Exploring the essentials of Terraform with 100 concise questions for quick learning!

1. **What is Terraform?**
   Terraform is an open-source infrastructure as code (IaC) tool developed by HashiCorp. It allows you to define and provision infrastructure using a high-level configuration language. Terraform is cloud-agnostic, meaning it supports multiple cloud providers like AWS, Azure, GCP, and on-premise systems. It uses a declarative approach, meaning you define the desired state of your infrastructure, and Terraform makes it happen. Its main features include versioning, state management, and modular configurations.

2. **What are the main components of Terraform?**
   Terraform consists of the following key components:
   - **Providers**: Manage resources in cloud services or on-prem systems.
   - **Modules**: Group reusable configurations for efficient scaling.
   - **State**: Maintains the current status of your infrastructure.
   - **Configuration Files**: Written in HashiCorp Configuration Language (HCL) to define infrastructure.
   - **Backend**: Defines where Terraform state data is stored, such as local files or remote storage.

3. **What is the difference between Terraform and other IaC tools like Ansible?**
   Terraform focuses on provisioning and managing infrastructure resources declaratively, while Ansible is used for configuration management and automation tasks. Terraform maintains a state file to track changes, enabling resource lifecycle management. Ansible uses an imperative approach, describing the steps needed to achieve the desired state. Terraform is cloud-agnostic, whereas Ansible works better for managing server configurations after infrastructure is provisioned. Both can complement each other in DevOps workflows.

4. **What is Terraform State? Why is it important?**
   Terraform State is a critical file that tracks the current status of your infrastructure managed by Terraform. It acts as a single source of truth, allowing Terraform to determine what resources exist and their configuration. The state file helps in resource dependency management and change detection. It supports team collaboration by enabling remote backends like S3 or Terraform Cloud. Proper state management is essential to prevent data corruption and ensure smooth Terraform operations.

5. **What are the different types of variables in Terraform?**
   Terraform supports three types of variables:

- **Input Variables**: Define values to customize configurations.
- **Environment Variables**: Set system-level values used by Terraform.
- **Output Variables**: Display resource attributes after execution.
  Variables help make configurations dynamic and reusable. You define variables in .tf files and reference them throughout your Terraform code.

Command-Related Questions (Commands Only):

6. **How do you initialize a Terraform configuration?**

terraform init

7. **How do you create a plan for infrastructure changes?**

terraform plan

8. **How do you apply changes to infrastructure?**

terraform apply

9. **How do you destroy all resources managed by Terraform?**

terraform destroy

10. **How do you format Terraform configuration files?**

terraform fmt

11. **What is a Terraform Provider?**
    A Terraform Provider is a plugin that manages specific types of resources within a cloud or on-prem environment. Examples include AWS, Azure, Google Cloud, and Kubernetes providers. Providers act as a bridge between Terraform and the APIs of these platforms. Each provider requires configuration, typically including authentication credentials and API endpoints. Without providers, Terraform cannot interact with your infrastructure.

12. **How does Terraform ensure idempotency?**
    Idempotency in Terraform means running the same configuration multiple times will not result in changes unless there's a difference between the desired and current states. Terraform achieves this through its state file, which tracks resources and their attributes. The plan phase identifies any drift between the desired state and reality. If no changes are needed, Terraform confirms everything is up-to-date. This ensures consistency and predictability.

13. **What is the purpose of terraform init?**
    The terraform init command initializes the working directory for Terraform. It downloads necessary provider plugins and installs them locally. It also sets up the backend for storing the Terraform state file if configured. This is the first command you run before executing any plans or applying configurations. Without initialization, Terraform cannot function properly.

14. **How do you manage multiple environments in Terraform?**
    Multiple environments, such as dev, staging, and production, can be managed using separate state files or workspaces. You can also create modular configurations with environment-specific variables. Tools like Terragrunt help organize Terraform projects with multiple environments. Using separate backends for each environment ensures isolation. Naming conventions and directory structures play a key role in maintaining clarity.

15. **What is Terraform backend?**
    The Terraform backend defines where the Terraform state file is stored. Common backend options include local storage, AWS S3, Azure Blob Storage, or Terraform Cloud. Using remote backends allows team collaboration and locking mechanisms to prevent simultaneous updates. The backend configuration must be defined in your .tf files. Proper backend setup is essential for scalable Terraform workflows.

