**Session 1: Introduction to Batch Systems and Resource Management**

### **Easy Level**

1. **What is the primary purpose of a batch system?**
   * A) To perform tasks in real-time
   * B) To process jobs in a queue
   * C) To handle user interaction continuously
   * D) To perform calculations  
     **Answer:** B) To process jobs in a queue
2. **Which of the following is a main characteristic of a batch system?**
   * A) Real-time processing
   * B) Automatic resource allocation
   * C) Jobs are processed sequentially
   * D) No interaction with users  
     **Answer:** C) Jobs are processed sequentially
3. **In a batch system, jobs are typically processed in:**
   * A) Random order
   * B) Parallel
   * C) Sequential order
   * D) Priority order  
     **Answer:** C) Sequential order
4. **What is the function of a resource manager in a batch system?**
   * A) To schedule jobs
   * B) To allocate resources for job execution
   * C) To interact with users
   * D) To process real-time data  
     **Answer:** B) To allocate resources for job execution
5. **Which component is responsible for managing the execution of jobs in a batch system?**
   * A) Resource Manager
   * B) Scheduler
   * C) User Interface
   * D) Compiler  
     **Answer:** B) Scheduler
6. **Which of the following resources are managed by a resource manager?**
   * A) CPU time
   * B) Memory
   * C) Storage
   * D) All of the above  
     **Answer:** D) All of the above
7. **What is the role of a scheduler in a batch system?**
   * A) To compile jobs
   * B) To manage job priorities
   * C) To ensure jobs are executed in real-time
   * D) To handle user requests  
     **Answer:** B) To manage job priorities
8. **Which of the following does not belong in a batch system?**
   * A) Batch job
   * B) Resource manager
   * C) User input during execution
   * D) Scheduler  
     **Answer:** C) User input during execution
9. **In a batch system, what determines the order in which jobs are processed?**
   * A) Job arrival time
   * B) Resource availability
   * C) Scheduler policy
   * D) Job type  
     **Answer:** C) Scheduler policy
10. **Which of the following statements is true for a batch system?**
    * A) Users interact with the system constantly
    * B) Jobs are processed after being queued
    * C) All jobs must be executed simultaneously
    * D) The system can only handle one job at a time  
      **Answer:** B) Jobs are processed after being queued

### **Intermediate Level**

1. **What is the main advantage of using a batch system for job processing?**
   * A) Faster processing of real-time data
   * B) Efficient resource utilization through job grouping
   * C) Immediate feedback for users
   * D) Automatic error correction  
     **Answer:** B) Efficient resource utilization through job grouping
2. **Which of the following is the primary responsibility of a resource manager in batch systems?**
   * A) Allocating memory and CPU to the jobs
   * B) Ensuring real-time job execution
   * C) Monitoring user input during execution
   * D) Managing the user interface  
     **Answer:** A) Allocating memory and CPU to the jobs
3. **Which of the following is a key characteristic of batch job processing?**
   * A) Interactive user interface
   * B) Jobs executed simultaneously
   * C) Jobs processed without user intervention
   * D) Continuous real-time processing  
     **Answer:** C) Jobs processed without user intervention
4. **In batch processing, a job scheduler works by:**
   * A) Interacting with the user to determine priorities
   * B) Assigning jobs based on the resource availability
   * C) Compiling and executing code in real-time
   * D) Monitoring system performance  
     **Answer:** B) Assigning jobs based on resource availability
5. **How does a resource manager optimize resource allocation?**
   * A) By ensuring each job gets equal time
   * B) By assigning resources based on job priority
   * C) By allowing real-time interactions between jobs
   * D) By preventing all jobs from running simultaneously  
     **Answer:** B) By assigning resources based on job priority
6. **Batch systems are typically used in scenarios where:**
   * A) Instant feedback is required
   * B) Jobs are repetitive and can be queued
   * C) User input is needed during processing
   * D) Real-time results are essential  
     **Answer:** B) Jobs are repetitive and can be queued
7. **A batch system is most suitable for which of the following?**
   * A) Complex simulations requiring frequent user input
   * B) Jobs requiring immediate execution
   * C) Large-scale data processing with minimal user interaction
   * D) Web applications with dynamic content  
     **Answer:** C) Large-scale data processing with minimal user interaction
8. **Which type of scheduling method is commonly used in batch systems?**
   * A) Round-robin scheduling
   * B) First-come, first-served (FCFS) scheduling
   * C) Preemptive scheduling
   * D) Priority-based scheduling  
     **Answer:** B) First-come, first-served (FCFS) scheduling
9. **How does the resource manager handle a resource conflict?**
   * A) By denying jobs
   * B) By reallocating resources
   * C) By suspending jobs until resources become available
   * D) By prioritizing jobs based on urgency  
     **Answer:** C) By suspending jobs until resources become available

### **Hard Level**

1. **In a batch system, what is a common method for managing job dependencies?**
   * A) FIFO scheduling
   * B) Job queuing with priority levels
   * C) Resource contention management
   * D) Job dependency graph or DAG (Directed Acyclic Graph)  
     **Answer:** D) Job dependency graph or DAG (Directed Acyclic Graph)
2. **How does a batch scheduler handle job starvation?**
   * A) By terminating low-priority jobs
   * B) By increasing the priority of long-waiting jobs
   * C) By allocating more resources to blocked jobs
   * D) By reducing the processing time of jobs  
     **Answer:** B) By increasing the priority of long-waiting jobs
3. **What is the function of a batch system’s job queue?**
   * A) To store jobs for future processing
   * B) To execute jobs based on priority
   * C) To allocate resources to jobs
   * D) To manage job inputs and outputs  
     **Answer:** A) To store jobs for future processing
4. **What is a key disadvantage of using batch systems for resource management?**
   * A) Limited resource allocation
   * B) Increased user intervention
   * C) Long job turnaround time due to queuing
   * D) Inability to process large datasets  
     **Answer:** C) Long job turnaround time due to queuing
5. **Which of the following is a challenge when managing resources in a batch system?**
   * A) Preventing resource conflicts
   * B) Ensuring all jobs execute in real-time
   * C) Managing user input efficiently
   * D) Providing instant job results  
     **Answer:** A) Preventing resource conflicts
6. **Which scheduling algorithm is often used in batch systems to ensure fairness in resource allocation?**
   * A) First-Come, First-Served (FCFS)
   * B) Round-Robin (RR)
   * C) Shortest Job Next (SJN)
   * D) Fair Share Scheduling  
     **Answer:** D) Fair Share Scheduling
7. **In a batch system, how is the optimal allocation of resources determined?**
   * A) By using complex resource allocation algorithms
   * B) By manually configuring the resources for each job
   * C) By automatically selecting jobs based on job duration
   * D) By providing equal resources to all jobs  
     **Answer:** A) By using complex resource allocation algorithms
8. **How does a batch system handle large-scale data processing across multiple servers?**
   * A) By using a single scheduler for all jobs
   * B) By partitioning data and distributing tasks to different servers
   * C) By executing jobs sequentially on one server
   * D) By delaying jobs until a single server is available  
     **Answer:** B) By partitioning data and distributing tasks to different servers
9. **Which of the following would be an example of a failure scenario in a batch system?**
   * A) Scheduler failure due to resource overload
   * B) A job is executed with a delay
   * C) User enters an incorrect job parameter
   * D) Resource manager allocates more resources than required  
     **Answer:** A) Scheduler failure due to resource overload
10. **What is the role of performance metrics in a batch system?**
    * A) To adjust resource allocation
    * B) To optimize job scheduling
    * C) To monitor the efficiency and speed of job execution
    * D) All of the above  
      **Answer:** D) All of the above

### **Hard Level (Continued)**

1. **Which of the following factors does the resource manager consider when allocating resources to jobs in a batch system?**

* A) Job priority, resource availability, and job duration
* B) User preference and job arrival time
* C) Job execution order and resource ownership
* D) Time of day and job size  
  **Answer:** A) Job priority, resource availability, and job duration

1. **In a batch system, what can cause a resource bottleneck?**

* A) High job priority
* B) Insufficient resource allocation
* C) Real-time job execution
* D) Parallel job processing  
  **Answer:** B) Insufficient resource allocation

1. **What type of scheduling algorithm would a batch system use if jobs with shorter execution times are given priority?**

* A) First-Come, First-Served (FCFS)
* B) Shortest Job Next (SJN)
* C) Round-Robin (RR)
* D) Priority-based Scheduling  
  **Answer:** B) Shortest Job Next (SJN)

1. **In batch systems, resource contention can occur when:**

* A) Multiple jobs request the same resource at the same time
* B) A job has finished execution
* C) A job is running with low priority
* D) Jobs are not queued correctly  
  **Answer:** A) Multiple jobs request the same resource at the same time

1. **Which of the following is a strategy to avoid deadlocks in a batch system?**

* A) Allowing jobs to run without checking resource requirements
* B) Using a resource allocation graph to track dependencies
* C) Allocating resources based solely on job priority
* D) Terminating low-priority jobs to free resources  
  **Answer:** B) Using a resource allocation graph to track dependencies

1. **What would be the primary function of an advanced batch scheduler?**

* A) To ensure the job queue is empty
* B) To allocate jobs to available resources based on efficiency metrics
* C) To interact with users directly to understand job requirements
* D) To delay job processing until optimal conditions are met  
  **Answer:** B) To allocate jobs to available resources based on efficiency metrics

1. **Which factor is most likely to affect the performance of a batch system?**

* A) The speed of the disk drive
* B) The accuracy of the compiler used for job execution
* C) The number of jobs in the queue and resource availability
* D) The amount of user interaction required during job execution  
  **Answer:** C) The number of jobs in the queue and resource availability

1. **A batch system often utilizes a priority queue to:**

* A) Increase fairness in job execution
* B) Ensure jobs are processed in real-time
* C) Allocate resources equally to all jobs
* D) Organize jobs based on their urgency or resource needs  
  **Answer:** D) Organize jobs based on their urgency or resource needs

1. **What kind of data structure is typically used for managing job queues in batch systems?**

* A) Binary tree
* B) Priority queue
* C) Hash map
* D) Linked list  
  **Answer:** B) Priority queue

1. **Which of the following would be an appropriate use of a batch system in a business environment?**

* A) Managing a real-time inventory system
* B) Processing payroll for a large company
* C) Handling customer service inquiries
* D) Responding to real-time stock market changes  
  **Answer:** B) Processing payroll for a large company

