D) Deadlock detection

**Answer: B**

5. Which scheduling policy can guarantee bounded waiting?  
A) FCFS  
B) Round Robin  
C) Priority Scheduling  
D) Multilevel Queue Scheduling

**Answer: B**

6. Which is the correct sequence of scheduling levels in a typical OS?  
A) Long-term → Medium-term → Short-term  
B) Short-term → Long-term → Medium-term  
C) Medium-term → Short-term → Long-term  
D) Short-term → Medium-term → Long-term

**Answer: A**

7. In Peterson's algorithm, mutual exclusion is guaranteed under which assumption?
- A) Atomicity of read/write operations
  - B) Preemptive kernel
  - C) Multiprocessor with cache coherence
  - D) Priority inheritance

**Answer: A**

8. Which of the following does NOT prevent deadlock?
- A) Requiring all processes to request resources in increasing order
  - B) Allowing preemption of resources
  - C) Using hold-and-wait
  - D) Releasing all resources before requesting new ones

**Answer: C**

9. In real-time scheduling, Rate Monotonic Scheduling (RMS) assumes:
- A) Periodic tasks with deadlines equal to their periods
  - B) Tasks with arbitrary deadlines
  - C) Tasks with dynamic priorities
  - D) Tasks with preemption disabled

**Answer: A**

10. The maximum CPU utilization under RMS for  $n$  processes is:
- A)  $n \times (2^{1/n} - 1)$
  - B)  $\log_2(n)$
  - C)  $1 - (1/n)$
  - D)  $(n - 1)/n$

**Answer: A**

11. In Earliest Deadline First (EDF) scheduling, schedulability is guaranteed if:
- A) CPU utilization  $\leq 1$
  - B) CPU utilization  $< 0.693$
  - C) Number of tasks  $\leq$  number of CPUs
  - D) Deadlines are uniform

**Answer: A**

12. Which IPC mechanism is most efficient for large data transfer between processes?
- A) Message queues
  - B) Shared memory
  - C) Pipes
  - D) Semaphores

**Answer: B**

13. Which of the following is NOT true about monitors?
- A) Only one process can execute in a monitor at a time
  - B) Condition variables are used for synchronization
  - C) They are supported directly by hardware
  - D) They eliminate busy waiting

**Answer: C**

14. In the Dining Philosophers problem, which technique guarantees no deadlock and no starvation?

- A) Arbitrator solution
- B) Resource hierarchy solution
- C) Chandy/Misra solution
- D) Using semaphores without ordering

**Answer: C**

15. Which statement about *two-phase locking* protocol is correct?

- A) Prevents deadlock completely
- B) Ensures serializability
- C) Requires preemption
- D) Allows cascading rollbacks

**Answer: B**

16. In Linux, which scheduling class is used for real-time processes?

- A) CFS
- B) FIFO
- C) Round Robin
- D) Both B and C

**Answer: D**

17. Which of the following contributes to *thrashing*?

- A) High degree of multiprogramming
- B) Low CPU utilization
- C) Frequent page faults
- D) All of the above

**Answer: D**

18. What is the main advantage of *spinlocks* over semaphores?

- A) Eliminate busy waiting
- B) Lower context switch overhead
- C) Provide fairness automatically
- D) Allow multiple process access

**Answer: B**

19. Which technique is commonly used for real-time *deadlock avoidance*?

- A) Banker's Algorithm
- B) Priority Inheritance
- C) Priority Ceiling Protocol
- D) Peterson's Algorithm

**Answer: C**

20. Which of the following is required for implementing EDF scheduling in multiprocessor systems?

- A) Global queue and migration
- B) Strict FCFS discipline
- C) Processor affinity
- D) Resource ordering

**Answer: A**

21. What is the primary purpose of *load balancing* in multiprocessor scheduling?

- A) Increase throughput

- B) Reduce context switching
- C) Ensure equal CPU utilization
- D) Decrease turnaround time

**Answer: C**

22. In the  $M/M/1$  queuing model, average waiting time in the queue is given by:

- A)  $\lambda / \mu$
- B)  $\lambda / (\mu - \lambda)$
- C)  $\mu / (\lambda - \mu)$
- D)  $\lambda \mu$

**Answer: B**

23. In real-time systems, a task set is *unschedulable* under RMS but schedulable under EDF when:

- A) Utilization exceeds  $n(2^{1/n} - 1)$  but  $\leq 1$
- B) Utilization  $< 0.5$
- C) All tasks are CPU-bound
- D) Deadlines are much longer than periods

**Answer: A**

24. Which system call combination implements process creation in UNIX?

- A) `fork()` + `exec()`
- B) `wait()` + `exit()`
- C) `clone()` + `kill()`
- D) `create()` + `run()`

**Answer: A**

25. What is the complexity of deadlock detection using a resource allocation graph with  $n$  processes and  $m$  resources?