Command-Related Questions (Commands Only):

16. **How do you validate Terraform configuration files?**

terraform validate

17. **How do you check the version of Terraform installed?**

terraform version

18. **How do you list all Terraform workspaces?**

terraform workspace list

19. **How do you create a new Terraform workspace?**

terraform workspace new <workspace_name>

20. **How do you switch between Terraform workspaces?**

terraform workspace select <workspace_name>

Theory-Based Questions (continued):

21. **What is the purpose of terraform plan?**
    The terraform plan command creates an execution plan that previews the actions Terraform will take to achieve the desired state. It does not modify resources but helps identify potential changes, such as additions, modifications, or deletions. This step allows you to verify changes before applying them. The plan output highlights resource dependencies and expected updates. It's a critical step for error-free infrastructure management.

22. **What is the Terraform Registry?**
    The Terraform Registry is an online platform that provides reusable modules and providers for Terraform. It contains both official and community-contributed modules that simplify infrastructure setup. Modules in the registry are pre-tested and configurable, saving time and effort. Examples include VPC setups, Kubernetes clusters, and database instances. The registry enables sharing and collaboration across teams and organizations.

23. **What are Terraform Modules?**
    Modules in Terraform are reusable configurations that group multiple resources together. They allow for efficient management and scalability of infrastructure. Modules can be local or stored in a version-controlled repository. Using modules improves code readability and consistency. For example, you can create a module for an AWS VPC and reuse it across multiple projects.

24. **What are Terraform Resource Dependencies?**
    Terraform automatically manages resource dependencies using the implicit dependency model. It analyzes the configuration to determine the order in which resources should be created or modified. Explicit dependencies can be specified using the depends_on argument. This ensures resources are provisioned in the correct order and avoids runtime errors. Proper dependency management is crucial for reliable deployments.

25. **How do you use sensitive data like credentials in Terraform?**
    Sensitive data can be managed securely in Terraform using environment variables, secret management tools, or Terraform variables with the sensitive attribute. Avoid

hardcoding sensitive values in .tf files. Tools like HashiCorp Vault or AWS Secrets Manager can store and retrieve credentials. Secure your state file as it may contain sensitive outputs. Use .gitignore to exclude sensitive files from version control.

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26. **How do you remove a Terraform resource without deleting it from the infrastructure?**

terraform state rm <resource_name>

27. **How do you taint a resource in Terraform?**

terraform taint <resource_name>

28. **How do you untaint a resource in Terraform?**

terraform untaint <resource_name>

29. **How do you output values from Terraform configurations?**

terraform output

30. **How do you lock the Terraform state file?**
    State locking is enabled by default in remote backends like S3 with DynamoDB. Ensure your backend configuration supports locking.

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31. **What are the benefits of using Terraform Cloud?**
    Terraform Cloud provides a managed service for Terraform workflows. It supports remote state management, collaboration, and policy enforcement. Features like cost estimation and drift detection enhance infrastructure governance. It eliminates the need for self-hosted solutions, reducing operational overhead. Terraform Cloud integrates seamlessly with CI/CD pipelines.
32. **What is the depends_on argument?**
    The depends_on argument in Terraform is used to explicitly define dependencies

between resources. This ensures that dependent resources are created or modified only after the referenced resources. It overrides Terraform's implicit dependency detection. Use depends_on sparingly and only when automatic detection fails. Proper dependency handling prevents race conditions and ensures successful deployments.

33. **What are the common Terraform file extensions?**
    Terraform configuration files use the .tf extension, and variable definitions can use .tfvars or .auto.tfvars. State files use the .tfstate extension and are stored locally or in remote backends. Module source code often includes main.tf, variables.tf, and outputs.tf files. Proper file organization improves code readability and maintainability.

34. **What is terraform fmt used for?**
    The terraform fmt command formats Terraform configuration files according to the HCL language style conventions. It helps maintain consistency in code structure and readability. The command automatically re-indents and organizes the code. Run it regularly to standardize code formatting across your team. It's especially useful in collaborative environments.