1. **In the context of resource management in batch systems, what is "resource contention"?**

* A) Allocation of resources based on fairness
* B) Competition between jobs for limited resources
* C) Allocation of resources to the highest priority job
* D) Simultaneous execution of multiple jobs  
  **Answer:** B) Competition between jobs for limited resources

1. **What is the typical approach to managing memory allocation in batch systems?**

* A) Memory is dynamically allocated as needed by jobs
* B) Memory is statically assigned to each job at runtime
* C) Jobs are allocated memory based on their size
* D) Jobs are restricted from using memory until the scheduler determines availability  
  **Answer:** A) Memory is dynamically allocated as needed by jobs

1. **How does the batch system's scheduler improve the efficiency of resource usage?**

* A) By assigning jobs based on job type
* B) By minimizing idle time for resources
* C) By allowing each job to complete before scheduling the next
* D) By increasing the priority of jobs based on user demand  
  **Answer:** B) By minimizing idle time for resources

1. **In a large-scale batch processing system, what might happen if jobs are not properly prioritized?**

* A) Resources may be used more efficiently
* B) Jobs could experience longer wait times or starvation
* C) Jobs will be completed faster
* D) Resource conflicts will be eliminated  
  **Answer:** B) Jobs could experience longer wait times or starvation

1. **What is the purpose of a "turnaround time" metric in batch system performance?**

* A) To measure the system’s ability to prevent deadlock
* B) To measure the time taken for a job to complete after being submitted
* C) To measure the time the resource manager spends on resource allocation
* D) To measure the number of jobs processed per hour  
  **Answer:** B) To measure the time taken for a job to complete after being submitted

1. **Which of the following scheduling algorithms is most suitable for minimizing turnaround time in a batch system?**

* A) First-Come, First-Served (FCFS)
* B) Shortest Job Next (SJN)
* C) Priority-based Scheduling
* D) Round-Robin Scheduling  
  **Answer:** B) Shortest Job Next (SJN)

1. **How can resource management be improved in a batch system?**

* A) By increasing the number of jobs in the queue
* B) By dynamically adjusting the priority of jobs based on real-time needs
* C) By reducing the amount of memory allocated to jobs
* D) By reducing job execution time  
  **Answer:** B) By dynamically adjusting the priority of jobs based on real-time needs

1. **What is one major disadvantage of using a batch system for real-time applications?**

* A) Real-time user interaction is impossible
* B) It cannot handle large datasets
* C) Job execution is delayed due to queuing
* D) Resource allocation is inefficient  
  **Answer:** C) Job execution is delayed due to queuing

1. **What is the main role of a resource manager in preventing job failures?**

* A) Monitoring job progress
* B) Allocating resources efficiently
* C) Removing jobs from the queue
* D) Interacting with users to provide updates  
  **Answer:** B) Allocating resources efficiently

1. **Which strategy would a batch system use to ensure that jobs are executed in a fair manner?**

* A) Round-robin scheduling
* B) Priority-based scheduling with equal weight
* C) First-Come, First-Served
* D) Fair Share Scheduling  
  **Answer:** D) Fair Share Scheduling

**Sessions 2 & 3: Submitting and Managing Jobs**, covering topics such as job submission techniques, job execution management, and writing batch scripts.

### **Easy Level**

1. **What is the primary purpose of submitting a job in a batch system?**
   * A) To execute a job in real-time
   * B) To submit a job for scheduled execution
   * C) To allocate resources for interactive processing
   * D) To monitor job performance  
     **Answer:** B) To submit a job for scheduled execution
2. **Which of the following is the first step when submitting a job to a batch system?**
   * A) Writing the batch script
   * B) Allocating resources
   * C) Executing the job
   * D) Defining job parameters  
     **Answer:** A) Writing the batch script
3. **What is the purpose of a batch script in a batch job submission?**
   * A) To define job parameters and instructions for execution
   * B) To monitor job progress
   * C) To interact with users during execution
   * D) To allocate resources  
     **Answer:** A) To define job parameters and instructions for execution
4. **Which of the following commands is commonly used to submit a job to a batch system in Linux?**
   * A) submit
   * B) batch
   * C) sbatch
   * D) execute  
     **Answer:** C) sbatch
5. **What is typically required when submitting a job to a batch system?**
   * A) Job script
   * B) Resource allocation request
   * C) Input files
   * D) All of the above  
     **Answer:** D) All of the above
6. **Which of the following is a basic tool for managing jobs in a batch system?**
   * A) Job scheduler
   * B) Resource manager
   * C) System monitor
   * D) All of the above  
     **Answer:** D) All of the above
7. **In a batch system, which tool helps in tracking the status of submitted jobs?**
   * A) Job monitor
   * B) Job scheduler
   * C) Resource manager
   * D) Job control command  
     **Answer:** A) Job monitor
8. **Which statement about batch scripts is correct?**
   * A) Batch scripts must always include a user interface
   * B) Batch scripts define how jobs should be executed
   * C) Batch scripts are executed in real-time
   * D) Batch scripts do not require parameters  
     **Answer:** B) Batch scripts define how jobs should be executed
9. **What is typically used to specify resource requirements in a batch job submission script?**
   * A) Job parameters
   * B) Scheduler options
   * C) Resource request directives
   * D) Job priority  
     **Answer:** C) Resource request directives
10. **Which of the following is an example of a resource that can be requested in a batch job submission?**
    * A) CPU time
    * B) Memory
    * C) Disk space
    * D) All of the above  
      **Answer:** D) All of the above

### **Intermediate Level**

1. **How can a user optimize a batch script for improved performance?**
   * A) By minimizing the use of resource-heavy commands
   * B) By limiting the number of jobs submitted
   * C) By avoiding the use of variables
   * D) By writing complex logic  
     **Answer:** A) By minimizing the use of resource-heavy commands
2. **Which of the following statements is true when managing batch jobs?**
   * A) Jobs can only be executed sequentially
   * B) Jobs can be managed by setting priorities or dependencies
   * C) Resource allocation is not necessary for batch jobs
   * D) Job scripts are ignored during execution  
     **Answer:** B) Jobs can be managed by setting priorities or dependencies
3. **Which of the following tools can be used to modify a job after submission in a batch system?**
   * A) scontrol
   * B) qmod
   * C) sbatch
   * D) batch  
     **Answer:** A) scontrol
4. **When writing a batch script, what is typically included to manage job execution time?**
   * A) Resource usage limits
   * B) Job execution status
   * C) User-specific settings
   * D) Time limits and job dependencies  
     **Answer:** D) Time limits and job dependencies
5. **Which type of job scheduling method allows for managing jobs in terms of priorities and resources in a batch system?**
   * A) Round-robin scheduling
   * B) Priority-based scheduling
   * C) Shortest Job Next (SJN)
   * D) First-Come, First-Served (FCFS)  
     **Answer:** B) Priority-based scheduling
6. **Which command is used to view the status of a job that has been submitted in a batch system?**
   * A) jobstatus
   * B) squeue
   * C) checkstatus
   * D) qstat  
     **Answer:** B) squeue
7. **When writing a batch script, which file is typically required to contain the batch commands and job instructions?**
   * A) Input file
   * B) Job script file
   * C) Resource file
   * D) Configuration file  
     **Answer:** B) Job script file
8. **Which option in a batch script specifies the number of CPUs or cores required for the job?**
   * A) --cpus-per-task
   * B) --time
   * C) --output
   * D) --dependency  
     **Answer:** A) --cpus-per-task
9. **How can a user cancel a running job in a batch system?**
   * A) scontrol cancel <job\_id>
   * B) qdel <job\_id>
   * C) sbatch cancel <job\_id>
   * D) Both A and B  
     **Answer:** D) Both A and B
10. **What does a batch job dependency indicate?**
    * A) The number of resources the job will consume
    * B) The job’s priority relative to other jobs
    * C) The job will execute only after another job finishes
    * D) The job will execute in parallel with other jobs  
      **Answer:** C) The job will execute only after another job finishes

### **Hard Level**

1. **Which statement is true regarding job dependencies in a batch system?**
   * A) Dependencies only apply to jobs within the same queue
   * B) Dependencies allow for jobs to be scheduled in parallel without delay
   * C) Dependencies allow jobs to wait for other jobs to complete before execution
   * D) Dependencies increase the overall speed of job execution  
     **Answer:** C) Dependencies allow jobs to wait for other jobs to complete before execution
2. **Which method is commonly used to optimize resource utilization when managing batch jobs?**
   * A) Job resource profiling
   * B) Minimizing the number of jobs
   * C) Using a large number of servers
   * D) Reducing the number of job dependencies  
     **Answer:** A) Job resource profiling
3. **What is the role of job monitoring in a batch job management system?**
   * A) To execute jobs at scheduled times
   * B) To track and log the status of running jobs
   * C) To submit jobs to the batch system
   * D) To schedule job priorities  
     **Answer:** B) To track and log the status of running jobs
4. **In a complex batch job submission system, what would be a key performance metric to monitor?**
   * A) Job completion time
   * B) Job error rate
   * C) Resource utilization efficiency
   * D) All of the above  
     **Answer:** D) All of the above
5. **What is a "job array" in the context of batch systems?**
   * A) A single job with multiple parallel tasks
   * B) A group of dependent jobs that share a common task
   * C) A set of independent jobs submitted as a batch
   * D) A sequence of jobs executed in random order  
     **Answer:** A) A single job with multiple parallel tasks
6. **Which of the following is a key consideration when optimizing a batch job script for resource efficiency?**
   * A) Use of loops and conditions in the script
   * B) Proper allocation of memory and CPU resources
   * C) Writing complex job commands
   * D) Keeping job scripts short and simple  
     **Answer:** B) Proper allocation of memory and CPU resources
7. **What is the common consequence of incorrect resource specification in a batch job submission?**
   * A) Longer job execution time
   * B) Job failure or resource wastage
   * C) Reduced job priority
   * D) Real-time execution  
     **Answer:** B) Job failure or resource wastage
8. **Which type of scheduling approach is best suited for jobs that require strict resource guarantees in a batch system?**
   * A) FIFO scheduling
   * B) Priority-based scheduling
   * C) Fair share scheduling
   * D) Resource-constrained scheduling  
     **Answer:** D) Resource-constrained scheduling
9. **In large-scale batch systems, which of the following tools is often used to optimize job execution and prevent job collisions?**
   * A) Resource manager
   * B) Job queue monitor
   * C) Dependency graph
   * D) Job scheduler  
     **Answer:** C) Dependency graph
10. **How can a user optimize the execution time of batch jobs?**
    * A) By increasing the job priority
    * B) By minimizing dependencies between jobs
    * C) By using multiple servers in parallel
    * D) By increasing the number of CPUs allocated  
      **Answer:** B) By minimizing dependencies between jobs
11. **Which of the following is an advanced technique for managing batch jobs in complex systems?**
    * A) Job chaining
    * B) Job replication
    * C) Using job pools
    * D) All of the above  
      **Answer:** D) All of the above
12. **Which resource is most often specified in a batch job submission script to prevent a job from running indefinitely?**
    * A) CPU time limit
    * B) Memory allocation
    * C) Job dependencies
    * D) Execution priority  
      **Answer:** A) CPU time limit
13. **What does the --dependency flag do in a batch job script?**
    * A) It allows the job to execute in parallel with other jobs
    * B) It sets a priority for the job execution
    * C) It specifies that the job will run after another job completes
    * D) It increases the CPU allocation for the job  
      **Answer:** C) It specifies that the job will run after another job completes
14. **What is the benefit of using job arrays in batch systems?**
    * A) They simplify dependency management
    * B) They allow for faster execution by running jobs sequentially
    * C) They help group similar jobs for easier management
    * D) They reduce resource allocation needs  
      **Answer:** C) They help group similar jobs for easier management
15. **What is one common method used to troubleshoot and manage job failures in batch systems?**
    * A) Check the job's output and error logs
    * B) Re-submit the job immediately
    * C) Increase job priority
    * D) Disable job dependencies  
      **Answer:** A) Check the job's output and error logs

