**50 potential exam questions related to real-time systems and their scheduling:**

1. Define a real-time system (RTS).

2. What is a real-time operating system (RTOS) and how does it differ from general-purpose operating systems?

3. Explain the concept of task preemption in RTS.

4. Describe the role of schedulers in real-time systems.

5. What are the differences between hard and soft real-time systems?

6. Define the term "scheduling" in the context of RTS.

7. Explain the concept of priority inversion and how it can be mitigated.

8. What are fixed-priority and dynamic-priority scheduling algorithms?

9. Describe rate monotonic scheduling and its applicability.

10. Explain the significance of Earliest Deadline First (EDF) scheduling in RTS.

11. Discuss the advantages of using multiprocessor systems in RTS.

12. What is task synchronization and why is it important in RTS?

13. Explain semaphore mechanisms and their uses in real-time systems.

14. Describe mutex locks and their role in ensuring mutual exclusion.

15. What is a message queue and how is it used in inter-task communication?

16. Explain the differences between periodic, aperiodic, and sporadic tasks in RTS.

17. What is deadline monotonic scheduling?

18. Describe how priority ceiling protocols work in RTS.

19. Explain the concept of deadline handling in real-time tasks.

20. Discuss the role of time constraints in scheduling decisions.

21. What are the challenges of scheduling in heterogeneous processor environments?

22. Explain the importance of task dependency graphs in RTS.

23. Describe the worst-case execution time (WCET) and its relevance to scheduling.

24. How does task migration impact scheduling in multiprocessor RTS?

25. Discuss the difference between offline and online scheduling.

26. What is the rate-monotonic analysis (RMA)?

27. How do real-time kernels manage task states?

28. Discuss the concept of utilization factor in task scheduling.

29. Explain the role of slack time in scheduling.

30. What are the implications of non-preemptive scheduling in RTS?

31. Describe the hybrid scheduling model in multiprocessor systems.

32. Explain task overruns and their handling in real-time systems.

33. How does real-time scheduling differ in uniprocessor and multiprocessor environments?

34. What are the benefits and challenges of partitioned scheduling in RTS?

35. Discuss the impact of task affinity in processor scheduling.

36. Explain the role of task deadlines in preemptive and non-preemptive scheduling.

37. What is the difference between static and dynamic scheduling approaches?

38. Discuss how resource allocation is managed in real-time systems.

39. Explain the significance of interrupt handling in real-time systems.

40. How is load balancing achieved in multiprocessor RTS?

41. What is the deadline sliding technique, and how does it optimize scheduling?

42. Describe the various types of real-time clocks and timers.

43. Discuss the challenges of integrating real-time and non-real-time tasks.

44. How are system overheads managed in real-time scheduling?

45. What are the criteria for selecting a scheduling algorithm for a specific real-time application?

46. Explain how real-time tasks are monitored and controlled during execution.

47. Discuss the security considerations in real-time scheduling.

48. What are the implications of real-time constraints on system design?

49. How does fault tolerance affect scheduling in real-time systems?

50. Describe the techniques used for timing analysis in real-time systems.

**QCM: real-time systems and their scheduling**

 **Define a real-time system (RTS).**

* A) System capable of handling many tasks
* B) System designed to meet strict timing constraints
* C) System that uses a large number of resources

Answer: **B**

 **What is a real-time operating system (RTOS) and how does it differ from general-purpose operating systems?**

* A) RTOS is designed for administrative tasks
* B) RTOS executes tasks with precise deadlines, unlike general-purpose operating systems
* C) RTOS is used only for video games

Answer: **B**

 **Explain the concept of task preemption in RTS.**

* A) Interrupting a task to execute a lower-priority one
* B) Interrupting a task to execute a higher-priority one
* C) Interrupting a task to eliminate it completely

Answer: **B**

 **Describe the role of schedulers in real-time systems.**

* A) Schedulers determine the order of task execution
* B) Schedulers only monitor memory usage
* C) Schedulers manage external devices

Answer: **A**

 **What are the differences between hard and soft real-time systems?**

* A) Hard real-time systems tolerate delays
* B) Hard real-time systems tolerate no delays, while soft real-time systems can tolerate some delays
* C) Soft real-time systems tolerate no delays

Answer: **B**

 **Define the term "scheduling" in the context of RTS.**

* A) Resource allocation for background tasks
* B) Organizing and allocating resources to execute tasks in an RTS
* C) Planning system updates

Answer: **B**

 **Explain the concept of priority inversion and how it can be mitigated.**

* A) A low-priority task blocks a high-priority task; solution: priority inheritance protocol
* B) A high-priority task blocks a low-priority task; solution: stop the high-priority task
* C) An intermediate task blocks all tasks; solution: complete rescheduling

Answer: **A**

 **What are fixed-priority and dynamic-priority scheduling algorithms?**

* A) Random and sequential scheduling
* B) Scheduling with fixed or dynamic priorities for tasks
* C) Batch and continuous scheduling

Answer: **B**

 **Describe rate monotonic scheduling and its applicability.**

* A) Scheduling based on resource availability
* B) Scheduling based on task request rates, applicable to periodic tasks
* C) Scheduling based on task complexity

Answer: **B**

 **Explain the significance of Earliest Deadline First (EDF) scheduling in RTS.**

* A) EDF prioritizes the least urgent tasks
* B) EDF prioritizes tasks with the furthest deadlines
* C) EDF prioritizes tasks with the nearest deadlines

