

Programming In Java
Prof. Debasis Samanta
Department of Computer Science Engineering
Indian Institute of Technology, Kharagpur

Lecture – 02
Java Programming Environment

So, in this lecture we are going to learn about how we can write our own program and then the same program can be executed in our machine. So, today we will discuss about the different steps of programming in Java in a very simple way. So, if you do not have any idea absolutely it is not a difficult of you will be able to follow it. Now, let us see how we can write our first Java program.

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Program in C and Java

A program in C to display message

```
#include <stdio.h>

int main()
{
    printf("Hello, World!");
    return 0;
}
```

A program in Java to display message

```
import java.lang.*;

class HelloWorldApp
{
    public static void main(String args[]){
        System.out.println("Hello, World!");
    }
}
```

Note: Both the languages are case sensitive

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Now, before going to write first Java program I just tell about how we usually write a program for example, in C. So, if you know C programming then it is good that you will be able to follow it. So, here is basically the idea it is given here how a C programming will look like that. So, it has basically (Refer Time: 01:03) preprocessing statement right say include. So, here is basically the include and then it basically the main. So, main function as you know the C programming is basically function oriented programming.

So, there should be one function is called the main function. So, this basically the program written in the C programming and you can see that this program will basically if you run it then it will print a message called “Hello, World!”. Now, let us see how the

same right task can be executed by writing a Java program. Now, a Java program will typically look like this. Now, you can see the difference between the two programs: one program is in C and another is in Java.

So, here it is include in C, but here it is import in Java. And here you write the main, here also we write the main like this, but with a peculiar that if syntax. The peculiar syntax is like this public static void which is not required there only int or some void can be there in C. So, here is the special things we learn about what is the meaning of these things is required in Java. Then this is basically here, then here the print statement is there right, how the print is message. Here in Java to do the same thing we need this kind of syntax system dot out dot println and then within this double quote the message that needs to be print.

So, essentially the two program will do the same thing, but they are written in a different syntax, the different language construct. So, this is the idea about that and this is your first program and one more thing that I should mention here is that in Java as it is an object oriented programming. So, we have to develop an object. And object is basically developed by means of defining a class. So, here this is the name of the class that basically we will be used to **run**; I mean run this program as an objects. So, the name of the class here is called HelloWorldApp this is the name you can give a 1, a 2 like this one also. But there are few things that you have to follow it before giving the particular name and whatever it.




Now, so we have learn about how we can run a program in Java to print a message and this is a typical look of this program, you may be little bit find a difficult. So, that what are the different syntax and everything, but as the time pass and then you will discuss many things. So, all these things will be easy for you and then you will be able to accustom to this concept. So, you should not be worried for that. Now, after running this and another important thing is that as a case sensitive, both the programming language as you know or if you know already C programming then you know that C is a case sensitive and Java is also a case sensitive. Case sensitive means for example, here the System is filled it like this. So, the first character is capital S and it matters.

So, if you write this program which system as a small letters all characters in small capital, small letters then it is not the same thing as it should be. And here for example,

the name of the class is HelloWorld and you see the some is capital letters some is small letters this means that they are distinguishable. So, if you write all in small letters this means that it defines a new class and like this. So, these are basically the case sensitive and Java is a case sensitive programming language. Then while you typing the program then you should consider about whether they have the right letters have been chosen or not.

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Aspects	C	Java	Aspects	C	Java
Paradigms	Procedural	Object-oriented	Inheritance	No inheritance	Supported (Simple inheritance)
Platform Dependency	Dependent	Independent	Pointers	Supported	No Pointers
Datatypes : union, structure	Supported	Not supported	Code translation	Compiled	Interpreted
Pre-processor directives (#include, #define)	Supported	Not supported	Multi-threading and Interfaces	Not supported	Supported
Header files	Supported	Use packages (import)	Exception Handling	No exception handling	Supported
Storage class	Supported	Not supported	Database Connectivity	Not supported	Supported