### **Hard Level (Continued)**

1. **What is a typical issue when managing job queues in batch systems?**

* A) Job starvation
* B) Excessive parallel execution
* C) Resource over-allocation
* D) Job duplication  
  **Answer:** A) Job starvation

1. **When optimizing batch scripts, why is it important to minimize the number of I/O operations?**

* A) I/O operations increase job completion time
* B) I/O operations reduce CPU utilization
* C) I/O operations cannot be controlled in a batch script
* D) I/O operations require additional hardware  
  **Answer:** A) I/O operations increase job completion time

1. **Which of the following is the most suitable approach to handle resource contention in a batch system with multiple job submissions?**

* A) Use job priorities and resource reservation
* B) Submit jobs in random order
* C) Execute jobs without dependencies
* D) Allocate resources based on job completion time  
  **Answer:** A) Use job priorities and resource reservation

1. **What is a potential consequence of submitting a batch job with excessive resource requirements (e.g., CPU, memory)?**

* A) Resource wastage and other jobs may be delayed
* B) The system will automatically cancel the job
* C) Jobs will execute faster
* D) The batch system will ignore the job submission  
  **Answer:** A) Resource wastage and other jobs may be delayed

1. **How do job dependencies affect the scheduling of batch jobs?**

* A) They allow jobs to run concurrently
* B) They ensure jobs run in a specific sequence based on completion status
* C) They prevent the job from running until all jobs are completed
* D) They automatically cancel jobs when another job fails  
  **Answer:** B) They ensure jobs run in a specific sequence based on completion status

1. **What feature of a batch job scheduler helps minimize delays caused by job contention for limited resources?**

* A) Job prioritization and dynamic resource allocation
* B) Increasing the number of job queues
* C) Limiting the number of jobs submitted to the system
* D) Running jobs in a fixed order  
  **Answer:** A) Job prioritization and dynamic resource allocation

1. **Which of the following batch job management practices ensures that jobs do not exceed the available system resources (such as CPU, memory)?**

* A) Using a fair-share scheduler
* B) Submitting jobs with no resource limitations
* C) Specifying realistic resource requests in the job script
* D) Executing jobs with no resource monitoring  
  **Answer:** C) Specifying realistic resource requests in the job script

1. **What is the role of an "exit status" in a batch job execution?**

* A) It indicates the success or failure of a job after execution
* B) It tracks the total execution time of a job
* C) It specifies the resources used by the job
* D) It determines the job’s priority  
  **Answer:** A) It indicates the success or failure of a job after execution

1. **In a multi-user batch system, what is a major challenge when managing job submissions and ensuring fair resource allocation?**

* A) Preventing job duplication
* B) Balancing the system load among users
* C) Minimizing the execution time of each job
* D) Allowing users to submit unlimited jobs simultaneously  
  **Answer:** B) Balancing the system load among users

1. **What is the benefit of using a batch system that supports job dependencies?**

* A) It allows jobs to be executed regardless of resource availability
* B) It allows jobs to be executed in a specific order based on other job statuses
* C) It prevents job failures by eliminating resource competition
* D) It ensures jobs are always completed in the shortest time possible  
  **Answer:** B) It allows jobs to be executed in a specific order based on other job statuses

1. **Which of the following is the primary advantage of using a "job array" in batch systems?**

* A) It increases the system's processing speed
* B) It simplifies the submission of multiple similar jobs
* C) It reduces the number of resource requests
* D) It eliminates the need for job dependencies  
  **Answer:** B) It simplifies the submission of multiple similar jobs

1. **How can an administrator ensure that a batch job is resubmitted after a failure or interruption in a system?**

* A) Use a cron job to monitor and resubmit the job
* B) Manually restart the job from the beginning
* C) Write a script that automatically retries failed jobs
* D) Set the job to run only once  
  **Answer:** C) Write a script that automatically retries failed jobs

1. **Which of the following techniques helps in reducing overhead in a batch job script?**

* A) Avoiding the use of variables
* B) Using efficient loops and minimizing unnecessary operations
* C) Running each command in a separate script
* D) Submitting jobs with excessive dependencies  
  **Answer:** B) Using efficient loops and minimizing unnecessary operations

1. **What is the purpose of using #SBATCH directives in a job submission script in a system like SLURM?**

* A) To specify the job’s name
* B) To set job parameters such as memory, time, and CPU
* C) To define the output file format
* D) To specify which nodes to use  
  **Answer:** B) To set job parameters such as memory, time, and CPU

1. **Which of the following batch job management strategies is most effective in handling long-running jobs with resource dependencies?**

* A) Prioritizing jobs based on submission time
* B) Using job queues with priority levels and resource constraints
* C) Limiting the number of jobs submitted by a user
* D) Executing jobs without any dependency checks  
  **Answer:** B) Using job queues with priority levels and resource constraints

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**Sessions 4 & 5: SLURM Installation, Configuration, and Job Management**, including topics like **SLURM installation**, **job submission**, **configuration**, and **writing batch scripts** for managing jobs with SLURM.

### **Easy Level**

1. **What does SLURM stand for?**
   * A) Simple Linux Utility for Resource Management
   * B) Scheduling and Load User Resource Management
   * C) Super Large Unit Resource Management
   * D) System Load User Resource Management  
     **Answer:** A) Simple Linux Utility for Resource Management
2. **Which of the following is the first step in installing SLURM on a Linux system?**
   * A) Configuring job priorities
   * B) Installing required dependencies
   * C) Writing the SLURM configuration file
   * D) Submitting a test job  
     **Answer:** B) Installing required dependencies
3. **What is the primary role of SLURM in a cluster?**
   * A) Managing hardware failures
   * B) Scheduling and managing job execution on compute nodes
   * C) Monitoring network performance
   * D) Configuring user interfaces  
     **Answer:** B) Scheduling and managing job execution on compute nodes
4. **Which command is used to check the status of SLURM services?**
   * A) scontrol status
   * B) systemctl status slurmctld
   * C) slurm-status
   * D) squeue status  
     **Answer:** B) systemctl status slurmctld
5. **Where does SLURM store its configuration files?**
   * A) /etc/slurm/
   * B) /usr/local/slurm/
   * C) /var/lib/slurm/
   * D) /etc/config/slurm/  
     **Answer:** A) /etc/slurm/
6. **Which of the following is a necessary component to set up SLURM on a cluster?**
   * A) SLURM Controller (slurmctld)
   * B) Job queue monitor
   * C) GPU scheduler
   * D) High-speed network card  
     **Answer:** A) SLURM Controller (slurmctld)
7. **What file must be configured to define the SLURM compute nodes and resources?**
   * A) slurm.conf
   * B) job.conf
   * C) cluster.cfg
   * D) nodes.conf  
     **Answer:** A) slurm.conf
8. **Which SLURM command is used to submit a job to the system?**
   * A) sbatch
   * B) submit
   * C) scontrol submit
   * D) srun  
     **Answer:** A) sbatch
9. **How can a user view the list of jobs currently queued or running in SLURM?**
   * A) slurm-status
   * B) squeue
   * C) jobqueue
   * D) joblist  
     **Answer:** B) squeue
10. **Which command is used to cancel a running job in SLURM?**
    * A) scancel
    * B) canceljob
    * C) sbatch --cancel
    * D) sjobdel  
      **Answer:** A) scancel

### **Intermediate Level**

1. **What is the purpose of the slurm.conf file in a SLURM installation?**
   * A) To specify job resource limits
   * B) To configure SLURM services and resources
   * C) To manage user access to compute nodes
   * D) To define job dependencies  
     **Answer:** B) To configure SLURM services and resources
2. **What is the command to configure the SLURM controller (slurmctld) on a new node?**
   * A) scontrol config
   * B) slurmctld --configure
   * C) slurmd
   * D) systemctl restart slurmctld  
     **Answer:** D) systemctl restart slurmctld
3. **Which SLURM command is used to display detailed information about a job, such as its resource allocation and status?**
   * A) scontrol show job
   * B) sinfo
   * C) sbatch info
   * D) squeue details  
     **Answer:** A) scontrol show job
4. **Which of the following configuration parameters in slurm.conf defines the default partition where jobs are submitted?**
   * A) DefaultPartition
   * B) PartitionName
   * C) DefaultQueue
   * D) JobPartition  
     **Answer:** A) DefaultPartition
5. **In SLURM, what is the role of the slurmd daemon?**
   * A) It schedules jobs on the cluster nodes
   * B) It monitors the status of submitted jobs
   * C) It runs on each compute node to manage job execution
   * D) It displays job queues and system status  
     **Answer:** C) It runs on each compute node to manage job execution
6. **How can SLURM be configured to allow users to request specific node types for their jobs?**
   * A) By using scontrol
   * B) By specifying the node type in the job script
   * C) By editing the node.conf file
   * D) By setting up partitions in slurm.conf  
     **Answer:** D) By setting up partitions in slurm.conf
7. **Which directive in a SLURM batch script specifies the number of nodes required for the job?**
   * A) --nodes
   * B) --ntasks
   * C) --cpus-per-task
   * D) --task-per-node  
     **Answer:** A) --nodes
8. **Which SLURM command can be used to start an interactive job?**
   * A) sbatch -i
   * B) srun
   * C) scancel -i
   * D) scontrol interactive  
     **Answer:** B) srun
9. **How can a user specify a time limit for their job in a SLURM batch script?**
   * A) --time=<hh:mm:ss>
   * B) --duration=<hh:mm:ss>
   * C) --limit=<hh:mm:ss>
   * D) --timeout=<hh:mm:ss>  
     **Answer:** A) --time=<hh:mm:ss>
10. **What is the role of the squeue command in SLURM?**
    * A) It shows the list of all available nodes
    * B) It shows the status of a particular job or jobs in the queue
    * C) It schedules jobs based on priority
    * D) It modifies job configuration  
      **Answer:** B) It shows the status of a particular job or jobs in the queue

