**Domain-Wise Database of Questions for Interviews**

**Data Structures**

Arrays and Strings

Linked Lists

Stacks and Queues

Trees

Graphs

Hash Tables

Self Balancing Trees

**Algorithms**

Sorting and Searching

Divide and Conquer

Greedy

Recursive

Dynamic

Bit manipulation

**Databases**

SQL queries

**Object Oriented Programming**

ER Diagrams

**Language Based**

C++

Java

**Logic and Math based / Puzzles**

**Projects**

**--------------------------------------------------------**

**Advanced**

Operating Systems

Networking

System Design and Scalability

Testing

**Profit / HR questions**

**QUESTIONS**

**Language Based**

C++/C:

1. Memory layout of C program

Ans: text segment, data segment, heap, stack and explanation

<https://www.geeksforgeeks.org/memory-layout-of-c-program/>

1. *Memory leak*

*Ans: create a memory in heap and forget to delete it*

# *Difference between ++\*p, \*p++ and \*++p*

[*https://www.geeksforgeeks.org/difference-between-p-p-and-p/*](https://www.geeksforgeeks.org/difference-between-p-p-and-p/)

1. *Operator overloading ? syntax? which operator is overloaded by default by the compiler in every user defined classes even if user has not written?*

*Ans:*

*the operators with a special meaning for a data type*

*operators to work for user defined classes*

*name of an operator function is always operator keyword followed by symbol of operator and operator functions are called when the corresponding operator is used.*

*Assign operator is by default available in all user defined classes*

*class Complex {*

*private:*

*int real, imag;*

*public:*

*Complex(int r = 0, int i =0) {real = r; imag = i;}*

*};*

*int main()*

*{*

*Complex c1(10, 5), c2(2, 4);*

*// For example, below code works fine*

*c1 = c2;*

*// But this code throws compiler error*

*if (c1 == c2)*

*cout << "Same";*

*return 0;*

*}*

1. How can we restrict dynamic allocation of objects of a class using new?

Ans: By making an empty private new and new[] operators

Eg.

class Test {

private:

void\* operator new(size\_t size) {}

void\* operator new[](size\_t size) {}

};

int main()

{

Test \*obj = new Test;

Test \*arr = new Test[10];

return 0;

}

1. *What’s the problem in this code?*

*#include <stdlib.h>*

*void f()*

*{*

*int \*ptr = (int \*) malloc(sizeof(int));*

*/\* Do some work \*/*

*return; }*

*Ans: memory leak so use free but dangling*

*dangling pointer*

*Ans: A pointer pointing to a memory location that has been deleted*

*So set ptr = NULL*

1. *Copy constructor*

*Ans:*

1. *Void pointer? Can it be dereferenced?*

*Ans: Void pointer is a specific pointer type – void \* – a pointer that points to some data location in storage, which doesn’t have any specific type. Void refers to the type. Basically the type of data that it points to is can be any.*

*void pointers cannot be dereferenced. It can however be done using type-casting the void pointer*

1. *Malloc calloc realloc free*

*Ans:*

*“malloc” or “memory allocation” method is used to dynamically allocate a single large block of memory with the specified size. It returns a pointer of type void which can be cast into a pointer of any form.*

*ptr = (cast-type\*) malloc(byte-size)*

*“calloc” or “contiguous allocation” method is used to dynamically allocate the specified number of blocks of memory of the specified type. It initializes each block with a default value ‘0’.*

*ptr = (cast-type\*)calloc(n, element-size);*

*“free” method is used to dynamically de-allocate the memory. The memory allocated using functions malloc() and calloc() are not de-allocated on their own. Hence the free() method is used, whenever the dynamic memory allocation takes place. It helps to reduce wastage of memory by freeing it.*

*“realloc” or “re-allocation” method is used to dynamically change the memory allocation of a previously allocated memory. In other words, if the memory previously allocated with the help of malloc or calloc is insufficient, realloc can be used to dynamically re-allocate memory.*

*ptr = realloc(ptr, nWild pointerewSize);*

1. *storage classes*

*Ans:*

*auto , extern, static, register*

*Explanation*

[*https://www.geeksforgeeks.org/storage-classes-in-c/*](https://www.geeksforgeeks.org/storage-classes-in-c/)

1. *Null pointer, Wild pointer*

*Ans: NULL Pointer is a pointer which is pointing to nothing. In case, if we don’t have address to be assigned to a pointer, then we can simply use NULL.*

*int \*ptr = NULL;*

*Wild pointer*

*Ans:*

*A pointer which has not been initialized to anything (not even NULL)*

1. *pointer vs reference*

*Ans:*

Pointers: A pointer is a variable that holds memory address of another variable. A pointer needs to be dereferenced with **\*** operator to access the memory location it points to.

