

1. What is the difference between `malloc()` and `calloc()`?
 - `malloc()` allocates a block of memory but doesn't initialize it, while `calloc()` allocates memory and initializes it to zero.
2. Explain the use of the `static` keyword in C.
 - `static` makes a variable retain its value between function calls or restricts the scope of a function or variable to the current file.
3. What is a pointer in C?
 - A pointer is a variable that stores the memory address of another variable.
4. What is the purpose of the `sizeof()` operator in C?
 - `sizeof()` returns the size, in bytes, of a data type or variable.
5. How can you pass an array to a function in C?
 - Arrays are passed to functions by reference. You pass the array's name as a parameter.
6. What is a segmentation fault?
 - A segmentation fault occurs when a program tries to access memory that it is not allowed to access.
7. What is the difference between `++i` and `i++`?
 - `++i` increments the value of `i` before it is used, while `i++` uses the value of `i` first, then increments it.
8. What is recursion in C?
 - Recursion occurs when a function calls itself to solve smaller instances of the problem.
9. How can you reverse a string in C without using a built-in function.

```
void reverseString(char str[]) {  
    int length = strlen(str);  
    for(int i = 0; i < length / 2; i++) {  
        char temp = str[i];  
        str[i] = str[length - i - 1];  
        str[length - i - 1] = temp;  
    }  
}
```
10. What is a structure in C?
 - A structure is a user-defined data type in C that groups different data types together.

11. What is a memory leak?

- A memory leak occurs when dynamically allocated memory is not freed, leading to wasted memory.

12. What is a stack in C?

- A stack is a linear data structure that follows the Last In, First Out (LIFO) principle.

13. How do you swap two numbers in C without a temporary variable?*

```
```c
a = a + b;
b = a - b;
a = a - b;
```
```

14. What is a file pointer?

- A file pointer is a pointer that stores the address of a file in memory. It is used to perform file operations.

15. Explain the difference between `exit()` and `_exit()` in C.

- `exit()` performs cleanup before terminating the program, while `_exit()` terminates the program immediately without cleanup.

16. What is a linked list in C?

- A linked list is a linear data structure in which elements (nodes) contain a data part and a reference (pointer) to the next node.

17. What is the difference between `malloc()` and `free()` in C?

- `malloc()` allocates memory, and `free()` deallocates the memory.

18. How does the `fopen()` function differ from `freopen()` in C?

- `fopen()` is used to open a file, while `freopen()` reopens an existing file to change its stream.

19. What is the `const` keyword used for in C?

- `const` defines a variable whose value cannot be changed after initialization.

20. Explain the purpose of `typedef` in C.

- `typedef` is used to create new data type names (aliases) for existing data types.

21. What is a binary search algorithm?

- A binary search finds the position of a target value within a sorted array by repeatedly dividing the search interval in half.

22. How do you declare and use a pointer in C?

```
```\nc
int a = 5;
int *p = &a; // p stores the address of a
printf("%d", *p); // prints the value of a
```\n
```

23. What is the difference between `div` and `mod`?

- `div` gives the quotient of division, while `mod` gives the remainder.

24. What is a function pointer?

- A function pointer is a pointer that points to a function instead of a data value.

25. What is the use of `#define` in C?

- `#define` is used to define constants or macros.

26. What is the `volatile` keyword in C?

- `volatile` tells the compiler not to optimize a variable's value as it can change unexpectedly, like in hardware or multi-threaded scenarios.

27. What is the difference between a stack and a queue in C?

- A stack follows LIFO (Last In First Out) order, while a queue follows FIFO (First In First Out) order.

28. What is a binary tree?

- A binary tree is a tree data structure where each node has at most two children.

29. Explain the difference between a structure and a union in C.

- A structure stores different types of data, each with its own memory, while a union stores multiple data types in the same memory location.

30. What is the time complexity of bubble sort?

- Bubble sort has a time complexity of $O(n^2)$ in the worst case.