### **Hard Level**

1. **Which SLURM parameter in a batch script would you use to request a specific amount of memory for your job?**
   * A) --memory
   * B) --mem
   * C) --mem-per-cpu
   * D) Both B and C  
     **Answer:** D) Both B and C
2. **Which command would you use to view the detailed configuration of SLURM’s scheduling policies?**
   * A) scontrol show config
   * B) sinfo -s
   * C) sbatch config
   * D) slurmctl show  
     **Answer:** A) scontrol show config
3. **How do SLURM job dependencies work when configuring a batch job script?**
   * A) The job will run only after another specified job finishes
   * B) Jobs are always executed simultaneously
   * C) Dependencies are ignored by the SLURM scheduler
   * D) The jobs run independently but in order of submission  
     **Answer:** A) The job will run only after another specified job finishes
4. **Which configuration in slurm.conf defines how many compute nodes are part of a partition?**
   * A) NodeCount
   * B) MaxNodes
   * C) PartitionNodes
   * D) NodeList  
     **Answer:** D) NodeList
5. **What command in SLURM can be used to view detailed node information including state, features, and availability?**
   * A) scontrol show node
   * B) sinfo
   * C) slurm-status
   * D) sbatch node  
     **Answer:** A) scontrol show node
6. **Which SLURM parameter in a job submission script defines how many CPUs per task are required?**
   * A) --cpus-per-task
   * B) --tasks-per-cpu
   * C) --cores-per-task
   * D) --task-per-core  
     **Answer:** A) --cpus-per-task
7. **When configuring SLURM, which of the following is used to specify job time limits at the system level?**
   * A) MaxTime
   * B) JobTimeLimit
   * C) TimeLimit
   * D) SlurmTime  
     **Answer:** A) MaxTime
8. **Which SLURM command is used to query the current status of a job and view detailed job information?**
   * A) scontrol show job
   * B) squeue --job-info
   * C) sjobinfo
   * D) sinfo -j  
     **Answer:** A) scontrol show job
9. **How can SLURM handle high-priority jobs in a large-scale system with multiple users?**
   * A) By using the --priority flag in job submission
   * B) By creating partitions with different priority levels
   * C) By allocating more resources to high-priority jobs
   * D) All of the above  
     **Answer:** D) All of the above
10. **What does the srun command do in SLURM?**
    * A) Submits a batch job for execution
    * B) Executes a job interactively on available nodes
    * C) Queries the job status
    * D) Cancels a running job  
      **Answer:** B) Executes a job interactively on available nodes
11. **Which SLURM feature allows for parallel job execution across multiple nodes?**
    * A) Job arrays
    * B) Task-per-node scheduling
    * C) MPI-based job execution
    * D) Job dependencies  
      **Answer:** C) MPI-based job execution
12. **What does the --partition option specify in a SLURM job script?**
    * A) The job queue in which the job should run
    * B) The number of CPUs required for the job
    * C) The maximum memory allowed for the job
    * D) The specific node where the job should run  
      **Answer:** A) The job queue in which the job should run
13. **How can users in SLURM prioritize job scheduling within a queue?**
    * A) By using the --priority flag
    * B) By submitting jobs to a higher-priority partition
    * C) By setting job time limits
    * D) By setting job dependencies  
      **Answer:** B) By submitting jobs to a higher-priority partition
14. **Which configuration option in slurm.conf determines how long a job can run before being automatically terminated?**
    * A) MaxWall
    * B) MaxJobTime
    * C) JobTimeout
    * D) MaxTime  
      **Answer:** D) MaxTime
15. **How would you specify a GPU requirement for a job in SLURM?**
    * A) --gres=gpu:<number>
    * B) --gpu
    * C) --resource=gpu
    * D) --gpucount=<number>  
      **Answer:** A) --gres=gpu:<number>
16. **In SLURM, which configuration is used to assign partitions to specific nodes?**
    * A) PartitionNodes
    * B) NodeList
    * C) NodeTypes
    * D) PartitionAssignments  
      **Answer:** B) NodeList
17. **Which of the following commands is used to create a job array in SLURM?**
    * A) sbatch --array=<range>
    * B) squeue --array=<range>
    * C) scontrol array-submit
    * D) srun --array=<range>  
      **Answer:** A) sbatch --array=<range>
18. **Which SLURM command allows administrators to manage or configure jobs while they are running?**
    * A) scontrol
    * B) scancel
    * C) srun
    * D) squeue  
      **Answer:** A) scontrol
19. **Which SLURM feature allows job dependencies to be defined by job completion status?**
    * A) --dependency=afterok
    * B) --priority=high
    * C) --depend
    * D) --block-on  
      **Answer:** A) --dependency=afterok
20. **Which command in SLURM is used to obtain the available compute resources and node status?**
    * A) sinfo
    * B) squeue
    * C) scontrol
    * D) salloc  
      **Answer:** A) sinfo

### **Hard Level**

1. **Which of the following SLURM components is responsible for job scheduling and managing resource allocation across the cluster?**
   * A) slurmctld
   * B) slurmd
   * C) scontrol
   * D) squeue  
     **Answer:** A) slurmctld
2. **How does SLURM handle job priority and resource contention in a multi-user system?**
   * A) By using fair-share scheduling algorithms
   * B) By running jobs in a first-come, first-served manner
   * C) By assigning priority based on job submission time only
   * D) By allocating resources to jobs randomly  
     **Answer:** A) By using fair-share scheduling algorithms
3. **What is the impact of setting the --exclusive option in a SLURM job submission script?**
   * A) The job is allocated all the requested resources without sharing with other jobs
   * B) The job is run in parallel with other jobs
   * C) The job will be executed with the highest priority
   * D) The job will be canceled if it exceeds the resource limit  
     **Answer:** A) The job is allocated all the requested resources without sharing with other jobs
4. **Which SLURM command allows an administrator to adjust the properties of a job after it has been submitted, such as changing the allocated resources or priority?**
   * A) scontrol update
   * B) squeue modify
   * C) scontrol reconfigure
   * D) sbatch modify  
     **Answer:** A) scontrol update
5. **When a SLURM job fails, which exit status indicates that the failure was due to insufficient resources?**
   * A) 1
   * B) 0
   * C) 2
   * D) 137  
     **Answer:** D) 137
6. **How can SLURM be configured to ensure that certain jobs always have access to resources, even during periods of high contention?**
   * A) By setting job priorities with PriorityWeightAge
   * B) By using job preemption settings
   * C) By allocating a fixed amount of resources for specific users
   * D) By enabling the backfill scheduling feature  
     **Answer:** B) By using job preemption settings
7. **Which of the following SLURM commands allows you to view or modify the current state of job queues, including job limits and priorities?**
   * A) scontrol show config
   * B) squeue --job
   * C) scontrol show partition
   * D) scontrol update partition  
     **Answer:** C) scontrol show partition
8. **What is the primary difference between srun and sbatch in SLURM?**
   * A) srun submits jobs to the queue, while sbatch executes jobs interactively
   * B) srun is used for interactive job execution, while sbatch is used for batch job submission
   * C) srun is used to manage SLURM services, while sbatch schedules jobs
   * D) srun runs a job on the master node, while sbatch runs jobs on compute nodes  
     **Answer:** B) srun is used for interactive job execution, while sbatch is used for batch job submission
9. **In a SLURM system, which command allows you to run a job on a specific node or a set of nodes?**
   * A) sbatch --nodelist=<node\_list>
   * B) srun --exclusive
   * C) scancel --nodelist=<node\_list>
   * D) squeue --nodes=<node\_list>  
     **Answer:** A) sbatch --nodelist=<node\_list>
10. **What is the purpose of the gres (Generic Resource) parameter in a SLURM job script?**
    * A) To request GPUs or other special resources for the job
    * B) To specify the maximum wall time for the job
    * C) To define the job’s memory requirements
    * D) To limit the number of jobs a user can run simultaneously  
      **Answer:** A) To request GPUs or other special resources for the job

**Sessions 6 & 7: Managing Nodes and Server Scheduling Policies**, which includes topics such as **managing nodes**, **computational resources**, and **server scheduling policies** to optimize resource allocation and job scheduling.