35. **How do you handle Terraform state file conflicts?**
    State file conflicts occur when multiple users or processes modify the state file simultaneously. Using remote backends with locking mechanisms, such as DynamoDB with S3, can prevent conflicts. If a conflict occurs, resolve it manually by merging changes and updating the state file. Tools like Terraform Cloud streamline collaboration and state management. Always use version control for state file backups.

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36. **How do you import existing infrastructure into Terraform?**

terraform import <resource_name> <resource_id>

37. **How do you view the current Terraform state?**

terraform show

38. **How do you display dependency graphs in Terraform?**

terraform graph | dot -Tsvg > graph.svg

39. **How do you generate a human-readable execution plan?**

terraform plan -out=<filename>

40. **How do you upgrade provider plugins in Terraform?**

terraform init -upgrade

41. **What is the purpose of terraform destroy?**
    The terraform destroy command is used to remove all infrastructure resources defined in your Terraform configuration. It ensures that all created resources are deleted in the correct order based on dependencies. This command is helpful for cleanup or testing purposes. Before destroying, Terraform prompts for confirmation to prevent accidental deletions. Use it cautiously in production environments.

42. **What is a Terraform State Lock?**
    A Terraform State Lock prevents multiple users or processes from modifying the state file simultaneously. It ensures consistency and avoids corruption of the state file. Remote backends like S3 with DynamoDB enable automatic state locking. If a lock is detected, Terraform will block further operations until the lock is released. State locking is essential for collaborative workflows.

43. **What is the purpose of the .terraform.lock.hcl file?**
    The .terraform.lock.hcl file ensures consistency in Terraform runs by locking provider versions. It records checksums of provider plugins to verify their integrity. This file prevents unexpected changes due to provider updates. It is automatically updated when you run terraform init. Include this file in version control to share locked versions across your team.

44. **What are dynamic blocks in Terraform?**
    Dynamic blocks in Terraform allow you to generate multiple nested configurations dynamically based on variables or conditions. This is useful for resources requiring repetitive configurations. Dynamic blocks reduce redundancy and improve code readability. They consist of the dynamic keyword, followed by a content block. Use them to simplify complex infrastructure setups.

45. **What is the difference between local-exec and remote-exec provisioners?**
    The local-exec provisioner executes commands on the machine running Terraform, while the remote-exec provisioner runs commands on a remote resource. Both are used for configuration or bootstrap tasks. Remote provisioners require SSH or WinRM access to the resource. Provisioners should be used sparingly, as they can complicate infrastructure management. Instead, prefer configuration management tools like Ansible.

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46. **How do you initialize a Terraform configuration with a specific backend?**

terraform init -backend-config=<config_file>

47. **How do you enable debugging logs in Terraform?**

TF_LOG=DEBUG terraform apply

48. **How do you refresh the Terraform state file with the current resource states?**

terraform refresh

49. **How do you forcefully unlock a Terraform state file?**

terraform force-unlock <lock_id>

50. **How do you replace a resource in Terraform without modifying other resources?**

terraform apply -replace=<resource_name>

51. **What is the purpose of a Terraform workspace?**
    Terraform workspaces allow you to maintain separate state files for the same configuration. This feature is helpful when managing multiple environments like dev, staging, and prod. Each workspace has its own state file, isolating resources between environments. The default workspace is called default. Workspaces simplify environment management but should not replace robust CI/CD practices.
52. **What is the difference between terraform validate and terraform plan?**
    The terraform validate command checks the configuration syntax for errors but does not interact with remote services. The terraform plan command simulates the execution of your configuration, showing changes that will be made. While validate focuses on correctness, plan ensures the desired infrastructure matches the configuration. Both commands are crucial in the development lifecycle.

53. **What is remote state in Terraform?**
    Remote state refers to storing the Terraform state file in a remote backend like AWS S3, Azure Blob Storage, or HashiCorp Consul. It allows multiple team members to access and update the state safely. Remote state also provides locking mechanisms to prevent concurrent modifications. Using remote state is essential for collaborative infrastructure management.

54. **What is Terraform Cloud, and how is it different from Terraform CLI?**
    Terraform Cloud is a SaaS offering by HashiCorp for managing Terraform workflows in a collaborative environment. It provides features like remote execution, policy enforcement, and state storage. Terraform CLI is the local command-line tool used for applying configurations. Terraform Cloud integrates with CLI and enhances team-based workflows with governance and version control.