References : A reference variable is an alias, that is, another name for an already e*xisting variable. A reference, like a pointer is also implemented by storing the address of an object.*

*int \*ptr = &i;*

*// A reference (or alias) for i.*

*int &ref = i;*

*A pointer can be re-assigned. a reference cannot be re-assigned, and must be assigned at initialization.*

*int &p;*

*p=a; // it is incorrect as we should declare and initialise references at single step*

*A pointer has its own memory address and size on the stack whereas a reference shares the same memory address (with the original variable) but also takes up some space on the stack.*

[*https://www.geeksforgeeks.org/pointers-vs-references-cpp/*](https://www.geeksforgeeks.org/pointers-vs-references-cpp/)

1. Is this valid? p + 4 = 18;

/\* invalid - "p + 4" is not an lvalue \*/

Can lvalue be a rvalue?

*Lvalue rvalue*

*L-value: “l-value” refers to memory location which identifies an object.*

*R-value: r-value” refers to data value that is stored at some address in memory. A r-value is an expression that can’t have a value assigned to it which means r-value can appear on right but not on left hand side of an assignment operator(=).*

# *How does free() know the size of memory to be deallocated?*

*When memory allocation is done, the actual heap space allocated is one word larger than the requested memory. The extra word is used to store the size of the allocation and is later used by free( )*

1. **Assume we have two objects obj1 and obj2 of the same class. The operation obj1 = obj2 should throw an error. How can this be achieved?**

Expected answer: Override the “=” operator to throw an error on that operation.

1. *scanf vs gets vs fgets -*
2. Which sort does C++ sort() function use internally?

Answer: Introsort, hybrid sorting algorithm uses three sorting algorithm to minimise the running time, Quicksort, Heapsort and Insertion Sort

1. #include<iostream>

using namespace std;

int main ()

{

int cin;

cin >> cin;

cout << "cin" << cin;

return 0;

} What’s the error/ output?

Answer: cin+junkvalue

1. Difference between endl and \n in c++.

Answer: cout << endl; can be said equivalent to cout << ‘\n’ << flush;

As a conclusion, cout << “\n” seems performance wise better than cout << endl; unless flushing of stream is required. Flushing of buffers is an Operating System task. Each time the buffer is flushed, a request has to be made to the OS and these requests are comparatively expensive. Furthermore, we don’t really need to flush the buffer every time we write something to the stream, since the buffers get flushed automatically when they get full.

1. Implement own version of stoi()

Answer: check if they cover corner cases

1. What is the Diamond Problem? How to solve it?

Answer: use the virtual keyword.

1. What are virtual function? How are they implemented in C++ ?

Answer: Using the VTable (<https://www.geeksforgeeks.org/virtual-function-cpp/>)

1. What are macros in C++, what are they used for? <https://www.geeksforgeeks.org/importance-of-macros-in-c/>
2. What causes the error segmentation fault core dumped?
3. Given code snippet, what shall be the output and why:

#define SIZE 3

int ar[SIZE][SIZE];

ar = {{2,3,5},{6,7,8},{9,1,0}};

cout << ar[1][3];

Answer is 9 [Since array is stored sequentially and address is calculated from the start]

20**. Whats the output of the code when run in c and c++**

#include<stdio.h>

int T;

int main()

{

printf("size of 'a' %d \n", sizeof('a'));//int in C char in cpp

struct T { double x; }; // struct prefix compulsory in C

printf("size of T %d \n", sizeof(T));

printf("size of 1==1 %d", sizeof(1==1));//bool not in C

return 0;

}

21**. Whats the output of the code when run in c and c++**

#include<stdio.h>

int main()

{

foo(); // foo() is called before its declaration/definition

}

int foo()

{

printf("Hello");

return 0;

}

22**. Whats the output of the code when run in c and c++**

#include <stdio.h>

void func()

{

/\* definition \*/

}

int main(void)

{

int const j = 20;

/\* The below assignment is invalid in C++, results in error

In C, the compiler \*may\* throw a warning, but casting is

implicitly allowed \*/

int \*ptr = &j; // A normal pointer points to const

printf("\*ptr: %d\n", \*ptr);

void \*vptr;

int \*iptr = vptr; //In C++, it must be replaced with int \*iptr=(int \*)vptr;

const int a;//cpp expects initialization

func();

func(2);//works in c,cpp expects func(void)

return 0;

}

**23. Does overloading work with inheritance in C++? What about with Java?**

Can directly give them the code here and ask how it’ll behave:

<https://www.geeksforgeeks.org/does-overloading-work-with-inheritance/>

ANS: In c++, unless the function is virtual, it is going to be associated with class rather than object. In java, the method is always associated with object because by default all functions in Java are virtual. Hence overloading across scopes does not work in C++ but works with Java.