31. What is the difference between `JDK`, `JRE`, and `JVM`?

- JDK (Java Development Kit) is used to develop Java applications. JRE (Java Runtime Environment) is used to run Java applications. JVM (Java Virtual Machine) is responsible for executing Java bytecode.

32. What are constructors in Java?

- Constructors are special methods that are used to initialize objects of a class when they are created.

33. Explain method overloading and method overriding in Java.

- Method overloading is defining multiple methods with the same name but different parameters. Method overriding is redefining a method from a parent class in a child class.

34. What is an interface in Java?

- An interface is a reference type, similar to a class, that contains only abstract methods. It is used to represent a contract for implementing classes.

35. What is the difference between `==` and `.equals()` in Java?

- `==` compares object references, while `.equals()` compares the contents of the objects.

36. What is polymorphism in Java?

- Polymorphism allows objects to be treated as instances of their parent class, with behavior defined in the child class.

37. Explain the use of `super()` in Java.

- `super()` is used to call the constructor of the parent class.

38. What is the difference between `ArrayList` and `LinkedList` in Java?

- `ArrayList` uses dynamic arrays to store elements, while `LinkedList` uses doubly linked lists.

39. What is a thread in Java?

- A thread is a lightweight process that allows multitasking in Java.

40. What is the difference between `final`, `finally`, and `finalize()` in Java?

- `final` is used to define constants or prevent inheritance/overriding, `finally` is used for code that should always execute, and `finalize()` is used for cleanup before object destruction.

41. What is the `this` keyword in Java?

- `this` refers to the current instance of a class.

42. Explain the concept of `synchronization` in Java.

- Synchronization is used to ensure that only one thread accesses a resource at a time.

43. What is the purpose of the `instanceof` keyword in Java?

- `instanceof` checks if an object is an instance of a specific class or interface.

44. What is the difference between `String`, `StringBuilder`, and `StringBuffer`?

- `String` is immutable, while `StringBuilder` and `StringBuffer` are mutable. `StringBuffer` is synchronized, while `StringBuilder` is not.

45. What are lambda expressions in Java?

- Lambda expressions allow you to pass behavior as arguments to methods, enabling functional-style programming.

46. What is an abstract class in Java?

- An abstract class is a class that cannot be instantiated and is used to provide a base for other classes.

47. What is an exception in Java?

- An exception is an event that disrupts the normal flow of the program, usually due to errors in runtime.

48. What is the difference between `ArrayList` and `Vector` in Java?

- `ArrayList` is not synchronized, while `Vector` is synchronized.

49. What is the role of the `main()` method in Java?

- The `main()` method is the entry point of any Java program.

50. What is the `final` keyword used for in Java?

`final` is used to define constants, prevent method overriding, or prevent inheritance of a class.

51. What are Python's key features?

- Python is high-level, dynamically typed, and interpreted, with a focus on simplicity and readability.

52. What is the difference between a list and a tuple in Python?

- Lists are mutable, while tuples are immutable.

53. What are Python's data types?

- Python includes various data types like `int`, `float`, `str`, `list`, `tuple`, `dict`, `set`, and `bool`.

54. How do you handle exceptions in Python?

- Exceptions are handled using `try`, `except`, `else`, and `finally` blocks.

55. What is a decorator in Python?

- A decorator is a function that modifies the behavior of another function.

56. What is the difference between `is` and `==` in Python?

- `is` checks object identity (if two objects are the same in memory), while `==` checks object equality (if two objects have the same value).

57. What is list comprehension in Python?

- List comprehension provides a concise way to create lists using an expression

within square brackets.

58. How do you define a function in Python?

```
```python
def my_function():
 print("Hello, world!")
```
```

59. What are lambda functions in Python?

- Lambda functions are anonymous functions defined using the `lambda` keyword.

60. What are Python generators?

- Generators are functions that yield values one at a time using the `yield` keyword.

61. What is the difference between `deepcopy()` and `copy()` in Python?

- `copy()` performs a shallow copy, while `deepcopy()` creates a copy of the object and its nested objects.