55. **What is the role of terraform graph?**
    The terraform graph command generates a visual representation of your Terraform resources and their dependencies. It outputs a graph in DOT format, which can be rendered into an image using tools like Graphviz. This helps understand resource relationships and dependency chains. Use it for debugging and documentation.

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56. **How do you switch to a different workspace?**

terraform workspace select <workspace_name>

57. **How do you create a new workspace?**

terraform workspace new <workspace_name>

58. **How do you import an existing resource into Terraform state?**

terraform import <resource_type>.<resource_name> <resource_id>

59. **How do you show the current Terraform workspace?**

terraform workspace show

60. **How do you format all Terraform configuration files?**

terraform fmt

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61. **What are Terraform modules?**
    Terraform modules are reusable pieces of Terraform configuration. They help organize code and promote reusability by encapsulating resource configurations. Modules can be local or fetched from remote repositories like GitHub or Terraform Registry. They simplify complex setups by abstracting details. Use modules to maintain consistency across environments.
62. **What is a backend in Terraform?**
    A backend in Terraform determines where and how the state file is stored. Backends can be local or remote, like AWS S3, Azure Blob, or HashiCorp Consul. Remote backends enable collaboration and locking. Choosing the right backend ensures state integrity and secure access. Backends are configured in the terraform block of the configuration file.
63. **What is the difference between count and for_each in Terraform?**
    The count parameter creates multiple resource instances based on a numeric value. The for_each parameter, introduced in Terraform 0.12, allows iteration over a collection like maps or sets. Use count for numeric-based replication and for_each for more flexible scenarios. Both parameters simplify resource creation and reduce redundancy.
64. **How does Terraform handle provider versions?**
    Terraform uses the required_providers block in the configuration file to specify provider versions. This ensures compatibility and prevents unexpected issues from version changes. When you run terraform init, it downloads the specified provider version. Locking provider versions is a best practice for stability.
65. **What are the types of Terraform provisioners?**
    Terraform supports two types of provisioners: local-exec and remote-exec. local-exec runs commands on the machine executing Terraform, while remote-exec runs on the provisioned resource. Provisioners are used for configuration tasks but should be avoided when possible. They can introduce complexities and reduce declarative behavior.

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66. **How do you manually lock a Terraform state file?**

terraform state lock

67. **How do you list all state files in a remote backend?**

terraform state list

68. **How do you taint a resource to force recreation?**

terraform taint <resource_name>

69. **How do you untaint a resource?**

terraform untaint <resource_name>

70. **How do you move a resource in the state file to a new address?**

terraform state mv <source_address> <destination_address>

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71. **What is the difference between terraform apply and terraform deploy?**
    Terraform uses apply to implement changes to the infrastructure based on your configuration. The term deploy is not a Terraform command but may refer to applying configurations in CI/CD pipelines. Terraform apply ensures resources are created, updated, or destroyed as needed. Use it cautiously in production.
72. **How does Terraform handle sensitive data?**
    Terraform allows you to mark variables as sensitive to prevent their values from being displayed in logs. Remote backends, like Terraform Cloud, also secure sensitive data in the state file. Use external secrets management tools like HashiCorp Vault for additional security. Avoid hardcoding sensitive data in configuration files.
73. **What is a Terraform sentinel policy?**
    Sentinel is HashiCorp's policy-as-code framework used to enforce governance in Terraform Cloud. It allows you to define rules for infrastructure provisioning, such as

cost constraints or resource limits. Policies are written in the Sentinel language and applied to runs in Terraform Cloud. Sentinel ensures compliance and best practices.

74. **What is the purpose of the terraform output command?**
    The terraform output command displays the output values defined in the configuration. These values can be used as inputs for other scripts or applications. Outputs are declared in the output block and provide access to resource attributes. Use it to share essential information from your Terraform setup.

75. **What is the lifecycle of a Terraform resource?**
    Terraform resources follow a lifecycle that includes creation, updating, and destruction. You can control this lifecycle using the lifecycle block with attributes like create_before_destroy, ignore_changes, and prevent_destroy. Lifecycle rules provide flexibility and minimize downtime during updates.