24. How to change the output of printf() in main() ?

<https://www.geeksforgeeks.org/c-puzzle/>

void fun()

{

// Add something here so that the printf in main prints 10

}

int main()

{

int i = 10;

fun();

i = 20;

printf("%d", i);

return 0;

}

25. Difference between malloc and new (~hrishikesh)

<https://www.geeksforgeeks.org/malloc-vs-new/>

|  |  |
| --- | --- |
| **NEW** | **MALLOC** |
| calls constructor | doesnot calls constructors |
| It is an operator | It is a function |
| Returns exact data type | Returns void \* |
| on failure, Throws | On failure, returns NULL |
| Memory allocated from free store | Memory allocated from heap |
| can be overridden | cannot be overridden |
| size is calculated by compiler | size is calculated manually |

**26. Can functions be overloaded if they differ only in the return type? Why so?**

ANS: No. Because the compiler cannot differentiate which method to call if they differ only in their return types. <https://www.geeksforgeeks.org/g-fact-75/>

**27. What is volatile in C++? How is it different from volatile in Java?**

ANS: C++ : tells compiler not to make any optimizations as the value of the variable may be changed outside the scope of program

Java : For guaranteeing that changes by one thread are visible to all other threads(part synchronization)

**Java**

# Difference between == and .equals() method in Java

Answer: Main difference between .equals() method and == operator is that one is method and other is operator. We can use == operators for reference comparison (**address comparison**) and .equals() method for **content comparison**. In simple words, == checks if both objects point to the same memory location whereas .equals() evaluates to the comparison of values in the objects.

1. What are the uses of the super keyword ?

Ans: It is used to call the constructor of the super class (super()) or it used to call a data member/function of the immediate super class(super.member)

3. In a multilevel inheritance of classes A<- B <- C. Can protected members of A be accessed in C? Can you access a public member in class A inside class C using super?

Ans. (a) Yes

(b) super.super is not allowed as it violates encapsulation principle.

4. Why is multiple inheritance (of classes) not supported in Java (<Java 8)?

Ans: Diamond Problem, Simplicity of implementation.

5. What are anonymous functions is Java? ( Aman )

<https://hashnode.com/post/anonymous-functions-in-java-explained-cj1opkbj8000sml53bsq6r6cj>

6. What is the output of the following program?

class A

{

int x = 10;

}

// class B

class B extends A

{

int x = 20;

}

// Driver class

public class Test

{

public static void main(String args[])

{

A a = new B(); // object of type B

System.out.println(a.x);

}

}

7. What is the output of the following program?

class Test {

public static void main(String args[]) {

System.out.println(fun());

}

static int fun()

{

static int x= 10; //Error: Static local variables are not allowed

return x--;

}

}

Ans: Error: Static local variables are not allowed

8. What is the output of the program below:

abstract class demo

{

public int a;

demo()

{

a = 10;

}

abstract public void set();

abstract final public void get();

}

class Test extends demo

{

public void set(int a)

{

this.a = a;

}

final public void get()

{

System.out.println("a = " + a);

}

public static void main(String[] args)

{

Test obj = new Test();

obj.set(20);

obj.get();

}

}

Ans. Compilation error: final methods cannot be overridden. Therefore an abstract function can’t be final

9. Why is java called platform independent?What is JDK, JRE and JVM?

|  |  |  |
| --- | --- | --- |
| **JDK** | **JRE** | **JVM** |
| It stands for Java Development Kit. | It stands for Java Runtime Environment. | It stands for Java Virtual Machine. |
| It is the tool necessary to compile, document and package Java programs. | JRE refers to a runtime environment in which java bytecode can be executed. | It is an abstract machine. It is a specification that provides run-time environment in which java bytecode can be executed. |
| Along with JRE, it includes an interpreter/loader, a compiler (javac), an archiver (jar), a documentation generator (javadoc) and other tools needed in Java development. In short, it contains JRE + development tools. | It implements the JVM (Java Virtual Machine) and provides all the class libraries and other support files that JVM uses at runtime. So JRE is a software package that contains what is required to run a Java program. Basically, it’s an implementation of the JVM which physically exists. | JVM follows three notations: Specification(document that describes the implementation of the Java virtual machine), **Implementation**(program that meets the requirements of JVM specification) and **Runtime Instance** (instance of JVM is created whenever you write a java command on the command prompt and run class). |

10. What are wrapper classes? What is autoboxing in Java?

Answer: <https://www.geeksforgeeks.org/autoboxing-unboxing-java/>

**Q11. What is Polymorphism?**

Polymorphism is briefly described as “one interface, many implementations”.Polymorphism is a characteristic of being able to assign a different meaning or usage to something in different contexts – specifically, to allow an entity such as a variable, a function, or an object to have more than one form. There are two types of polymorphism:

1. Compile time polymorphism
2. Run time polymorphism

Compile time polymorphism is method overloading whereas Runtime time polymorphism is done using inheritance and interface.

**Q12.What purpose does the keywords final, finally, and finalize fulfill?**

#### 

#### Final: Final is used to apply restrictions on class, method and variable. Final class can’t be inherited, final method can’t be overridden and final variable value can’t be changed.

Finally: Finally is used to place important code, it will be executed whether exception is handled or not

Finalize: Finalize is used to perform clean up processing just before object is garbage collected. Let’s take a look at the example below to understand it better.

**13:What is an infinite Loop? How infinite loop is declared?**

Ans: An infinite loop runs without any condition and runs infinitely. An infinite loop can be broken by defining any breaking logic in the body of the statement blocks.