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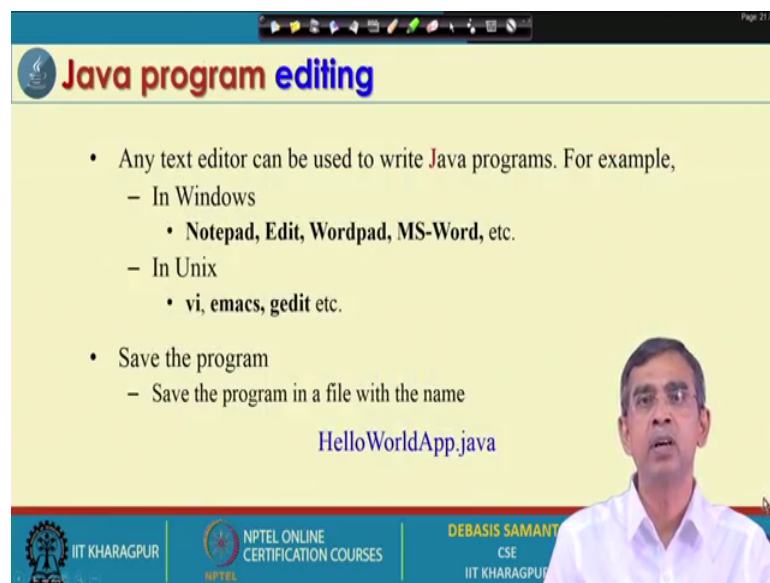
Now, here again there are few more differences about the C programming versus Java programming and regarding the paradigms that we use, by this paradigm the two program languages are totally different. And, also C programming is not the platform independent whereas, Java programming is the platform independent. And few things you can note it from this table that many things which support C programming, but does not support Java programming. This may be little bit surprising, but is not the surprise actually Java developer wants to make the programming as simple as possible, as easy for the programmer is it possible.

So, that is why the many critical and then complex issues which basically leads to lot of errors has been carefully ignored in Java programming setting. So, that is why there are many things which are not supported by Java programmer and in addition to this there are few things also which is not possible in function oriented programming like C, but it is possible in Java programming. For example, inheritance on concept we have discussed

in the last lectures. It is basically not possible in C whereas, it is possible in Java. Pointer is one great deal of errors and then is learning capabilities actually so, it usually a very difficult to cope with this concept.

So, Java developer has ignored this there that mean there is no business of pointer in Java programming; few things is very much essential. So, far the distributed programming and then internet applications they are called a multithreading and interfaces those things are there. And, to make the robust and most reliable programming the Java introduced the concept which is new of its kind. In fact, is called the exception handling which is not there in C programming language, but it is readily available in Java programming. And, database connectivity usually C does not support database connectivity, but with Java we will be able to connect the database. All these are the basically facility over the C programming and that is we can enjoy from the Java programming environment.

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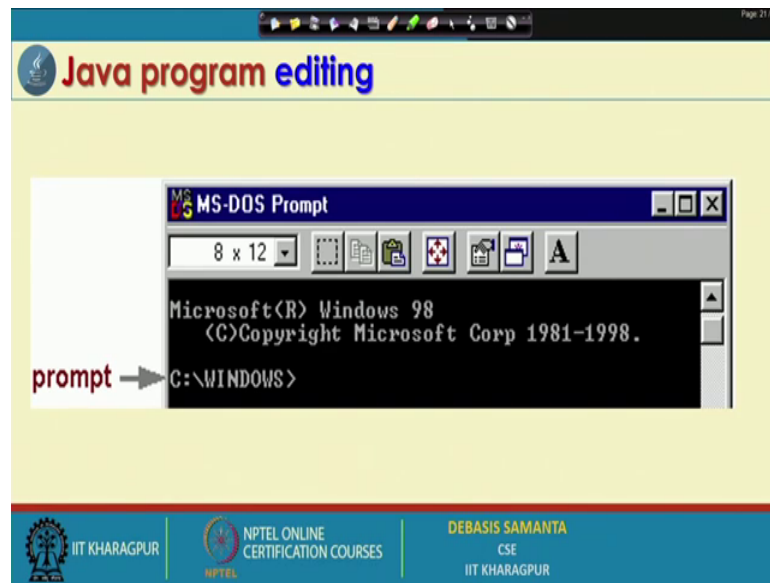
The slide is titled "Java program editing" and contains the following text:

- Any text editor can be used to write Java programs. For example,
 - In Windows
 - Notepad, Edit, Wordpad, MS-Word, etc.
 - In Unix
 - vi, emacs, gedit etc.
- Save the program
 - Save the program in a file with the name
`HelloWorldApp.java`

The slide also features a video inset of a man in a white shirt speaking, and a footer with logos for IIT KHARAGPUR, NPTEL ONLINE CERTIFICATION COURSES, and DEBASIS SAMANT CSE IIT KHARAGPUR.