- A)  $O(n + m)$
- B)  $O(mn)$
- C)  $O(n^2)$
- D)  $O(nm^2)$

**Answer: B**

26. Which algorithm is used by Linux's Completely Fair Scheduler (CFS)?

- A) Red-Black Tree based fair queuing
- B) Round Robin
- C) Priority queue
- D) Banker's Algorithm

**Answer: A**

27. Which of the following can occur even if deadlock is prevented?

- A) Starvation
- B) Circular wait
- C) Mutual exclusion
- D) Resource preemption

**Answer: A**

28. Which mechanism avoids *busy waiting* in the Producer-Consumer problem?

- A) Semaphores with blocking

- B) Spinlocks
- C) Test-and-set
- D) Peterson's Algorithm

**Answer: A**

29. In multiprocessor scheduling, *gang scheduling* refers to:
- A) Running related threads simultaneously on multiple CPUs
  - B) Assigning one process to one CPU permanently
  - C) Time slicing among unrelated processes
  - D) Using a single ready queue for all CPUs

**Answer: A**

30. Which situation can cause *livelock* instead of deadlock?
- A) Processes keep changing states but make no progress
  - B) Processes hold resources indefinitely
  - C) Circular waiting with no release
  - D) Context switching stops

**Answer: A**

31. Which of the following is a solution to the Readers-Writers problem ensuring fairness?
- A) Readers preference algorithm
  - B) Writers preference algorithm
  - C) Queue-based synchronization
  - D) Peterson's algorithm

**Answer: C**

32. In Linux, the nice value affects:
- A) Memory allocation
  - B) CPU scheduling priority
  - C) I/O scheduling
  - D) Deadlock detection

**Answer: B**

33. The worst-case response time analysis in real-time scheduling is used for:
- A) Hard real-time tasks
  - B) Soft real-time tasks
  - C) Background jobs
  - D) Batch jobs

**Answer: A**

34. Which of the following ensures *bounded waiting* in critical section problems?
- A) Bakery algorithm
  - B) Spinlocks
  - C) Test-and-set
  - D) Mutex

**Answer: A**

35. Which of the following is NOT true about preemptive scheduling?
- A) Increases responsiveness
  - B) May cause starvation
  - C) Requires timer interrupts

D) Eliminates context switching overhead

**Answer: D**

36. Which mechanism is best for synchronizing threads in multicore systems with shared cache?

- A) Spinlocks
- B) Mutexes with backoff
- C) Monitors
- D) Test-and-set

**Answer: B**

37. Which real-time scheduling policy is optimal for uniprocessor systems?

- A) EDF
- B) RMS
- C) FCFS
- D) Priority Scheduling

**Answer: A**

38. In UNIX, a process in the *zombie* state is one that:

- A) Has terminated but not reaped by parent
- B) Is waiting indefinitely for I/O
- C) Is stuck in deadlock
- D) Is swapped out of memory

**Answer: A**

39. Which of the following is a hardware feature to support synchronization?

- A) Test-and-set instruction
- B) Swap instruction
- C) Compare-and-swap instruction
- D) All of the above

**Answer: D**

40. Which of the following is an advantage of microkernel design for process management?

- A) Faster context switches
- B) Fault isolation
- C) Larger kernel size
- D) Direct hardware access by all processes

**Answer: B**

41. Which of the following is a drawback of using priority-based preemptive scheduling in multiprocessors?

- A) Priority inversion
- B) Cache affinity loss
- C) Load imbalance
- D) All of the above

**Answer: D**

42. The  $M/M/c$  queuing model with  $c$  servers has lower waiting time compared to  $M/M/1$  because:

- A) Arrival rate decreases
- B) Service capacity increases
- C) CPU scheduling improves

D) Context switching reduces

**Answer: B**

43. Which of the following is true about the *sleeping barber problem*?

- A) It demonstrates deadlock
- B) It demonstrates synchronization and resource utilization
- C) It has no relation to process scheduling
- D) It eliminates starvation completely

**Answer: B**

44. In multiprocessor systems, which strategy prevents cache thrashing?

- A) Processor affinity
- B) Priority scheduling
- C) Round Robin
- D) Resource ordering

**Answer: A**

45. Which scheduling algorithm is most suitable for multimedia streaming applications?

- A) EDF
- B) FCFS
- C) Priority Scheduling
- D) Lottery Scheduling

**Answer: D**

46. Which of the following can detect AND recover from deadlock?

- A) Wait-die scheme
- B) Wound-wait scheme
- C) Periodic resource allocation graph check
- D) Peterson's Algorithm

**Answer: C**

47. Which is the key disadvantage of EDF scheduling?

- A) Not optimal
- B) High runtime overhead for dynamic priority adjustment
- C) Cannot handle preemption
- D) Works only for periodic tasks

**Answer: B**

48. What is the main advantage of lottery scheduling?

- A) Proportional resource allocation
- B) Guaranteed fairness
- C) Zero overhead
- D) Deadlock prevention

**Answer: A**

49. In real-time systems, a *missed deadline* in a **hard real-time** task results in:

- A) Reduced performance
- B) Task termination or system failure
- C) Starvation
- D) Increased turnaround time

**Answer: B**

50. Which technique allows CPUs in a multiprocessor to run threads of the same process simultaneously while sharing cache?
- A) Simultaneous multithreading (SMT)
  - B) Gang scheduling
  - C) Processor affinity
  - D) EDF scheduling

**Answer: A**