Interview Questions Sep ‘24

# Command Line

## Round 1 Questions

1. What command is used to list all files and directories?
2. What command is used to display the contents of a file?
3. How can you redirect the output of a command to a file in the shell?
4. What command is used to change file permissions?
5. How can you rename a file or directory?
6. How do you copy a file from one directory to another?
7. What is the command to show the last 10 lines of a file?
8. How can you create an empty file from the command line?
9. How do you count the number of lines, words, and characters in a file?
10. What command allows you to run a command as a superuser or another user?

## Round 2 Questions

1. How can you view the disk usage of a directory and its subdirectories?
2. How can you compare the contents of two files to see the differences?
3. How do you display a list of all currently running processes?
4. How can you kill a process by its name?
5. What is the command to recursively list all files and directories starting from the current directory?
6. You have a text file with a list of URLs, and you need to download all of them using a single command. How can you achieve this?
7. Given a large log file, write a command to find the top 10 most frequently occurring IP addresses.
8. You need to monitor a log file in real-time and alert if a specific keyword appears. How would you do that?
9. How can you replace all occurrences of a specific word in all text files within a directory?
10. How can you find and delete all empty files and directories within a directory tree?

# Git and Github

## Round 1 Questions

1. What is the purpose of a .gitignore file?
2. Explain the difference between git fetch and git pull.
3. What does git diff do?
4. How do you revert a file to its last committed state?
5. What is the purpose of a pull request in GitHub?
6. What does git log display?
7. How can you undo the last commit without losing the changes?
8. What does git stash do, and how do you apply a stashed change?
9. What is the difference between git reset and git revert?
10. Explain how you can resolve merge conflicts in Git.
11. How do you check out a specific commit in Git?
12. How do you compare two branches in Git?
13. How do you set up a GitHub Actions workflow?
14. Explain the concept of rebasing and how it differs from merging.
15. What are submodules in Git, and how do you use them?

## Round 2 Questions

1. You want to squash several commits into a single one. How do you achieve this?
2. Explain how you would create a Git hook to automate tasks like running tests before a commit.
3. You accidentally committed sensitive information (e.g., passwords) into a Git repository in multiple commits. How would you completely remove this sensitive information from the entire Git history?
4. How do you ensure that your GitHub repository’s main branch is protected against direct pushes?

# Docker

## Round 1 Questions

1. What is the purpose of a Dockerfile?
2. What is the difference between a Docker image and a Docker container?
3. In terms of size, which one is bigger, a Docker image or a Docker container?
4. What command is used to list all running Docker containers?
5. How do you pull a Docker image from Docker Hub?
6. What is a Docker volume?
7. What does the docker run command do?
8. How do you stop a running Docker container?
9. What is the purpose of the .dockerignore file?
10. What command is used to inspect the logs of a running Docker container?
11. How does Docker handle port mapping between the host and the container?
12. What is the difference between CMD and ENTRYPOINT in a Dockerfile?
13. How can you persist data in Docker containers?

## Round 2 Questions

1. What is a Kernel, and how does Docker interact with the Kernel?
2. Explain how Docker achieves container isolation at the OS level.
3. How do namespaces and cgroups work in the context of Docker?
4. What are some security best practices for running Docker containers in production?
5. How does Docker handle network namespaces to provide isolation between containers?
6. Describe the concept of Docker's OverlayFS and its role in image layering.
7. What problem does Kubernetes solve and how does it differ from Docker?
8. How can you optimise a Docker image to reduce its size and build time?
9. How do you create a network in Docker?
10. Explain the use of the docker-compose.yml file.
11. What is a multi-stage build in Docker, and why is it useful?

# Server & Computer Networking

## Round 1 Questions

1. What is an IP address?
2. What is the purpose of a router in a network?
3. What does DHCP stand for, and what is its function?
4. Define the term "MAC address."
5. What is a firewall, and why is it important in networking?
6. How does a switch differ from a hub in networking?
7. What does SSL stand for, and why is it important for secure communication?
8. Explain the difference between a public and a private IP address.
9. What is the role of an ISP in internet connectivity?
10. What is the function of a default gateway in a network?
11. Explain the OSI model and name its seven layers.
12. What is a VLAN, and why might you use one?
13. How does NAT (Network Address Translation) work?
14. What is the difference between symmetric and asymmetric encryption in network security?
15. Explain the purpose of a proxy server.
16. What are the main differences between IPv4 and IPv6?
17. How does ARP (Address Resolution Protocol) work?
18. What is BGP (Border Gateway Protocol) and why is it critical for the internet?
19. Describe the concept of port forwarding.
20. What is QoS (Quality of Service) and why is it important in networking?

## Round 2 Questions

1. Explain the process of packet switching in networks.
2. When you enter google.com and you press enter what happens
3. What is a subnet and why are they important
4. What is the Spanning Tree Protocol (STP), and how does it prevent network loops?
5. How does MPLS (Multiprotocol Label Switching) work, and what are its benefits in modern networks?
6. Describe how SSL/TLS handshake works during a secure connection establishment.
7. What are the security implications of using IPv6 compared to IPv4?
8. Explain how DNSSEC (DNS Security Extensions) works and why it is used.
9. Describe how load balancing works and the different algorithms that can be used.
10. How does OSPF (Open Shortest Path First) work, and how does it differ from EIGRP (Enhanced Interior Gateway Routing Protocol)?
11. What are the key differences between SDN (Software-Defined Networking) and traditional networking approaches?