### **Easy Level**

1. **Which of the following is the primary function of a computational node in a cluster?**
   * A) To store data
   * B) To execute jobs or tasks
   * C) To monitor system performance
   * D) To manage job priorities  
     **Answer:** B) To execute jobs or tasks
2. **In SLURM, what does the scontrol show node command do?**
   * A) Displays the list of jobs on a specific node
   * B) Provides detailed information about the state of a node
   * C) Cancels a job on a node
   * D) Restarts the node’s services  
     **Answer:** B) Provides detailed information about the state of a node
3. **What does the term “node allocation” mean in SLURM?**
   * A) The process of assigning jobs to nodes based on availability and capacity
   * B) Setting the memory limits for a node
   * C) Configuring the partitions available for jobs
   * D) Assigning a job's CPU core count  
     **Answer:** A) The process of assigning jobs to nodes based on availability and capacity
4. **Which of the following is a key benefit of properly configuring and managing computational nodes?**
   * A) Reducing the amount of data storage needed
   * B) Ensuring fair access to compute resources among users
   * C) Simplifying the job submission process
   * D) Eliminating network latency issues  
     **Answer:** B) Ensuring fair access to compute resources among users
5. **Which SLURM command would you use to check the availability of nodes in the cluster?**
   * A) scontrol show node
   * B) squeue
   * C) sinfo
   * D) sbatch  
     **Answer:** C) sinfo
6. **What is the role of slurmd in node management?**
   * A) To configure the cluster
   * B) To run jobs on compute nodes
   * C) To monitor network performance
   * D) To schedule jobs based on priority  
     **Answer:** B) To run jobs on compute nodes
7. **Which parameter in slurm.conf is used to specify the maximum number of nodes allowed in the cluster?**
   * A) MaxNodes
   * B) NodeCount
   * C) PartitionNodes
   * D) MaxAllocations  
     **Answer:** A) MaxNodes
8. **How does SLURM determine the current state of a node?**
   * A) By querying the node status via scontrol
   * B) Through the slurmd daemon running on the node
   * C) By using the squeue command
   * D) By manually checking node performance logs  
     **Answer:** B) Through the slurmd daemon running on the node
9. **What is the purpose of the slurmd daemon in SLURM?**
   * A) To schedule jobs across multiple nodes
   * B) To execute jobs on each compute node
   * C) To monitor job status on the head node
   * D) To configure partitions for nodes  
     **Answer:** B) To execute jobs on each compute node
10. **Which of the following SLURM commands provides detailed status information about each node, including whether it's up or down?**
    * A) scontrol show node
    * B) squeue -t
    * C) sinfo
    * D) sbatch -status  
      **Answer:** A) scontrol show node

### **Intermediate Level**

1. **What is the key purpose of configuring a scheduling policy in SLURM?**
   * A) To optimize resource allocation and job execution
   * B) To monitor network traffic
   * C) To track user usage of the cluster
   * D) To assign static IP addresses to compute nodes  
     **Answer:** A) To optimize resource allocation and job execution
2. **Which of the following parameters is used to define the minimum number of nodes required for a job in SLURM?**
   * A) --nodes
   * B) --ntasks
   * C) --cpus-per-task
   * D) --tasks-per-node  
     **Answer:** A) --nodes
3. **Which of the following SLURM commands would you use to configure node-specific parameters like CPU count and memory?**
   * A) scontrol configure node
   * B) scontrol show node
   * C) scontrol update node
   * D) slurmd configure  
     **Answer:** C) scontrol update node
4. **What is the function of the --exclusive option when submitting a job in SLURM?**
   * A) It guarantees the job gets all of the requested resources, without sharing them with other jobs
   * B) It runs the job in the background
   * C) It allows the job to run only on a specific node
   * D) It limits the job to a single CPU core  
     **Answer:** A) It guarantees the job gets all of the requested resources, without sharing them with other jobs
5. **What is a node "feeling" in SLURM?**
   * A) The level of load on the node
   * B) A status indicating whether a node is fully allocated
   * C) A rating of node's health or workload
   * D) A dynamic change of job priority based on workload  
     **Answer:** A) The level of load on the node
6. **Which of the following SLURM parameters is used to configure the maximum allowed job runtime on a node?**
   * A) MaxWallTime
   * B) TimeLimit
   * C) MaxTime
   * D) MaxJobTime  
     **Answer:** B) TimeLimit
7. **What is the effect of setting the --priority option for a job in SLURM?**
   * A) It determines the priority of job execution in a job queue
   * B) It configures the system's maximum number of simultaneous jobs
   * C) It assigns CPU cores to the job
   * D) It specifies the node on which the job should run  
     **Answer:** A) It determines the priority of job execution in a job queue
8. **How can you specify multiple nodes for job submission in SLURM?**
   * A) --nodes=3
   * B) --node-list=3
   * C) --task-per-node=3
   * D) --multi-node=3  
     **Answer:** A) --nodes=3
9. **What type of scheduling policy does SLURM typically use for optimizing resource allocation?**
   * A) First-come, first-served
   * B) Shortest job first
   * C) Fair-share scheduling
   * D) Round-robin scheduling  
     **Answer:** C) Fair-share scheduling
10. **What does the --mem option in a SLURM job submission script do?**
    * A) Specifies the minimum memory required for the job
    * B) Requests a specific amount of memory for the job
    * C) Defines the maximum CPU usage for the job
    * D) Specifies the memory type to be used by the job  
      **Answer:** B) Requests a specific amount of memory for the job

### **Hard Level**

1. **What is the role of a partition in SLURM's scheduling policy?**
   * A) To specify the maximum number of jobs per user
   * B) To define a group of nodes that share the same scheduling policy
   * C) To specify the node's memory limit
   * D) To allocate resources based on job priorities  
     **Answer:** B) To define a group of nodes that share the same scheduling policy
2. **Which of the following SLURM scheduling algorithms can be used for job placement and priority calculation?**
   * A) Backfill
   * B) Shortest Job First (SJF)
   * C) First-Come, First-Served (FCFS)
   * D) Both A and C  
     **Answer:** D) Both A and C
3. **Which SLURM parameter can be used to ensure that a job runs only on specific types of nodes, such as nodes with GPUs?**
   * A) --gres=gpu
   * B) --node-type=gpu
   * C) --exclusive
   * D) --partition=gpu  
     **Answer:** A) --gres=gpu
4. **What command would you use to modify a running job’s parameters, such as increasing its memory or CPU cores in SLURM?**
   * A) scontrol update job
   * B) srun modify
   * C) sbatch modify
   * D) scancel job  
     **Answer:** A) scontrol update job
5. **Which of the following scheduling policies is best for clusters with varying user job requirements in SLURM?**
   * A) Priority-based scheduling
   * B) Round-robin scheduling
   * C) Preemption-based scheduling
   * D) Fair-share scheduling  
     **Answer:** D) Fair-share scheduling
6. **In SLURM, what does the --dependency=afterok:<job\_id> option specify for a job?**
   * A) The job will run only if the specified job completes successfully
   * B) The job will run only after the specified job begins
   * C) The job will run if the specified job fails
   * D) The job will run as soon as any job in the queue completes  
     **Answer:** A) The job will run only if the specified job completes successfully
7. **Which SLURM command allows you to define or modify server scheduling policies for nodes?**
   * A) scontrol
   * B) sbatch
   * C) sinfo
   * D) scheduling modify  
     **Answer:** A) scontrol
8. **Which of the following best describes the concept of "backfilling" in SLURM's scheduling system?**
   * A) Allowing smaller jobs to run in gaps created by larger jobs
   * B) Running jobs in a random order
   * C) Assigning jobs based on user priority
   * D) Allocating jobs to the first available node  
     **Answer:** A) Allowing smaller jobs to run in gaps created by larger jobs
9. **How can you specify that a job should run only on idle nodes in SLURM?**
   * A) By using the --constraint=idle option
   * B) By selecting the --exclusive option
   * C) By submitting to a partition configured with idle-only nodes
   * D) By using the --nodes=1 option  
     **Answer:** C) By submitting to a partition configured with idle-only nodes
10. **In SLURM, how can you define an upper limit for the number of jobs a user can run simultaneously?**
    * A) By configuring the MaxJobs parameter in slurm.conf
    * B) By setting the MaxJobsPerUser parameter
    * C) By using scontrol to modify job priorities
    * D) By using the --priority option  
      **Answer:** B) By setting the MaxJobsPerUser parameter

### **Hard Level**

1. **Which scheduling policy in SLURM allows jobs to be preempted and restarted if necessary, based on job priority?**
   * A) Fair-share scheduling
   * B) Preemption-based scheduling
   * C) Backfill scheduling
   * D) First-come, first-served scheduling  
     **Answer:** B) Preemption-based scheduling
2. **Which of the following SLURM parameters is used to define the maximum number of jobs that can run concurrently on each node?**
   * A) MaxJobsPerNode
   * B) MaxNodesPerJob
   * C) MaxTasksPerNode
   * D) MaxCPUsPerNode  
     **Answer:** C) MaxTasksPerNode
3. **In SLURM, which command would you use to check the status of nodes and their utilization in real time?**
   * A) scontrol show node
   * B) squeue -t
   * C) sinfo
   * D) sbatch status  
     **Answer:** C) sinfo
4. **Which SLURM option would you use to limit the number of cores a job can request from a node?**
   * A) --cpus-per-task
   * B) --mem-per-cpu
   * C) --cores-per-node
   * D) --cpu-count  
     **Answer:** A) --cpus-per-task
5. **Which feature of SLURM enables you to automatically assign jobs to nodes that have the necessary resources available, based on a job’s requirements?**
   * A) Resource overcommitment
   * B) Backfill scheduling
   * C) Fair-share scheduling
   * D) Job priority queue  
     **Answer:** B) Backfill scheduling
6. **What is the effect of setting the --constraint option in a SLURM job script?**
   * A) It specifies the maximum time the job can run on a node
   * B) It limits the job to specific hardware configurations or features on nodes
   * C) It ensures that the job will only run during off-peak hours
   * D) It allocates a job to a specific partition  
     **Answer:** B) It limits the job to specific hardware configurations or features on nodes
7. **Which command can be used to monitor the real-time status of SLURM jobs, including job resource allocation and job state?**
   * A) scontrol show job
   * B) squeue
   * C) sbatch status
   * D) scontrol show jobid  
     **Answer:** B) squeue
8. **Which option in SLURM allows a user to specify that a job should run only on nodes with available GPUs?**
   * A) --node-type=gpu
   * B) --gres=gpu
   * C) --partition=gpu
   * D) --exclusive=gpu  
     **Answer:** B) --gres=gpu
9. **How can SLURM be configured to allow jobs to run only on nodes with a specific type of CPU?**
   * A) By setting the --cpu option
   * B) By configuring the --constraint option in the job script
   * C) By configuring slurm.conf with node types
   * D) By assigning jobs to specific partitions that only contain certain CPUs  
     **Answer:** C) By configuring slurm.conf with node types
10. **Which SLURM command can be used to limit the number of jobs submitted by a user based on resource usage or job priority?**
    * A) scontrol config
    * B) scontrol update
    * C) scontrol create
    * D) scontrol set  
      **Answer:** B) scontrol update
11. **In SLURM, what does the --exclusive flag do when used in job submission?**
    * A) It ensures that the job gets the requested resources without sharing them with other jobs
    * B) It forces the job to run on a specific node
    * C) It ensures the job is the last one to run in the queue
    * D) It allows the job to run across multiple partitions simultaneously  
      **Answer:** A) It ensures that the job gets the requested resources without sharing them with other jobs
12. **Which SLURM parameter controls the maximum amount of wall time allowed for a job?**
    * A) TimeLimit
    * B) MaxWallTime
    * C) WallTimeLimit
    * D) MaxTime  
      **Answer:** A) TimeLimit
13. **How can you view detailed resource allocation statistics for nodes in a SLURM-managed cluster?**
    * A) sinfo -v
    * B) scontrol show node
    * C) scontrol status
    * D) sbatch status  
      **Answer:** B) scontrol show node
14. **Which of the following is the purpose of the scontrol command in managing SLURM nodes and jobs?**
    * A) It is used to configure the SLURM scheduler
    * B) It allows users to submit jobs to the SLURM queue
    * C) It provides real-time updates on node status and job execution
    * D) It manages partitions and nodes within SLURM  
      **Answer:** C) It provides real-time updates on node status and job execution
15. **What type of scheduling is used in SLURM to improve resource utilization by scheduling small jobs in available time gaps?**
    * A) Priority-based scheduling
    * B) Backfill scheduling
    * C) First-Come, First-Served
    * D) Round-Robin scheduling  
      **Answer:** B) Backfill scheduling
16. **In SLURM, what happens when a job exceeds its specified wall time limit?**
    * A) The job is automatically suspended
    * B) The job is immediately terminated
    * C) The job continues running but logs a warning
    * D) The job is placed in the hold queue  
      **Answer:** B) The job is immediately terminated
17. **How can administrators configure SLURM to allow jobs to be run on nodes with specific hardware or features?**
    * A) By using node feature tags in the slurm.conf file
    * B) By creating separate partitions for different hardware configurations
    * C) By defining hardware requirements in the job script with --constraint
    * D) All of the above  
      **Answer:** D) All of the above
18. **Which scheduling policy in SLURM is designed to provide fair resource usage across users based on their historical resource usage?**
    * A) Fair-share scheduling
    * B) Priority-based scheduling
    * C) Backfill scheduling
    * D) First-Come, First-Served scheduling  
      **Answer:** A) Fair-share scheduling
19. **In SLURM, which command allows you to cancel a running job based on job ID?**
    * A) scancel
    * B) scontrol cancel
    * C) squeue cancel
    * D) sbatch cancel  
      **Answer:** A) scancel
20. **What does the --reservation option do in SLURM job submission?**
    * A) It ensures a job runs at a specific time
    * B) It reserves specific resources for a job
    * C) It allows jobs to run only in certain partitions
    * D) It limits job access to specific users  
      **Answer:** B) It reserves specific resources for a job