Infinite loop is declared as follows:

for (;;)

{

// Statements to execute

// Add any loop breaking logic

}

**Q14**.**What is ternary operator? Give an example.**

Ans: Ternary operator , also called conditional operator is used to decide which value to assign to a variable based on a Boolean value evaluation. It's denoted as ?

In the below example, if rank is 1, status is assigned a value of "Done" else "Pending".

public class conditionTest {

public static void main(String args[]) {

String status;

int rank = 3;

status = (rank == 1) ? "Done" : "Pending";

System.out.println(status);

}

}

Q15. Can main() method in Java can return any data?

Ans: In java, main() method can't return any data and hence, it's always declared with a void return type.

Q16.In the below example, how many String Objects are created?

String s1="I am Java Expert";

String s2="I am C Expert";

String s3="I am Java Expert";

Ans: In the above example, two objects of Java.Lang.String class are created. s1 and s3 are references to same object.

Q17. Why Strings in Java are called as Immutable?

Ans: In java, string objects are called immutable as once value has been assigned to a string, it can't be changed and if changed, a new object is created.

Q18. Give an example of use of Pointers in Java class.

Ans: There are no pointers in Java. So we can't use concept of pointers in Java.

**Q19. Which operations are valid/invalid and why ?**

class A{

public void print(){

System.out.println("From A");

}

}

class B extends A{

public static void main(String args[]){

/\*

1.

B b;

b = new A();

b.print();

//Ans: not allowed, ask why it doesn't make sense to do this(any example like animals and cats)

\*/

/\*

2.

B b;

b = new B();

b.print();\*/

/\*

3.

A a;

a = new A();

a.print();\*/

/\*

4.

A a;

a = new B();

a.print();

//prints from B as java by default has virtual func

\*/

}

public void print(){

System.out.println("From B");

}

}

**Q20 ^Follow up to above 4. How can I call the base class method using object A that points to instance of class B?**

ANS: super.print()

**Q21. Are static methods inherited? If I make a parent class object point to an instance of child class, and then call the static method(defined in both child and parent classes), which version will be called?** (Basically intended to clear difference between hiding and overriding)

class A

{

public static void print(){

System.out.println("From A");

}

}

// class B

class B extends A

{

public static void print(){

System.out.println("From B");

}

}

// Driver class

public class Test

{

public static void main(String args[])

{

A a = new B();

a.print(); //prints from A since early binding

}

}

ANS: Yes, all public, protected members of base class are accessible by child class. Since static methods are bound to the class, JVM resolves the function call at compile time by looking at the object type(and not instance type). Hence parent version is called. <https://coderanch.com/wiki/659959/Overriding-Hiding>

<https://stackoverflow.com/questions/10594052/overriding-vs-hiding-java-confused>

**Q22. Is an object created when main() is called in Java? How can you check?**

ANS: Not needed, as main is a static method. By making the class abstract(as abstract classes cannot be instatiated <https://www.geeksforgeeks.org/jvm-create-object-main-class-class-contains-main/>

**Q23. Can static methods be private? Why so?**

ANS: Yes. If we want only the class to be able to access the method and not any external class. <https://softwareengineering.stackexchange.com/questions/234412/why-have-private-static-methods>

**Q24. Is the following valid/invalid? What is the output?**

class Base{

private void func(){

System.out.println("In Base Class func method !!");

};

}

class Derived extends Base{

public void func(){ // Is this a Method Overriding..????

System.out.println("In Derived Class func method");

}

}

class InheritDemo{

public static void main(String [] args){

/\*1.

Base b = new Derived();

b.func(); //error, compiler tries to resolve the call at compile time using base object as it is not overriding

//private reference to base class\*/

/\*2.

Derived d = new Derived();

d.func(); //valid, but it is not overriding, you can check by throwing a call to super.fucn();\*/

}

}

<https://stackoverflow.com/questions/11976446/can-a-private-method-in-super-class-be-overridden-in-the-sub-class>

**Q25. What is String pool in Java? What is the difference between these two following statements?**

String s = "text";

String s = new String("text");

**Q26. How can you create a copy of objects in C++? Can you do so in Java?** (Basically trying to bring the topic to Clone class in Java)

**Q27. What is a shallow copy? What is a deep copy?**

<https://www.geeksforgeeks.org/clone-method-in-java-2/>

Q28. how will you ensure that there is only one instance of a **class** is created in the **Java** Virtual Machine?

Ans: singleton pattern

<https://www.javainterviewpoint.com/what-is-the-use-of-a-private-constructors-in-java/>

**Databases**

# **SQL query to find second highest salary?**

**Consider below simple table:**

Name Salary

---------------

A 100000

B 1000000

C 40000

D 50000

ANS:

SELECT name, MAX(Salary)FROM Employee WHERE Salary < (SELECT MAX(Salary) FROM Employee);

OR

SELECT Salary FROM (SELECT Salary FROM Employee ORDER BY Salary DESC LIMIT 2) ORDER BY Salary LIMIT 1;

1. ^ Instead of second highest, nth highest salary?