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76. **How do you remove a resource from the Terraform state file?**

terraform state rm <resource_name>

77. **How do you validate syntax and logic errors in Terraform files?**

terraform validate

78. **How do you print the plan to a file for review?**

terraform plan -out=<plan_file>

79. **How do you apply changes from a saved plan file?**

terraform apply <plan_file>

80. **How do you list all resources in the current Terraform state?**

terraform state list

81. **What are Terraform dynamic blocks, and when should they be used?**
    Dynamic blocks allow you to create multiple instances of a block within a resource based on variable data. They are useful for generating nested configurations that depend on input variables or complex conditions. Use them when the number or type of blocks is not static. They improve code flexibility but can reduce readability. Always use dynamic blocks judiciously.
82. **How does Terraform ensure idempotency?**
    Terraform ensures idempotency by tracking resource states in the state file and comparing them with the desired configuration. It calculates the delta and applies only the necessary changes. This approach guarantees the same result regardless of how many times the configuration is applied. Idempotency reduces errors and ensures consistent infrastructure.
83. **What is the difference between terraform destroy and terraform apply -destroy?**
    Both commands achieve the same result—destroying infrastructure—but they are used differently. terraform destroy directly removes all resources managed by Terraform. terraform apply -destroy first creates a plan file for the destruction before executing it. Use the latter when you need to review the changes before deletion.
84. **What is the role of provider plugins in Terraform?**
    Provider plugins allow Terraform to interact with various infrastructure platforms like AWS, Azure, or GCP. They translate Terraform configurations into API calls specific to the platform. Each provider has its own set of resource types and data sources. Plugins are downloaded automatically during terraform init.
85. **How does Terraform handle dependencies between resources?**
    Terraform automatically manages resource dependencies using its resource graph. It understands dependencies based on resource attributes and interpolation expressions. For explicit control, you can use the depends_on meta-argument to define manual dependencies. This ensures resources are created or destroyed in the correct order.

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86. **How do you reinitialize the working directory in Terraform?**

terraform init -reconfigure

87. **How do you upgrade Terraform provider plugins to their latest version?**

terraform init -upgrade

88. **How do you refresh the state file to reflect changes made outside of Terraform?**

terraform refresh

89. **How do you generate a human-readable output for debugging Terraform state?**

terraform show

90. **How do you check the version of Terraform installed on your system?**

terraform version

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91. **What are data sources in Terraform?**
    Data sources allow you to fetch data from external systems or existing resources. They do not create or manage resources but provide information used in configurations. For example, you can use a data source to retrieve an existing VPC ID in AWS. Data sources improve flexibility and prevent hardcoding.
92. **How does Terraform handle resource replacement?**
    Terraform replaces resources by first destroying the existing resource and then recreating it. This behavior is triggered when changes to the resource configuration require replacement (e.g., changing immutable attributes). You can control this process using lifecycle rules like create_before_destroy.
93. **What is terraform.lock.hcl, and why is it important?**
    The terraform.lock.hcl file locks provider versions for the configuration. It ensures consistent behavior across environments and prevents breaking changes due to provider updates. This file is created during terraform init and should be committed to version control.
94. **What are some best practices for writing Terraform code?**
    - Use modules for reusability and organization.
    - Lock provider and Terraform versions.

- Store state files securely in remote backends.
- Use variables and outputs for flexibility.
- Regularly review and validate configurations.

95. **How does Terraform manage state for resources created outside Terraform?**
    Terraform can import existing resources into its state file using the terraform import command. After importing, you need to update the configuration file to match the resource attributes. This allows Terraform to manage the resource moving forward.

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96. **How do you output specific details from the state file?**

terraform output <output_name>

97. **How do you lock a Terraform state file manually?**

terraform state lock

98. **How do you remove an outdated provider version?**

terraform providers mirror <directory>

99. **How do you check resource dependencies in the state file?**

terraform state show <resource_name>

100. **How do you enable debug logging for Terraform commands?**
     TF_LOG=DEBUG terraform <command>

101. **What is the use of terraform taint?**
     The terraform taint command marks a resource for forced recreation on the next terraform apply. It is used when a resource needs to be replaced without changing its configuration. After marking a resource, Terraform destroys and recreates it during the next apply. This ensures any underlying issues are resolved.