# SQL & Postgres

## Round 1 Questions

1. What is the difference between INNER JOIN and LEFT JOIN in SQL?
2. To do a JOIN, do you always need a primary key and/or foreign key?
3. Can you explain the difference between WHERE and HAVING in SQL?
4. What is a primary key in a database? Why is it important?
5. What is the use of the GROUP BY clause in SQL? Can you give an example with an aggregate function?
6. What does the DISTINCT keyword do in a SQL query?
7. How do you retrieve all the records from a table named "employees"?
8. What is the purpose of the ORDER BY clause in SQL?
9. Can you explain what a foreign key is and how it relates to referential integrity?
10. What is a NULL value in SQL, and how is it different from an empty string or zero?
11. What are the differences between UNION and UNION ALL?
12. How can you optimise a SQL query for better performance?
13. What are window functions in PostgreSQL, and how do they differ from aggregate functions?
14. Can you explain the difference between a CROSS JOIN and a FULL OUTER JOIN?
15. How does PostgreSQL handle transactions, and what is the significance of ACID properties?
16. Explain the difference between VARCHAR and TEXT in PostgreSQL.
17. What are Common Table Expressions (CTEs) in SQL, and when would you use them?
18. Can you describe the process of indexing in PostgreSQL and its impact on query performance?
19. What is a recursive query in SQL, and can you provide an example?
20. How do you create a materialised view in PostgreSQL, and what are its advantages over a regular view?

## Round 2 Questions

1. What are the different types of indexes in PostgreSQL, and when should each be used?
2. How do you perform a query to find the second highest salary in an employees table without using the LIMIT clause?
3. What are the differences between row-level and statement-level triggers in PostgreSQL?
4. Can you explain the concept of MVCC (Multi-Version Concurrency Control) in PostgreSQL and its significance?
5. How do you handle large datasets in PostgreSQL to avoid performance bottlenecks?
6. What are partitioned tables in PostgreSQL, and how do they differ from regular tables?
7. Can you explain the EXPLAIN ANALYZE command in PostgreSQL and how it helps in query optimization?
8. What is the role of WAL (Write-Ahead Logging) in PostgreSQL, and how does it contribute to data integrity?
9. How would you design a database schema for a social networking application, considering relationships between users, posts, comments, and likes?
10. What are lateral joins in PostgreSQL, and how do they differ from regular joins? Can you provide a use case?

# Machine learning

## Round 1 Questions

1. What is the difference between a classification and a regression problem?
2. What is a feature in the context of machine learning?
3. Can you explain what overfitting is and how to avoid it?
4. What is the purpose of a validation set in machine learning?
5. What is cross-validation, and why is it important?
6. What are hyperparameters in machine learning models?
7. What is a confusion matrix, and what does it tell you?
8. What is the role of activation functions in neural networks?
9. What is a decision tree, and how does it work?
10. What is the purpose of regularisation in machine learning?

## Round 2 Questions

1. How do you handle imbalanced datasets in classification problems?
2. Can you explain the difference between bagging and boosting?
3. What is the bias-variance tradeoff, and how do you manage it?
4. What is transfer learning, and when would you use it?
5. How does the backpropagation algorithm work in training neural networks?
6. What are Generative Adversarial Networks (GANs), and how do they work?
7. What is the vanishing gradient problem, and how can it be mitigated?
8. Can you explain the difference between L1 and L2 regularisation?
9. What are support vector machines (SVMs), and how do they find the optimal hyperplane?
10. What is a recurrent neural network (RNN), and how does it differ from a standard neural network?
11. How does dropout work in neural networks, and why is it effective?
12. What is the purpose of a kernel in SVMs, and how does it transform the data?
13. How does the attention mechanism work in models like Transformers?
14. What are the trade-offs between different types of gradient-based optimization algorithms like SGD, Adam, and RMSprop?
15. How do autoencoders work, and what are their applications in machine learning?
16. Can you explain the concept of "curse of dimensionality" in the context of machine learning?
17. What is the difference between bagging and stacking in ensemble methods?
18. How would you implement a custom loss function in a neural network?
19. What is an adversarial example, and how can machine learning models be made robust against them?
20. Can you explain the difference between a convolutional layer and a fully connected layer in a neural network?

# Mathematics

## Round 1 Questions

1. Explain the concept of a linear regression model.
2. Define what a matrix is in linear algebra.
3. What is the derivative of a function, and how does it relate to the slope of a curve?
4. What is Bayes’ theorem, and how is it applied in probability theory?
5. Explain the difference between mean, median, and mode in statistics.
6. Explain what a gradient is and how it’s used in optimization problems.
7. Define a polynomial function and give an example.

## Round 2 Questions

1. Explain the concept of entropy in information theory and its role in machine learning models.
2. What is the Central Limit Theorem, and why is it important in statistics?
3. Explain backpropagation using a simple example
4. Explain the concept of the bias-variance tradeoff in machine learning, and how it affects model performance.
5. Explain the concept of cross-entropy loss in classification problems and how it is used in training neural networks.
6. How do you interpret the coefficients in a logistic regression model?
7. What is the purpose of a loss function in a machine learning model, and how does it guide the training process?
8. Explain the concept of overfitting in machine learning and how cross-validation helps to mitigate it.
9. How does the concept of a gradient relate to the optimization of machine learning models?
10. How does the learning rate affect the convergence of gradient descent in training neural networks?