Answer: SELECT Salary FROM Employee

ORDER BY Salary DESC LIMIT n-1,1

1. Write a trigger for the above question, to update the salaries for the above table
2. What are database engines? Which engine does MySQL use? Which is better considering a system might crash in the middle of the query?

1. A database engine (or storage engine) is the underlying software component that a database management system (DBMS) uses to create, read, update and delete (CRUD) data from a database. Most database management systems include their own application programming interface (API) that allows the user to interact with their underlying engine without going through the user interface of the DBMS.

2. InnoDB and MyISAM

3. InnoDB supports transactions

1. What are DB indexes?

Answer: A database index is a data structure that improves the speed of operations in a table. Indexes can be created using one or more columns, providing the basis for both rapid random lookups and efficient ordering of access to records.

creating index, it should be taken into consideration which all columns will be used to make SQL queries and create one or more indexes on those columns.

While Practically, indexes are also a type of tables, which keep primary key or index field and a pointer to each record into the actual table.

The users cannot see the indexes, they are just used to speed up queries and will be used by the Database Search Engine to locate records very fast.

1. How to select only even/ odd rows of the table?

SELECT cols FROM ( SELECT cols, @rowNumber := @rowNumber+ 1 rn FROM YourTable JOIN (SELECT @rowNumber:= 0) r ) t WHERE rn % 2 = 1;

1. SQL injection

Ans:

SQL injection is a technique used to exploit user data through web page inputs by injecting SQL commands as statements

Eg. adding 1=1 in where clause as a condition **1=1** always holds true, user data is compromised

~~SAMRUDDHI

1. Preventing SQL injection

ANS :

Authentication

Restricting access privileges of users

not using system administrator accounts

^ANS: Using preparedStatment, related methods to sanitize input

# How to print duplicate rows in a table?

Ans: SELECT col1, col2 FROM tbl

GROUP BY col1, col2

HAVING COUNT(\*) > 1

1. Where vs. having

The difference between the having and where clause in SQL is that the where clause canNOT be used with aggregates, but the having clause can.

The Where clause acts as a pre filter where as Having as a post filter.

# Difference between SQL and NoSQL

Ans: <https://www.geeksforgeeks.org/difference-between-sql-and-nosql/>

1. In what cases does one prefer to use SQL databases over the other newer database options?

Answer: Applications where joins are needed

**12. What are the types of join and explain each?**

There are various types of join which can be used to retrieve data and it depends on the relationship between tables.

**Inner Join.**Inner join return rows when there is at least one match of rows between the tables.

* **Right Join.**Right join return rows which are common between the tables and all rows of Right hand side table. Simply, it returns all the rows from the right hand side table even though there are no matches in the left hand side table.
* **Left Join:**Left join return rows which are common between the tables and all rows of Left hand side table. Simply, it returns all the rows from Left hand side table even though there are no matches in the Right hand side table.
* **Full Join.**Full join return rows when there are matching rows in any one of the tables. This means, it returns all the rows from the left hand side table and all the rows from the right hand side table.

**13. What is the difference between DELETE and TRUNCATE commands?**

DELETE command is used to remove rows from the table, and WHERE clause can be used for conditional set of parameters. Commit and Rollback can be performed after delete statement.

TRUNCATE removes all rows from the table. Truncate operation cannot be rolled back

**14. What are local and global variables and their differences?**

Local variables are the variables which can be used or exist inside the function. They are not known to the other functions and those variables cannot be referred or used. Variables can be created whenever that function is called.

Global variables are the variables which can be used or exist throughout the program. Same variable declared in global cannot be used in functions. Global variables cannot be created whenever that function is called.

**15. What is data Integrity?**

Data Integrity defines the accuracy and consistency of data stored in a database. It can also define integrity constraints to enforce business rules on the data when it is entered into the application or database

**16. How can you create an empty table from an existing table?**

Example will be -.

Select \* into studentcopy from student where 1=2

Here, we are copying student table to another table with the same structure with no rows copied.

**17. How to select unique records from a table?**

Select unique records from a table by using DISTINCT keyword.

Select DISTINCT StudentID, StudentName from Student.

**18. What is the command used to fetch first 5 characters of the string?**

There are many ways to fetch first 5 characters of the string -.

Select SUBSTRING(StudentName,1,5) as studentname from student

Select RIGHT(Studentname,5) as studentname from student

**19. Explain the ACID properties in brief.**

Ans:

1. Atomicity − This property states that a transaction must be treated as an atomic unit, that is, either all of its operations are executed or none. There must be no state in a database where a transaction is left partially completed. States should be defined either before the execution of the transaction or after the execution/abortion/failure of the transaction
2. .Consistency − The database must remain in a consistent state after any transaction. No transaction should have any adverse effect on the data residing in the database. If the database was in a consistent state before the execution of a transaction, it must remain consistent after the execution of the transaction as well.
3. Durability − The database should be durable enough to hold all its latest updates even if the system fails or restarts. If a transaction updates a chunk of data in a database and commits, then the database will hold the modified data. If a transaction commits but the system fails before the data could be written on to the disk, then that data will be updated once the system springs back into action.
4. Isolation − In a database system where more than one transaction are being executed simultaneously and in parallel, the property of isolation states that all the transactions will be carried out and executed as if it is the only transaction in the system. No transaction will affect the existence of any other transaction.