102. **What are Terraform modules, and why are they important?**
Modules are reusable containers for Terraform configurations that simplify code organization. They help you write DRY (Don't Repeat Yourself) code and ensure consistency across infrastructure. For example, you can use a module for VPC creation and reuse it for different environments. Modules improve maintainability and scalability.

103. **What is the purpose of Terraform backend?**
Backends define how and where Terraform stores its state data. They enable collaboration by storing state files remotely (e.g., in S3 or Azure Blob Storage). Backends also provide locking mechanisms to prevent concurrent changes. Examples include local (default), s3, and remote.

104. **What is the difference between terraform fmt and terraform validate?**
- terraform fmt: Automatically formats Terraform code according to the standard style.
- terraform validate: Validates the configuration syntax and checks for logical errors. Use both to ensure code quality and correctness.

105. **How does Terraform handle provider authentication?**
Terraform uses provider-specific authentication mechanisms, such as AWS credentials or Azure service principals. Credentials can be stored in environment variables, configuration files, or directly in the Terraform provider block. Secure handling of credentials is critical for production environments.

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106. **How do you taint a specific resource?**
terraform taint <resource_name>

107. **How do you remove a tainted resource without recreating it?**
terraform untaint <resource_name>

108. **How do you move a resource in the state file?**
terraform state mv <source> <destination>

109. **How do you remove an invalid resource from the state file?**
terraform state rm <resource_name>

110. **How do you check which Terraform commands are available?**
terraform --help

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111. **What is the purpose of lifecycle in Terraform resources?**
The lifecycle block allows you to customize resource behavior during creation, updates, and deletion. Key arguments include prevent_destroy, create_before_destroy, and ignore_changes. These help in handling sensitive

resources, ensuring zero-downtime updates, and skipping specific changes. Proper use avoids accidental deletions and errors.

112. **What is a terraform.workspace, and when is it used?**
Workspaces enable multiple state files for the same configuration, allowing isolated environments like dev, test, and prod. They are useful for managing non-overlapping infrastructure within the same project. The default workspace is named default. Use terraform workspace commands to manage them.

113. **What are resource arguments in Terraform?**
Resource arguments define the properties and configurations of a resource. For example, in AWS, arguments like ami, instance_type, and tags define an EC2 instance. Arguments can take static values, variables, or expressions. Correct argument usage ensures desired resource behavior.

114. **What are provider aliases in Terraform?**
Provider aliases allow multiple instances of the same provider within a configuration. For example, if you need to deploy resources in multiple AWS regions, you can create provider blocks with aliases for each region. Use aliases to specify which provider instance a resource should use.

115. **What is the purpose of terraform graph?**
The terraform graph command generates a dependency graph of resources in the configuration. The output can be visualized using tools like Graphviz. It helps understand resource dependencies and troubleshoot complex configurations.

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116. **How do you create a new workspace?**
terraform workspace new <workspace_name>

117. **How do you switch to a different workspace?**
terraform workspace select <workspace_name>

118. **How do you delete a workspace?**
terraform workspace delete <workspace_name>

119. **How do you generate a dependency graph in Terraform?**
terraform graph | dot -Tsvg > graph.svg

120. **How do you ignore specific changes to a resource?**
hcl lifecycle { ignore_changes = [<attribute_name>] }

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121. **What are Terraform state locking mechanisms?**
State locking prevents concurrent operations on the state file, avoiding corruption. Remote backends like S3 or Azure Blob Storage support locking mechanisms using DynamoDB or Blob leases. Locking is enabled automatically for supported backends.

122. **What is the purpose of output values in Terraform?**
Output values share information about resources or configurations after execution. For example, you can output an EC2 instance's public IP. Outputs help in passing information between modules or displaying key details to the user.

123. **How do you test Terraform configurations?**
Testing can be done using tools like terraform validate for syntax checks, terraform plan for change previews, and integration tests with frameworks like Terratest. Testing ensures configurations behave as expected.

124. **What is remote state in Terraform?**
Remote state stores Terraform state files in a shared location, enabling collaboration among teams. Examples include S3 buckets, Azure Blob Storage, or Terraform Cloud. Remote state prevents conflicts and ensures consistent infrastructure management.

125. **How do you handle sensitive data in Terraform?**
Sensitive data like passwords or keys should be stored securely using environment variables, secret managers, or encrypted files. Use the sensitive argument in output blocks to hide sensitive data during command execution.