62. Explain Python's Global Interpreter Lock (GIL).

- The GIL is a mutex that prevents multiple native threads from executing Python bytecodes at once in multi-threaded programs.

63. What is a module in Python?

- A module is a file containing Python definitions and statements that can be imported and used in other programs.

64. What is a class in Python?

- A class is a blueprint for creating objects (instances) that define a set of properties and methods.

65. What is inheritance in Python?

- Inheritance allows one class (child class) to inherit the attributes and methods of another class (parent class).

66. What is the `self` keyword in Python?

- `self` refers to the instance of the class in which it is used.

67. What are Python's built-in data structures?

- Python's built-in data structures include lists, tuples, sets, and dictionaries.

68. What are Python's built-in functions?

- Examples include `print()`, `len()`, `range()`, `sum()`, etc.

69. What is an iterable in Python?

- An iterable is any object that can be looped over (e.g., lists, tuples, strings).

70. What is the purpose of the `with` statement in Python?

- The `with` statement simplifies exception handling by ensuring resources are properly cleaned up.

71. What is SQL?

- SQL (Structured Query Language) is a language used to communicate with and manipulate databases.

72. What is the difference between `INNER JOIN` and `OUTER JOIN`?

- `INNER JOIN` returns records that have matching values in both tables, while `OUTER JOIN` returns all records from one table and the matching records from the other.

73. What is the `GROUP BY` clause used for in SQL?

- `GROUP BY` groups rows sharing a property, typically used with aggregate functions like `SUM()`, `AVG()`, etc.

74. What is a subquery in SQL?

- A subquery is a query nested inside another query, typically used in the `WHERE` or `HAVING` clause.

75. What is a foreign key in SQL?

- A foreign key is a field in one table that links to the primary key of another table.

76. What is normalization in SQL?

- Normalization is the process of organizing data to reduce redundancy and dependency by dividing a database into smaller tables.

77. What is the difference between `DELETE` and `TRUNCATE` in SQL?

- `DELETE` removes rows one by one and can be rolled back, while `TRUNCATE` deletes all rows from a table and cannot be rolled back.

78. What is an index in SQL?

- An index improves the speed of data retrieval operations on a table.

79. What is the difference between `CHAR` and `VARCHAR` in SQL?

- `CHAR` is used for fixed-length strings, while `VARCHAR` is used for variable-length strings.

80. What is the purpose of the `DISTINCT` keyword in SQL?

- `DISTINCT` is used to remove duplicate rows from the result set.

81. What is a view in SQL?

- A view is a virtual table based on the result of a SELECT query.

82. What is a stored procedure in SQL?

- A stored procedure is a precompiled set of SQL statements stored in a database that can be executed multiple times.

83. What is the difference between `UNION` and `UNION ALL` in SQL?

- `UNION` removes duplicate rows, while `UNION ALL` includes all rows, even duplicates.

84. What is a trigger in SQL?

- A trigger is a set of actions executed automatically when certain events occur in a table (e.g., INSERT, UPDATE).

85. What is a composite key in SQL?

- A composite key is a primary key made up of two or more columns in a table.

86. What is a primary key in SQL?

- A primary key uniquely identifies each record in a table and cannot contain `NULL` values.

87. What is the purpose of the `EXPLAIN` keyword in SQL?

- `EXPLAIN` is used to show the execution plan for a SQL query, helping to optimize query performance.

88. What is a transaction in SQL?

- A transaction is a unit of work performed in a database, ensuring that operations are either fully completed or not executed at all (atomicity).

89. What is the difference between `IN` and `BETWEEN` in SQL?

- `IN` checks if a value matches any value in a list, while `BETWEEN` checks if a value is within a specified range.

90. How do you find the second highest salary from an employee table in SQL?

```
```sql
SELECT MAX(salary)
FROM employees
WHERE salary < (SELECT MAX(salary) FROM employees);
```