**20. What is normalization? What are the types? Explain with examples.**

Intended to test whether they understand the need for various normal forms. Explain till BCNF.

1NF : No composite data

2NF : No partial dependency of non prime attributes on candidate keys

3NF : No transitive dependency on candidate keys

BCNF : For every dependency X->Y, X is always the superkey.

**21. Can ask what normal form the following table is in and how can you convert it to the next normal form.**

Pizza Topping Topping Type

-------- ---------- -------------

1 mozzarella cheese

1 pepperoni meat

1 olives vegetable

2 mozzarella cheese

2 sausage meat

2 peppers vegetable

Pizza can have exactly three topping types:

* one type of cheese
* one type of meat
* one type of vegetable

i.e. each pizza can have exactly one type of topping.

ANS: 3NF. Can be converted to BCNF by separating Pizza + Topping and Topping + Topping Type

They might get confused between 2NF and BCNF in the above table(like I did :P)(Why is the above table in 2NF? Isn’t there a partial dependency between Topping and Topping Type?). The reason the above table is 2NF is because all the attributes are potential primary keys i.e. candidate keys. You can have Pizza + Topping or Pizza + Topping Type as PK. 2NF is meant to resolve partial dependencies of *non prime attributes* on candidate keys, but here the dependency is of a prime attribute.

<https://stackoverflow.com/questions/8437957/difference-between-3nf-and-bcnf-in-simple-terms-must-be-able-to-explain-to-an-8>

<https://stackoverflow.com/questions/21330539/difference-between-2nf-and-bcnf>

**22. What is the difference between 3NF and BCNF? (Try discussing the anomalies that arise if the db is in 3NF but not in BCNF).**

3NF : Every attribute that is not a part of primary key must *directly* depend on the primary key.

BCNF : *BCNF acts differently from 3NF only when there are multiple overlapping candidate keys.*

<https://stackoverflow.com/questions/8437957/difference-between-3nf-and-bcnf-in-simple-terms-must-be-able-to-explain-to-an-8>

**Logic and Math based / Puzzles**

1. <https://www.geeksforgeeks.org/puzzle-4-pay-an-employee-using-a-gold-rod-of-7-units/>
2. <https://www.geeksforgeeks.org/puzzle-16-100-doors/>

# Print 1 to 100 without looping or recursion

#include<iostream>

using namespace std;

class A

{

public:

static int a;

A()

{ cout<<a++<<endl; }

};

int A::a = 1;

int main()

{

int N = 100;

A obj[N];

return 0;

}

# Print Hello World without semicolon in C/C++

if(printf(“Hello World”){

}

1. <https://www.quora.com/You-have-1000-wine-bottles-one-of-which-is-poisoned-You-want-to-determine-which-bottle-is-poisoned-by-feeding-the-wine-to-the-rats-The-poisoned-wine-takes-one-hour-to-work-How-many-rats-are-necessary-to-find-the-poisoned-bottle-in-one-hour>
2. You have 20 bottles of pills. 19 bottles have 1.0 gram pills, but one has pills of weight 1.1 grams. Given a scale that provides an exact measurement, how would you find the heavy bottle? You can only use the scale once.

**Ans:** Take 1 pill from bottle 1, 2 pills from bottle 2, … Subtract 200 from the measured weight and multiply by 10 for the bottle no.

1. There is an 8x8 chessboard in which two diagonally opposite corners have been cut off. You are given 31 dominos, and a single domino can cover exactly two squares. Can you use the 31 dominos to cover the entire board? Prove your answer

**Ans:** No. There must be equal pairs of black and white squares.

1. <https://www.geeksforgeeks.org/blue-eyed-island-puzzle/>
2. Three ants are sitting at the three corners of an equilateral triangle. Each ant starts randomly picks a direction and starts to move along the edge of the triangle. What is the probability that none of the ants collide?

Answer: P(No collision) = P(All ants go in a clockwise direction) + P( All ants go in an anti-clockwise direction) = 0.5 \* 0.5 \* 0.5 + 0.5 \* 0.5 \* 0.5 = 0.25

1. What is the minimum number of queens required to attack all squares on an 8\*8 chessboard?

Ans: 5. <https://puzzling.stackexchange.com/questions/22/how-many-chess-pieces-does-it-take-to-cover-all-spaces-on-a-chessboard>

12. What if we had n coins out which x are heads divide the coins in two group in equal no of heads

<https://www.geeksforgeeks.org/puzzle-39-hundred-coin-puzzle/>

13. <https://www.geeksforgeeks.org/puzzle-can-2-persons-be-with-same-number-of-hairs-on-their-heads/>

14.