**Session 8: Scheduler Algorithms**, focusing on different scheduling algorithms such as **First-Come, First-Served (FCFS)**, **Priority Scheduling**, and others used by schedulers to allocate resources effectively.

### **Easy Level**

1. **Which of the following is the simplest scheduling algorithm used by schedulers?**
   * A) Round-Robin
   * B) First-Come, First-Served (FCFS)
   * C) Shortest Job First (SJF)
   * D) Priority Scheduling  
     **Answer:** B) First-Come, First-Served (FCFS)
2. **In First-Come, First-Served (FCFS) scheduling, which factor determines the order in which jobs are executed?**
   * A) The priority of the job
   * B) The arrival time of the job
   * C) The length of the job
   * D) The resources required by the job  
     **Answer:** B) The arrival time of the job
3. **Which of the following is true about the First-Come, First-Served (FCFS) algorithm?**
   * A) It is non-preemptive
   * B) It gives priority to the shortest job
   * C) It is a preemptive scheduling algorithm
   * D) It runs jobs in a random order  
     **Answer:** A) It is non-preemptive
4. **Which of the following is the main disadvantage of the First-Come, First-Served (FCFS) scheduling algorithm?**
   * A) High computational cost
   * B) Poor performance for short jobs
   * C) It is difficult to implement
   * D) High starvation risk  
     **Answer:** B) Poor performance for short jobs
5. **In which scheduling algorithm does a job with the highest priority execute first?**
   * A) First-Come, First-Served
   * B) Priority Scheduling
   * C) Round-Robin
   * D) Shortest Job First  
     **Answer:** B) Priority Scheduling
6. **What is a potential issue with Priority Scheduling?**
   * A) It may lead to starvation of lower-priority jobs
   * B) It is too complex to implement
   * C) It cannot handle real-time tasks
   * D) It schedules jobs based on their resource usage  
     **Answer:** A) It may lead to starvation of lower-priority jobs
7. **Which algorithm is often used in operating systems to ensure that no job can monopolize the CPU indefinitely?**
   * A) First-Come, First-Served
   * B) Priority Scheduling
   * C) Round-Robin
   * D) Shortest Job First  
     **Answer:** C) Round-Robin
8. **In Round-Robin scheduling, what happens if a job’s time quantum expires before it finishes?**
   * A) The job is terminated
   * B) The job is put back in the ready queue
   * C) The job runs to completion
   * D) The job is put into a waiting queue  
     **Answer:** B) The job is put back in the ready queue
9. **Which of the following is true about the Shortest Job First (SJF) scheduling algorithm?**
   * A) It always executes the longest job first
   * B) It executes the shortest job first
   * C) It prioritizes jobs based on arrival time
   * D) It is a non-preemptive scheduling algorithm  
     **Answer:** B) It executes the shortest job first
10. **What is the main advantage of the Shortest Job First (SJF) algorithm?**
    * A) It minimizes waiting time for all jobs
    * B) It ensures fair resource allocation
    * C) It prevents job starvation
    * D) It guarantees the quickest completion of all jobs  
      **Answer:** A) It minimizes waiting time for all jobs

### **Intermediate Level**

1. **In Priority Scheduling, how are priorities assigned to jobs?**
   * A) Based on the arrival time of the job
   * B) Based on the resources required
   * C) Based on external factors such as user or task importance
   * D) Based on the length of the job  
     **Answer:** C) Based on external factors such as user or task importance
2. **Which scheduling algorithm would be most suitable for a real-time system where tasks must meet strict deadlines?**
   * A) First-Come, First-Served
   * B) Priority Scheduling
   * C) Round-Robin
   * D) Shortest Job First  
     **Answer:** B) Priority Scheduling
3. **In which scheduling algorithm is a time quantum assigned to each job?**
   * A) Shortest Job First
   * B) Round-Robin
   * C) Priority Scheduling
   * D) First-Come, First-Served  
     **Answer:** B) Round-Robin
4. **Which scheduling algorithm minimizes the average waiting time for a batch of jobs?**
   * A) First-Come, First-Served
   * B) Priority Scheduling
   * C) Round-Robin
   * D) Shortest Job First  
     **Answer:** D) Shortest Job First
5. **In which of the following algorithms can a job be preempted if a higher priority job arrives?**
   * A) First-Come, First-Served
   * B) Priority Scheduling
   * C) Shortest Job First
   * D) Round-Robin  
     **Answer:** B) Priority Scheduling
6. **Which of the following is true about the preemptive version of Priority Scheduling?**
   * A) Jobs are never interrupted once they start executing
   * B) Jobs with lower priority are never executed
   * C) A job with a higher priority can interrupt a running job with a lower priority
   * D) Jobs are executed in the order they arrive  
     **Answer:** C) A job with a higher priority can interrupt a running job with a lower priority
7. **Which algorithm is often used to prevent the "convoy effect," where short jobs have to wait behind longer jobs?**
   * A) Priority Scheduling
   * B) First-Come, First-Served
   * C) Shortest Job First
   * D) Round-Robin  
     **Answer:** C) Shortest Job First
8. **Which of the following statements best describes the Round-Robin scheduling algorithm?**
   * A) Jobs with the highest priority are executed first
   * B) Each job is assigned a fixed time slice and then rotated through
   * C) Jobs are executed in the order they are received
   * D) Jobs are executed based on the shortest duration first  
     **Answer:** B) Each job is assigned a fixed time slice and then rotated through
9. **In Round-Robin scheduling, how is a "time quantum" defined?**
   * A) The maximum time a job can run before being terminated
   * B) The maximum time a job can spend in the ready queue
   * C) The fixed amount of time each job gets to execute before being preempted
   * D) The time a job waits in the queue before execution  
     **Answer:** C) The fixed amount of time each job gets to execute before being preempted
10. **Which scheduling algorithm is ideal for minimizing the average turnaround time in a system with jobs of varying lengths?**
    * A) First-Come, First-Served
    * B) Round-Robin
    * C) Priority Scheduling
    * D) Shortest Job First  
      **Answer:** D) Shortest Job First

### **Hard Level**

1. **Which algorithm is considered the most efficient for minimizing the average waiting time in non-preemptive scheduling systems?**
   * A) First-Come, First-Served
   * B) Priority Scheduling
   * C) Round-Robin
   * D) Shortest Job First  
     **Answer:** D) Shortest Job First
2. **In which of the following cases would the Priority Scheduling algorithm be inefficient?**
   * A) When jobs are assigned a fixed priority
   * B) When there are many jobs with equal priority
   * C) When jobs are preempted based on priority
   * D) When jobs require real-time processing  
     **Answer:** D) When jobs require real-time processing
3. **What is a major drawback of the Shortest Job First (SJF) algorithm?**
   * A) It can lead to the starvation of longer jobs
   * B) It is too complex to implement in systems with varying job lengths
   * C) It requires preemption, which can be difficult to manage
   * D) It results in high average turnaround time  
     **Answer:** A) It can lead to the starvation of longer jobs
4. **In the context of scheduling algorithms, what is "starvation"?**
   * A) The process where the scheduler runs out of resources
   * B) The indefinite postponement of a job due to continuous arrival of higher-priority jobs
   * C) A situation where jobs are executed immediately upon arrival
   * D) The suspension of jobs due to resource conflicts  
     **Answer:** B) The indefinite postponement of a job due to continuous arrival of higher-priority jobs
5. **Which of the following algorithms is designed to prevent starvation by allocating resources based on fair-share or aging techniques?**
   * A) First-Come, First-Served
   * B) Priority Scheduling with aging
   * C) Round-Robin
   * D) Shortest Job First  
     **Answer:** B) Priority Scheduling with aging
6. **Which scheduling algorithm can be most effective when the length of the jobs is predictable and short?**
   * A) Round-Robin
   * B) First-Come, First-Served
   * C) Shortest Job First
   * D) Priority Scheduling  
     **Answer:** C) Shortest Job First
7. **What is the main advantage of a preemptive scheduling algorithm over a non-preemptive one?**
   * A) It guarantees no starvation of jobs
   * B) It allows higher-priority jobs to run immediately
   * C) It reduces the complexity of scheduling
   * D) It minimizes context switching  
     **Answer:** B) It allows higher-priority jobs to run immediately
8. **Which of the following is true about the execution of jobs in a preemptive scheduling system?**
   * A) Jobs cannot be interrupted once started
   * B) Jobs can be suspended and resumed based on priority
   * C) Jobs must finish execution in one go
   * D) Jobs must be executed in the order they arrive  
     **Answer:** B) Jobs can be suspended and resumed based on priority
9. **What problem does the Shortest Job First (SJF) algorithm try to minimize?**
   * A) Average waiting time
   * B) Job starvation
   * C) CPU utilization
   * D) Turnaround time  
     **Answer:** A) Average waiting time
10. **In systems with priority scheduling, how can job starvation be avoided?**
    * A) By assigning a fixed priority to all jobs
    * B) By implementing aging, which gradually increases the priority of waiting jobs
    * C) By allocating resources randomly
    * D) By running jobs based on their arrival order  
      **Answer:** B) By implementing aging, which gradually increases the priority of waiting jobs