Answer: **C**

 **Discuss the advantages of using multiprocessor systems in RTS.**

* A) Increases complexity
* B) Reduces reliability
* C) Increases reliability and performance

Answer: **C**

 **What is task synchronization and why is it important in RTS?**

* A) Coordinating tasks to avoid conflicts in accessing shared resources
* B) Synchronizing tasks to increase execution times
* C) Synchronizing tasks to avoid execution

Answer: **A**

 **Explain semaphore mechanisms and their uses in real-time systems.**

* A) Used for allocating network resources
* B) Used for synchronizing access to shared resources
* C) Used for logging errors

Answer: **B**

 **Describe mutex locks and their role in ensuring mutual exclusion.**

* A) Used to create processes
* B) Used to ensure mutual exclusion
* C) Used to execute tasks in parallel

Answer: **B**

 **What is a message queue and how is it used in inter-task communication?**

* A) To send emails
* B) For inter-task communication
* C) To temporarily store data

Answer: **B**

 **Explain the differences between periodic, aperiodic, and sporadic tasks in RTS.**

* A) Periodic: regular intervals, aperiodic: no regularity, sporadic: minimum time between executions
* B) Periodic: no regularity, aperiodic: regular intervals, sporadic: minimum time between executions
* C) Periodic: minimum time between executions, aperiodic: regular intervals, sporadic: no regularity

Answer: **A**

 **What is deadline monotonic scheduling?**

* A) Scheduling based on task request rates
* B) Scheduling tasks based on their deadlines
* C) Scheduling tasks based on fixed priorities

Answer: **B**

 **Describe how priority ceiling protocols work in RTS.**

* A) To increase the priorities of less important tasks
* B) To prevent priority inversion
* C) To schedule tasks randomly

Answer: **B**

 **Explain the concept of deadline handling in real-time tasks.**

* A) Managing deadlines to reduce resources
* B) Managing deadlines to increase delays
* C) Managing deadlines to ensure timing constraints are met

Answer: **C**

 **Discuss the role of time constraints in scheduling decisions.**

* A) Time constraints influence scheduling decisions
* B) Time constraints play no role
* C) Time constraints are used only for non-critical tasks

Answer: **A**

 **What are the challenges of scheduling in heterogeneous processor environments?**

* A) Increased complexity in scheduling
* B) Reduced performance
* C) Increased simplicity

Answer: **A**

 **Explain the importance of task dependency graphs in RTS.**

* A) To schedule tasks randomly
* B) To define relationships and dependencies between tasks
* C) To remove task dependencies

Answer: **B**

 **Describe the worst-case execution time (WCET) and its relevance to scheduling.**

* A) WCET: estimation of the maximum execution time of a task
* B) WCET: estimation of the minimum execution time of a task
* C) WCET: estimation of the average execution time of a task

Answer: **A**

 **How does task migration impact scheduling in multiprocessor RTS?**

* A) Reduces scheduling efficiency
* B) Has no impact
* C) Impacts scheduling efficiency

Answer: **C**

 **Discuss the difference between offline and online scheduling.**

* A) Offline is pre-determined, online is done in real-time
* B) Online is pre-determined, offline is done in real-time
* C) Both are identical

Answer: **A**

 **What is rate-monotonic analysis (RMA)?**

* A) Analysis to check the feasibility of real-time tasks
* B) Analysis to increase task delays
* C) Analysis to remove unnecessary tasks

Answer: **A**

 **How do real-time kernels manage task states?**

* A) Via queues and interrupts
* B) By removing tasks
* C) By stopping processes

Answer: **A**

 **Discuss the concept of utilization factor in task scheduling.**

* A) Measures system load relative to its capacity
* B) Measures processor speed
* C) Measures memory size

Answer: **A**

 **Explain the role of slack time in scheduling.**

* A) Slack time is used to stop tasks
* B) Slack time between task executions, used to optimize scheduling
* C) Slack time is used to increase load

Answer: **B**

 **What are the implications of non-preemptive scheduling in RTS?**

* A) Can cause delays but simplifies task management
* B) Increases task speed
* C) Reduces task complexity

Answer: **A**

 **Describe the hybrid scheduling model in multiprocessor systems.**

* A) Hybrid model combines multiple scheduling techniques
* B) Hybrid model removes non-critical tasks
* C) Hybrid model uses a single processor

Answer: **A**

 **Explain task overruns and their handling in real-time systems.**

* A) Task execution time exceeds limit, solutions: monitoring and resource reallocation
* B) Task execution time exceeds limit, solutions: stopping tasks
* C) Task execution time exceeds limit, solutions: removing tasks

Answer: **A**

 **How does real-time scheduling differ in uniprocessor and multiprocessor environments?**

* A) Differences in complexity and scheduling strategies
* B) No difference
* C) Reduced complexity in both cases

Answer: **A**

 **What are the benefits and challenges of partitioned scheduling in RTS?**

* A) Partitioned scheduling allocates specific tasks to defined processors
* B) Partitioned scheduling removes unnecessary tasks
* C) Partitioned scheduling reduces processor load

Answer: **A**

 **Discuss the impact of task affinity in processor scheduling.**

* A) Increases scheduling performance
* B) Reduces scheduling performance
* C) Has no