<https://www.geeksforgeeks.org/puzzle-1000-light-bulbs-switched-on-off-by-1000-persons-passing-by/>

15.

<https://www.geeksforgeeks.org/puzzle-minimum-planes-to-go-around-the-world/>

16. <https://www.geeksforgeeks.org/puzzle-9-find-the-fastest-3-horses/>

17. <https://www.geeksforgeeks.org/puzzle-100-people-in-a-circle-with-gun-puzzle/>

18. <https://www.geeksforgeeks.org/puzzle-20-5-pirates-and-100-gold-coins/>

19. <https://www.geeksforgeeks.org/puzzle-26-know-average-salary-without-disclosing-individual-salaries/>

**Q.20 *You’re about to get on a plane to Seattle. You want to know if it’s raining. You call 3 random friends who live there and ask each if it’s raining. Each friend has a 2/3 chance of telling you the truth and a 1/3 chance of messing with you by lying. All 3 friends tell you that “Yes” it is raining. What is the probability that it’s actually raining in Seattle?***

**Answer**

You only need 1 of your friends to be telling the truth for it to be raining in Seattle.It’s fastest just to calculate the odds that all 3 are lying, and it’s not raining.Each friend has a 1/3 chance of lying. Multiply the odds together… you get 1/27 (1/3 \* 1/3 \* 1/3).We’re not done yet though… 1/27 is the probability that all 3 friends lied at the same time.The probability that at least 1 told you the truth? 26/27 or around a 96% that it’s raining in Seattle.

**Q21.*You have a 3 gallon jug and 5 gallon jug, how do you measure out exactly 4 gallons?***

**Answer…**

We know we can’t get the final result in the 3 gallon jug. It’ll overflow. We need to end up with 4 gallons in the 5 gallon jug.

First fill the 3 gallon jug.

Then pour the 3 gallons into the 5 gallon jug.

Now the 3 gallon jug is empty, and the 5 gallon jug has 3 gallons in it.

Fill the 3 gallon jug again. Slowly pour into the 5 gallon jug. Only 2 gallons will fit because it already has 3. Now it’s full.

Exactly 1 gallon is left in the 3 gallon jug.

Dump out the 5 gallon jug.

Pour your 1 gallon into the 5 gallon jug.

Fill up the 3 gallon jug one more time and pour it into the 5 gallon jug! You have exactly 4 gallons

**Object Oriented Programming**

ER Diagrams

1. **Aggregation vs Composition**

ANS:

Aggregation - Weak dependency, child can exist independently of parent. Eg. Car and engine.

Composition - Complete dependency. Child cannot exist without parent. Eg. House and room.

<https://www.visual-paradigm.com/guide/uml-unified-modeling-language/uml-aggregation-vs-composition/#association-vs-aggregation-vs-composition>

**Advanced topics(OS, networking, etc)**

**Operating Systems**

1. What is deadlock?

Deadlock is a situation when two or more processes wait for each other to finish and none of them ever finish. when there are two or more processes hold some resources and wait for resources held by other(s)

1. What is Virtual Memory? How is it implemented?

Virtual memory creates an illusion that each user has one or more contiguous address spaces, each beginning at address zero. The sizes of such virtual address spaces is generally very high.

The idea of virtual memory is to use disk space to extend the RAM. Running processes don’t need to care whether the memory is from RAM or disk. The illusion of such a large amount of memory is created by subdividing the virtual memory into smaller pieces, which can be loaded into physical memory whenever they are needed by a process.

1. What are the various scheduling algorithms for process scheduling?
2. Explain LRU algorithm. What data structures will you use to implement it?
3. A process executes the following code, The total number of child processes created is for (i = 0; i < n; i++) fork();

Answer: 2\*\*n -1

6. What is a Thread? What are the differences between process and thread?

Ans: A thread is a single sequence stream within in a process. Because threads have some of the properties of processes, they are sometimes called lightweight processes. Threads are popular way to improve application through parallelism. For example, in a browser, multiple tabs can be different threads. MS word uses multiple threads, one thread to format the text, other thread to process inputs, etc.

A thread has its own program counter (PC), a register set, and a stack space. Threads are not independent of one other like processes as a result threads shares with other threads their code section, data section and OS resources like open files and signals.

7. Explain the Bootstrap program and the process to boot the system.

Answer:

The process of starting a computer system by loading the kernel is known as booting the system. Whenever a user first-time logs into the system then an initial program has to run. The program which instructs the system on its initial run is the [bootstrap program](https://www.educba.com/angular-vs-bootstrap/). This program is stored in read-only memory or EEPROM (electrically erasable programmable read-only memory). [The bootstrap program](https://www.educba.com/bootstrap-vs-jquery/) will locate the kernel and will load it into main memory and then the program will start its execution.

**8) What is GUI?**

GUI is short for Graphical User Interface. It provides users with an interface wherein actions can be performed by interacting with icons and graphical symbols. People find it easier to interact with the computer when in a GUI especially when using the mouse. Instead of having to remember and type commands, users click on buttons to perform a process.

