**Mathwork**

1. Why Java is generic?
2. How to work with threads in Java?
3. Is it possible to execute Garbage collector force fully?

Ans: No, You can’t force garbage collection.

Even using “**System.gc(); or Runtime.gc();** "

You can just make a request for garbage collection but it depends on JVM to do it or not.

1. Hash map and Hash table. Difference?
   1. [Hashtable](http://java.sun.com/javase/7/docs/api/java/util/Hashtable.html) is synchronized, whereas [HashMap](http://java.sun.com/javase/7/docs/api/java/util/HashMap.html) is not. This makes HashMap better for non-threaded applications, as unsynchronized Objects typically perform better than synchronized ones.
   2. Hashtable does not allow null keys or values. HashMap allows one null key and any number of null values.
   3. Hashtable is much slower than HashMap if used in Single threaded environment.
   4. Insertion Order :   Both HashMap and Hashtable  does not guarantee that  the order of the map will remain constant over time. Instead use LinkedHashMap, as the order remains constant over time.
   5. The iterator in Hashmap is fail-fast iterator while the enumerator for Hashtable is not.  
      According to [Oracle Docs](http://docs.oracle.com/javase/7/docs/api/java/util/Hashtable.html),  if the Hashtable is structurally modified at any time after the iterator is created in any way except the iterator's own remove method , then the iterator will throw
2. What is mutex, semaphore?
3. Arraylist or Vector?

**Vector** is synchronized while **ArrayList** is not synchronized . Synchronization and thread safe means at a time only one thread can access the code .In **Vector** class all the methods are synchronized .Thats why the **Vector** object is already synchronized when it is created.

1. How to access the static methods of a class?

It is only possible to access those methods using reflection. You cannot reference a class directly, only an instance of type Class.

class A {

public static void foo() {}

}

class B {

public static void foo() {}

}

Method method = clazz.getMethod("foo", null);

method.invoke(null, null); // foo returns nothing

**Technical Phone Interview**

**C++:**

1. Will this work?
   1. **Yes, it will work fine., without any compilation or runtime error**

char \*p = "hello";

\*p++; // works, as it increments the pointer, o/p => "ello"

cout << \*p; // prints 'e' as \*p points to first block

1. Will this work/compile?
   1. **Yes it will.**
   2. Then he asked me how will line “base\* b1 = new base();” work, as we do not have any constructor. Ans: Compiler will use the default constructor.
   3. How will line “base b2 = \*b1;” work? Ans: Compiler will use the default copy constructor here.
   4. How will line “b3 = b2;” work? Ans: The compiler will use the default assignment operator.
   5. Where will it use copy constructor and where will it use assignment operator?
      1. **base b2 = \*b1;** -> copy constructor, as we are trying to construct a new object with an existing one.
      2. **b3 = b2;** ->Assignment operator, as we are trying to assign an already constructed object to another constructed one.

using namespace std;

#include <iostream>

class base

{

private:

char\* name;

};

class derived

{

};

int main()

{

base\* b1 = new base();

base b2 = \*b1; // calls any copy constructor, else calls the default copy   
 // constructor (bit copy)

base b3;

b3 = b2; // calls the assignment operator

delete b1;

return 0;

}

1. What’s the use of a private constructor?
   1. It is used to make sure no one creates an object of the class.
   2. It is useful in case of singleton pattern, where we can have only one instance of the class.
2. What’s will the program do?
   1. In the main the first line which is trying to create an object of the class emaple will not work, it gives a compilation error. As setName() = 0 means the class is a pure virtual class or an abstract class.
   2. Then he commented the “virtual void setName() = 0;” line and asked me whether now it will allow. Yes, it will work.
   3. He asked me whats the significance of line virtual void getname(). Ans: It is to achieve dynamic polymorphism / runtime polymorphism.

using namespace std;

#include <iostream>

class example

{

double d1;

public:

example(double dd) : d1(dd){}

virtual void getname();

virtual void setName() = 0;

};

int main()

{

**example\* e1 = new e1(100.00);**

return 0;

}

1. What will be output of the following program?

#include <stdio.h>

void foo()

{

static int i = 0;

printf("i = %d \n", i);

i = i + 1;

}

int main()

{

foo(); // output: 0

foo(); // output: 1

foo(); // output: 2

}

Ans: Static has the lifetime of the program, so it gets incremented on every call.

Output = 0 1 2

**Java:**

1. What will this do:
   1. **LinkedList <Integer> Llist = new LinkedList<Integer>();**
   2. Either Integer or int or String. Not sure.
   3. Ans: This will create a linked list of a Integer.
2. **Output of the following program:**
   1. Outputs in comments:

**class** vehicle

{

**public** **void** getOp()

{

System.*out*.println("vehicle::getOp()");

}

}

**class** car **extends** vehicle

{

**public** **void** getOp()

{

System.*out*.println("car::getOp()");

}

**public** **void** haswheels()

{

System.*out*.println("car::wheels()");

}

}

**public** **class** mathwork

{

**public** **static** **void** main(String[] args)

{

vehicle ch = **new** car();

ch.getOp(); // will print car::getOp()

((vehicle)ch).getOp(); // will print car::gerOp()

((car)ch).haswheels(); // will print car::wheels()

ch.haswheels();//will not work, compilation error

}

}

1. As we do not have destructors in java, how will java free the memory?
   1. With the help of garbage collector.
2. How will garbage collector work?
   1. Garbage collector will run for regular interval and if the object is dereferenced and do not have any reference, then the object will be freed.
3. What if I have the following scenario:
   1. A -> B and B -> A
      1. A refers B and B refers A, will java garbage collector collect this?
      2. Ans: No, only on dereferencing it, it will free them.
4. What is the output of the following:

String s = "Hello";

s.concat("Java!"); // For this to work: String xs = s.concat("Java!");

System.*out*.println(s); // Hello

StringBuffer sb = **new** StringBuffer();

sb.append(" Hello Java!");

System.*out*.println(sb); // Hello Java!

1. What are generics in Java?
   1. You can write a single generic method declaration that can be called with arguments of different types. Based on the types of the arguments passed to the generic method, the compiler handles each method call appropriately.

**Object-Oriented Design:**

1. What are the advantages of Object Oriented Programming?
2. Design a parking lot. Tell me what classes it will have and what methods it will have.
3. What is the complexity to search an element in a binary search tree?
   1. **O(n)**
4. What is the critical section in operating system?
   1. A critical section is a part of a multi-process program that may not be concurrently executed by more than one of the program's processes.
   2. The important point is that when one process is executing shared modifiable data in its critical section, no other process is to be allowed to execute in its critical section. Thus, the execution of critical sections by the processes is mutually exclusive in time.
5. How do you achieve the critical section?
   1. Mutex – mutually exclusive events. Ex: Two processes trying to access a single file but not simultaneously.
   2. Semaphore: It kind of a lock, when one process goes into critical section execution it acquires a semaphore lock, so that other processes have to wait until it is done.

**Math:**

1. What is the difference between Definite and Indefinite Integral? Is limit –infinity to + infinity a definite or infdefinite integral (ans: Definite integral).
2. How can you find a matrix is invertible?
3. [2 4 ; 7 0] is this matrix invertible ? (Yes, they are)
4. Find the orthogonal vector (perpendicular) to A=i+2j+k; B=j+2k
5. Find lim sin x/x when x->0