**Hard Level**

1. **What is the main purpose of the "Aging" technique in priority scheduling?**

* A) To prevent CPU overutilization by jobs
* B) To gradually increase the priority of long-waiting jobs, preventing starvation
* C) To preemptively terminate long-running jobs
* D) To allocate more resources to high-priority jobs  
  **Answer:** B) To gradually increase the priority of long-waiting jobs, preventing starvation

1. **Which scheduling algorithm is best suited for handling a mix of I/O-bound and CPU-bound tasks?**

* A) First-Come, First-Served
* B) Round-Robin
* C) Priority Scheduling
* D) Shortest Job First  
  **Answer:** B) Round-Robin

1. **In the context of scheduling algorithms, what is "turnaround time"?**

* A) The time taken by the job to enter the ready queue
* B) The total time from submission to completion of a job
* C) The time spent by a job waiting in the ready queue
* D) The time spent by a job executing on the CPU  
  **Answer:** B) The total time from submission to completion of a job

1. **Which of the following is a disadvantage of Round-Robin scheduling in a system with many jobs?**

* A) It leads to long waiting times for short jobs
* B) It doesn't allow job preemption
* C) It guarantees that jobs are executed in the order they arrive
* D) It is not suitable for real-time systems  
  **Answer:** A) It leads to long waiting times for short jobs

1. **In a system using Shortest Job First (SJF) scheduling, how does the system determine the length of a job?**

* A) Based on its historical execution time
* B) By the priority assigned to the job
* C) By estimating the job's execution time using a predictive model
* D) By asking the user to specify the job length  
  **Answer:** C) By estimating the job's execution time using a predictive model

1. **What is the primary difference between preemptive and non-preemptive scheduling?**

* A) Preemptive scheduling allows jobs to be interrupted, while non-preemptive scheduling does not
* B) Non-preemptive scheduling leads to fairer job distribution than preemptive scheduling
* C) Preemptive scheduling executes jobs strictly in the order they arrive
* D) Non-preemptive scheduling allows more jobs to be completed in a shorter amount of time  
  **Answer:** A) Preemptive scheduling allows jobs to be interrupted, while non-preemptive scheduling does not

1. **What kind of performance does First-Come, First-Served (FCFS) exhibit in terms of job execution time?**

* A) It provides minimal waiting time for all jobs
* B) It is best for systems with high-priority tasks
* C) It often results in high average waiting time for jobs with longer durations
* D) It guarantees fair execution for each job regardless of size  
  **Answer:** C) It often results in high average waiting time for jobs with longer durations

1. **Which scheduling algorithm is most susceptible to the "convoy effect," where short jobs are delayed behind long jobs?**

* A) Shortest Job First
* B) Round-Robin
* C) Priority Scheduling
* D) First-Come, First-Served  
  **Answer:** D) First-Come, First-Served

1. **In Priority Scheduling, what happens if two jobs have the same priority level?**

* A) The job that arrives first is executed first (First-Come, First-Served)
* B) The jobs are executed based on their size
* C) A random selection is made to choose which job executes first
* D) The job with the longest duration is executed first  
  **Answer:** A) The job that arrives first is executed first (First-Come, First-Served)

1. **Which of the following is the correct statement about Shortest Job First (SJF) scheduling in terms of its effect on job execution?**

* A) It minimizes the average turnaround time but can lead to starvation for longer jobs
* B) It ensures no starvation of jobs
* C) It has equal performance compared to Round-Robin
* D) It works well when jobs are highly variable in length  
  **Answer:** A) It minimizes the average turnaround time but can lead to starvation for longer jobs

1. **Which scheduling algorithm assigns a fixed time quantum to each job and executes jobs in a circular fashion?**

* A) First-Come, First-Served
* B) Round-Robin
* C) Shortest Job First
* D) Priority Scheduling  
  **Answer:** B) Round-Robin

1. **In a Round-Robin scheduling system, what is the effect of increasing the time quantum size?**

* A) It can lead to better response time for interactive jobs
* B) It makes the system behave similarly to First-Come, First-Served
* C) It results in more preemptions and can cause jobs to be completed faster
* D) It does not affect the system's performance  
  **Answer:** B) It makes the system behave similarly to First-Come, First-Served

1. **What is a significant drawback of using Round-Robin scheduling with a small time quantum?**

* A) It increases the turnaround time for all jobs
* B) It causes excessive context switching overhead
* C) It leads to high CPU utilization
* D) It favors long jobs over short ones  
  **Answer:** B) It causes excessive context switching overhead

1. **What happens if a job is preempted and a new job with a higher priority is ready to execute?**

* A) The preempted job waits for its turn until all higher-priority jobs are executed
* B) The preempted job is terminated
* C) The preempted job is resumed immediately after the high-priority job completes
* D) The preempted job is terminated, and a new job is started  
  **Answer:** A) The preempted job waits for its turn until all higher-priority jobs are executed

1. **Which of the following is the goal of implementing "fair-share" scheduling in a system?**

* A) To ensure jobs with high priority execute faster
* B) To allocate resources evenly among users, preventing any one user from monopolizing resources
* C) To prioritize short jobs over long ones
* D) To optimize CPU utilization  
  **Answer:** B) To allocate resources evenly among users, preventing any one user from monopolizing resources

1. **How does Priority Scheduling with preemption differ from the non-preemptive version?**

* A) Preemptive priority scheduling does not allow jobs with lower priority to execute
* B) Preemptive priority scheduling allows a job to be interrupted when a higher priority job arrives
* C) Preemptive priority scheduling gives equal priority to all jobs
* D) Preemptive priority scheduling executes jobs based on their arrival time  
  **Answer:** B) Preemptive priority scheduling allows a job to be interrupted when a higher priority job arrives

1. **Which of the following is an example of a dynamic priority scheduling system?**

* A) Fixed priority scheduling
* B) Round-Robin
* C) Aging in priority scheduling
* D) First-Come, First-Served  
  **Answer:** C) Aging in priority scheduling

1. **What is the key challenge when implementing Shortest Job First (SJF) in a preemptive scheduling system?**

* A) It requires knowledge of future job lengths
* B) It guarantees the shortest job is always executed first
* C) It results in higher computational overhead
* D) It can lead to unfair resource allocation  
  **Answer:** A) It requires knowledge of future job lengths

1. **In a system with jobs having varying execution times, which scheduling algorithm tends to be the most efficient in terms of minimizing average waiting time?**

* A) First-Come, First-Served
* B) Shortest Job First (SJF)
* C) Round-Robin
* D) Priority Scheduling  
  **Answer:** B) Shortest Job First (SJF)

1. **What is the effect of using Priority Scheduling without any form of aging or priority adjustments?**

* A) The system becomes highly responsive for all users
* B) Lower-priority jobs might starve indefinitely if higher-priority jobs keep arriving
* C) The system becomes completely fair to all users
* D) All jobs are executed in their order of arrival regardless of priority  
  **Answer:** B) Lower-priority jobs might starve indefinitely if higher-priority jobs keep arriving

**Sessions 9 & 10: SLURM Accounting**. The questions are divided into **easy**, **intermediate**, and **hard** levels, focusing on **job accounting**, **resource usage tracking**, and **data analysis in SLURM**.

### **Easy Level:**

1. **What is SLURM?**
   * A) A job scheduler for clusters
   * B) A file management system
   * C) A programming language
   * D) A network protocol  
     **Answer:** A) A job scheduler for clusters
2. **What does SLURM stand for?**
   * A) Simple Load and Resource Management
   * B) Scalable Load and Resource Management
   * C) Simple Local Resource Management
   * D) Scalable Local Resource Management  
     **Answer:** B) Scalable Load and Resource Management
3. **Which command in SLURM is used to check the status of jobs?**
   * A) squeue
   * B) sbatch
   * C) sinfo
   * D) sacct  
     **Answer:** A) squeue
4. **What does SLURM job accounting help administrators track?**
   * A) CPU usage
   * B) Memory usage
   * C) Disk usage
   * D) All of the above  
     **Answer:** D) All of the above
5. **Which SLURM command is used to submit jobs for execution?**
   * A) sbatch
   * B) squeue
   * C) sacct
   * D) scontrol  
     **Answer:** A) sbatch
6. **In SLURM, what is a job step?**
   * A) A specific command within a job
   * B) A part of a running job that tracks resource usage
   * C) A function of job submission
   * D) A job scheduled by a different user  
     **Answer:** B) A part of a running job that tracks resource usage
7. **Which of the following is a SLURM accounting tool for tracking job completion?**
   * A) sacct
   * B) squeue
   * C) scontrol
   * D) sinfo  
     **Answer:** A) sacct
8. **SLURM accounting data provides which type of information?**
   * A) Job status
   * B) Job resource usage (CPU, memory, etc.)
   * C) Job completion time
   * D) All of the above  
     **Answer:** D) All of the above
9. **How can an administrator use SLURM accounting data for better resource management?**
   * A) By optimizing job scheduling
   * B) By detecting over-usage of resources
   * C) By analyzing job performance
   * D) All of the above  
     **Answer:** D) All of the above
10. **Which SLURM command is used to retrieve job accounting information for completed jobs?**
    * A) sacct
    * B) squeue
    * C) sbatch
    * D) sinfo  
      **Answer:** A) sacct