**9) What is a folder in Ubuntu?**

There is no concept of Folder in Ubuntu. Everything included in your hardware is a FILE

**Networking**

1. What happens when you type a URL in web browser?

Answer:

A URL may contain request to HTML, image file or any other type.

* 1. If content of the typed URL is in cache and fresh, then display the content.
  2. Else find IP address for the domain so that a TCP connection can be setup. Browser does a DNS lookup.
  3. Browser needs to know IP address for a url, so that it can setup a TCP connection. This is why browser needs DNS service. Browser first looks for URL-IP mapping browser cache, then in OS cache. If all caches are empty, then it makes a recursive query to the local DNS server. The local DNS server provides the IP address.
  4. Browser sets up a TCP connection using three way handshake.
  5. Browser sends a HTTP request.
  6. Server has a web server like Apache, IIS running that handles incoming HTTP request and sends a HTTP response.
  7. Browser receives the HTTP response and renders the content.

1. **How can one find out the IP address of a given device?**

Answer: ipconfig in cmd, else ifconfig

**3. What is DNS?**

Ans: The Domain Name Systems (DNS) is the phonebook of the Internet. Humans access information online through domain names, like nytimes.com or espn.com. Web browsers interact through Internet Protocol (IP) addresses. DNS translates domain names to IP addresses so browsers can load Internet resources.

Each device connected to the Internet has a unique IP address which other machines use to find the device. DNS servers eliminate the need for humans to memorize IP addresses such as 192.168.1.1 (in IPv4), or more complex newer alphanumeric IP addresses such as 2400:cb00:2048:1::c629:d7a2 (in IPv6).

**4) What is backbone network?**

A backbone network is a centralized infrastructure that is designed to distribute different routes and data to various networks. It also handles management of bandwidth and various channels.

**5) What is anonymous FTP?**

Anonymous FTP is a way of granting user access to files in public servers. Users that are allowed access to data in these servers do not need to identify themselves, but instead log in as an anonymous guest.

**6) What is NIC?**

NIC is short for Network Interface Card. This is a peripheral card that is attached to a PC in order to connect to a network. Every NIC has its own MAC address that identifies the PC on the network

**7) What are proxy servers and how do they protect computer networks?**

Proxy servers primarily prevent external users who identifying the IP addresses of an internal network. Without knowledge of the correct IP address, even the physical location of the network cannot be identified. Proxy servers can make a network virtually invisible to external users.

**8) What is a private IP address?**

Private IP addresses are assigned for use on intranets. These addresses are used for internal networks and are not routable on external public networks. These ensures that no conflicts are present among internal networks while at the same time the same range of private IP addresses are reusable for multiple intranets since they do not "see" each other.

**9) What are gateways?**

Gateways provide connectivity between two or more network segments. It is usually a computer that runs the gateway software and provides translation services. This translation is a key in allowing different systems to communicate on the network.

**Projects**

1. If the project is related to databases and concurrent access to an entry is possible(eg flight booking or similar real time projects), one can ask how the application will handle such cases. Expected answer: Explanation about locks, timestamp based protocols and related concepts.
2. Describe a major problem you encountered during the development of this project and how did you solve it?

**Linux**

1. What is the linux command to view all processes?

Ans: ps or top

1. What is apt? How does it work?

Ans: It is a program (Advanced Packaging Tool) which allows users to download and install packages from links to online repositories called PPAs(Personal Package Archives) which have to be added before downloading a program from the same.

**PYTHON**

1. Output? (Intended to clear how objects are passed to functions)

def clear\_a(x):

x = []

def clear\_b(x):

while x:

x.pop()

z = [1,2,3]

clear\_a(z) # z will not be changed

clear\_b(z) # z will be emptied

1. range vs xrange in Python2?

xrange is a generator meaning it creates the next element on the fly hence adding optimization

range generates a list(thus consuming memory) and then iterates over the list elements.

<https://www.geeksforgeeks.org/range-vs-xrange-python/>

1. input() vs raw\_input() in Python2? What was the drawback in using input? How did Python3 solve the drawback?

Python 2

raw\_input() - string ip

input() - evaluates the ip(user can perform unauthorized functions like os.remove(file\_names))

Python 3

input() - string ip (raw\_input of Python 2)

eval() - evaluates the ip(input() of Python 3)

<https://www.geeksforgeeks.org/vulnerability-input-function-python-2-x/>

<https://stackoverflow.com/a/7710959/8005781>

1. What are lamba functions?
2. What is map?
3. What are decorators?
4. What are \*args and \*\*kwargs?
5. Polymorphism in Python?

<https://stackoverflow.com/a/4747427/8005781>

**Profit / HR questions**

1. Which is your dream company?
2. Try to sell your project to us.
3. Who do you look up to in life?
4. What is your strength and weakness ?
5. Tell us something about your achievements
6. What is the toughest problem you've had to face? And how did you overcome it?
7. Tell me about a time when you were particularly effective on prioritizing tasks and completing a project on schedule ?
8. What are the goals you have set for you in life?