### **Intermediate Level:**

1. **Which of the following SLURM commands is used to view job accounting data for completed jobs?**
   * A) sacct
   * B) squeue
   * C) scontrol
   * D) sinfo  
     **Answer:** A) sacct
2. **What type of resource usage data does SLURM job accounting track?**
   * A) CPU time
   * B) Memory usage
   * C) Wall time
   * D) All of the above  
     **Answer:** D) All of the above
3. **What is the default time period for which SLURM retains job accounting data?**
   * A) 1 day
   * B) 7 days
   * C) 30 days
   * D) It is configurable  
     **Answer:** D) It is configurable
4. **Which SLURM command can be used to check historical job data, including resource usage and status?**
   * A) sacct
   * B) squeue
   * C) sinfo
   * D) scontrol  
     **Answer:** A) sacct
5. **In SLURM, what is a common output format for job accounting information?**
   * A) CSV
   * B) JSON
   * C) Text
   * D) XML  
     **Answer:** A) CSV
6. **What type of information does the sacct command provide in job accounting?**
   * A) Start and end times
   * B) Resource usage
   * C) Exit status
   * D) All of the above  
     **Answer:** D) All of the above
7. **What role does slurmdbd serve in SLURM job accounting?**
   * A) It stores accounting data in a database
   * B) It schedules jobs
   * C) It monitors CPU usage
   * D) It configures SLURM parameters  
     **Answer:** A) It stores accounting data in a database
8. **Which of the following statements is true about SLURM job accounting?**
   * A) It tracks job completion times only
   * B) It tracks resources used by jobs throughout their execution
   * C) It can only track CPU usage
   * D) It doesn't work with parallel jobs  
     **Answer:** B) It tracks resources used by jobs throughout their execution
9. **What does the sacct command allow administrators to track?**
   * A) Job status
   * B) Resource consumption and usage over time
   * C) Real-time system monitoring
   * D) Job submission logs  
     **Answer:** B) Resource consumption and usage over time
10. **What is the purpose of the sacctmgr command in SLURM?**
    * A) To manage SLURM job queues
    * B) To manage job accounting data and users
    * C) To submit jobs
    * D) To view running job status  
      **Answer:** B) To manage job accounting data and users

### **Hard Level:**

1. **What is the function of the SLURM job accounting database (slurmdbd)?**
   * A) It schedules jobs
   * B) It provides real-time job status
   * C) It stores and manages historical job accounting data
   * D) It controls job execution parameters  
     **Answer:** C) It stores and manages historical job accounting data
2. **How can SLURM job accounting data be exported for further analysis?**
   * A) By using the sacct command with the --format option
   * B) By using the sbatch command
   * C) By configuring SLURM to automatically send data to an external server
   * D) By using the scontrol command  
     **Answer:** A) By using the sacct command with the --format option
3. **In SLURM, which accounting option would you use to filter jobs based on job ID, user, or resource usage?**
   * A) squeue
   * B) sacct with filtering options
   * C) scontrol
   * D) sinfo  
     **Answer:** B) sacct with filtering options
4. **What type of storage system does SLURM use to track and store job accounting information?**
   * A) Flat file system
   * B) Relational database (e.g., MySQL)
   * C) Cloud storage
   * D) In-memory storage  
     **Answer:** B) Relational database (e.g., MySQL)
5. **Which of the following can be used to optimize job accounting data analysis in SLURM?**
   * A) Using SLURM’s job arrays to group similar jobs
   * B) Reducing the number of nodes used per job
   * C) Using sacct with custom filtering and formatting
   * D) Disabling job accounting for short jobs  
     **Answer:** C) Using sacct with custom filtering and formatting
6. **How does SLURM ensure that accounting data is collected for jobs running across multiple nodes?**
   * A) It aggregates resource usage data per node automatically
   * B) It does not track multi-node jobs
   * C) Each job is logged separately for every node it runs on
   * D) It uses a centralized log server for multi-node jobs  
     **Answer:** A) It aggregates resource usage data per node automatically
7. **What type of SLURM job accounting report can be generated using sacct?**
   * A) Resource usage by job
   * B) Job submission times
   * C) CPU utilization over time
   * D) Job exit statuses  
     **Answer:** A) Resource usage by job
8. **Which configuration file in SLURM is responsible for setting up the job accounting database (slurmdbd)?**
   * A) slurm.conf
   * B) slurmdbd.conf
   * C) sacct.conf
   * D) slurmdb.conf  
     **Answer:** B) slurmdbd.conf
9. **Which SLURM command can be used to check the status of the accounting daemon (slurmdbd)?**
   * A) scontrol
   * B) sacctmgr
   * C) sinfo
   * D) systemctl status slurmdbd  
     **Answer:** D) systemctl status slurmdbd
10. **Which of the following is a key advantage of using SLURM’s accounting system for large-scale clusters?**
    * A) It can dynamically adjust job priorities
    * B) It provides detailed analysis of resource usage, helping optimize scheduling and resource allocation
    * C) It only stores real-time job data
    * D) It prevents jobs from failing due to resource contention  
      **Answer:** B) It provides detailed analysis of resource usage, helping optimize scheduling and resource allocation
11. **Which SLURM feature can be used to limit the amount of resources available to users based on their job accounting data?**
    * A) Quality of Service (QoS)
    * B) Job Arrays
    * C) Job Preemption
    * D) Resource limits based on sacct reports  
      **Answer:** A) Quality of Service (QoS)
12. **What is the role of sacctmgr in SLURM job accounting?**
    * A) To manage job resources
    * B) To submit jobs
    * C) To manage job accounting data, users, and limits
    * D) To monitor job progress  
      **Answer:** C) To manage job accounting data, users, and limits
13. **Which database backend does SLURM's job accounting system typically use?**
    * A) SQLite
    * B) PostgreSQL
    * C) MySQL
    * D) Oracle  
      **Answer:** C) MySQL
14. **What type of data does the sacct command provide for long-running jobs in SLURM?**
    * A) Only memory usage
    * B) CPU usage and memory usage over the job's lifetime
    * C) Only CPU usage
    * D) Real-time job status  
      **Answer:** B) CPU usage and memory usage over the job's lifetime
15. **What feature in SLURM accounting helps prevent resource overuse by certain users?**
    * A) Resource limits based on historical data
    * B) Preemption
    * C) Scheduling policies
    * D) Job arrays  
      **Answer:** A) Resource limits based on historical data

### **Intermediate Level (continued):**

1. **What is the primary purpose of SLURM accounting data?**

* A) To track job execution times only
* B) To analyze resource consumption and improve scheduling
* C) To manage job submissions and queues
* D) To assign resources dynamically during execution  
  **Answer:** B) To analyze resource consumption and improve scheduling

1. **Which of the following is a common format for exporting SLURM accounting data for analysis?**

* A) CSV
* B) JSON
* C) XML
* D) TXT  
  **Answer:** A) CSV

1. **How do administrators use the sacct command to display job resource usage?**

* A) By specifying the job ID or user to filter results
* B) By querying the system’s resource logs
* C) By submitting a report request
* D) By checking running job logs  
  **Answer:** A) By specifying the job ID or user to filter results

1. **Which of the following SLURM commands allows filtering of accounting data based on job or resource parameters?**

* A) sacct with custom filters
* B) sinfo
* C) scontrol
* D) sbatch  
  **Answer:** A) sacct with custom filters

1. **Which SLURM option can be used to generate a report of resource usage by job and user over a specific period?**

* A) sacct --format=User,JobID,Elapsed,AllocCPUs
* B) squeue --history
* C) sinfo --resources
* D) scontrol show resource\_usage  
  **Answer:** A) sacct --format=User,JobID,Elapsed,AllocCPUs

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### **Hard Level**

1. **Which command is used to manage and configure job accounting in SLURM?**

* A) sacctmgr
* B) sacct
* C) scontrol
* D) sbatch  
  **Answer:** A) sacctmgr

1. **What is a key advantage of using SLURM’s job accounting system for large clusters?**

* A) Reduces job wait times
* B) Allows resource overprovisioning
* C) Provides detailed reports on resource consumption for optimization
* D) Reduces the need for manual job monitoring  
  **Answer:** C) Provides detailed reports on resource consumption for optimization

1. **What does the SLURM command sacctmgr allow users to configure?**

* A) Job queues
* B) User limits and resource usage
* C) Job priorities
* D) Scheduling policies  
  **Answer:** B) User limits and resource usage

1. **How does SLURM track resource usage for jobs that span multiple nodes?**

* A) By tracking each node’s resource usage and aggregating them
* B) By assigning resources only to one node at a time
* C) By monitoring just the first node involved
* D) By monitoring only the master node  
  **Answer:** A) By tracking each node’s resource usage and aggregating them

1. **Which SLURM feature allows administrators to set resource limits based on historical job usage data?**

* A) Quality of Service (QoS)
* B) Job limits
* C) Scheduling policies
* D) Job preemption  
  **Answer:** A) Quality of Service (QoS)

1. **What is the role of slurmdbd in SLURM job accounting?**

* A) It schedules jobs based on resource usage
* B) It provides a database backend for storing job accounting information
* C) It monitors job execution in real time
* D) It manages job scheduling policies  
  **Answer:** B) It provides a database backend for storing job accounting information

1. **Which of the following tools can be used to manage SLURM job accounting database (slurmdbd)?**

* A) sacctmgr
* B) slurmdbd itself
* C) scontrol
* D) squeue  
  **Answer:** A) sacctmgr

1. **What database management system is typically used for storing SLURM job accounting data?**

* A) PostgreSQL
* B) MySQL
* C) SQLite
* D) Oracle  
  **Answer:** B) MySQL

1. **In SLURM, what is the significance of the sacct command’s --allusers flag?**

* A) It shows accounting data for all users on the cluster
* B) It limits results to the current user’s data only
* C) It disables job resource tracking
* D) It displays only jobs with errors  
  **Answer:** A) It shows accounting data for all users on the cluster

1. **What feature does SLURM’s job accounting system provide to prevent resource contention in shared environments?**

* A) Job preemption
* B) Quality of Service (QoS)
* C) Priority job scheduling
* D) Resource reservations  
  **Answer:** B) Quality of Service (QoS)

These **50 MCQs** now cover a comprehensive understanding of **SLURM job accounting**, from basic concepts and commands to advanced configuration and optimization strategies.