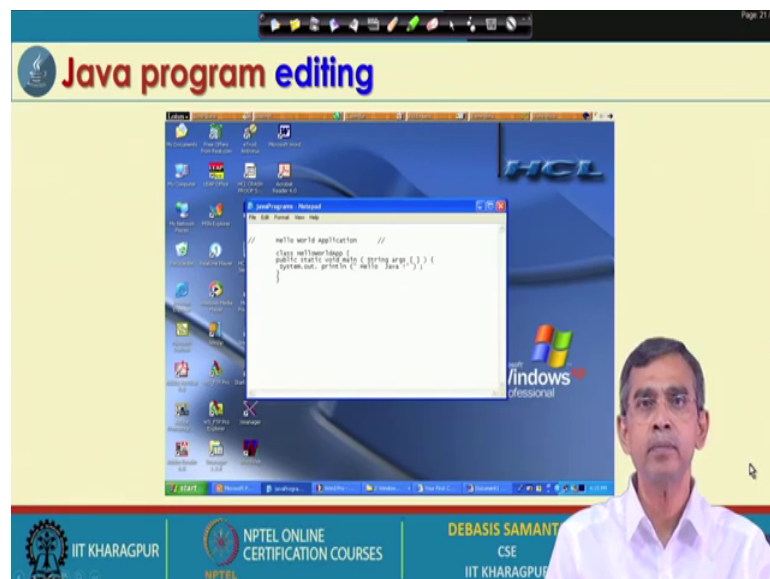
Now, so we have discussed about first program that we can write in java programming, we have a idea about it. Now, let us see how we can type this program, what setting should we should have to do that. Now, you can use any editor, there is a text editor like say Notepad or MS-Word or Edit command in Unix whatever it is there. In Unix there are some other comma editor is also there like vi, emacs and gedit. So, you can use any editor and then type any text like your java program that we have discussed in few slides back HelloWorldApp you can write it.

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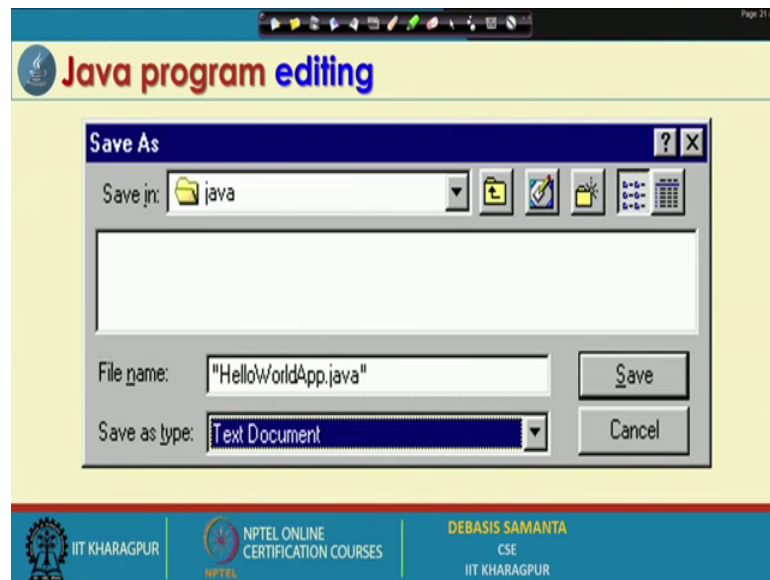
So, writing the program using editor is not a big things to discuss and once you write this program you have to save this program. So, you should save this program in a particular directory and that can be used using any command in Unix or any prompt common prompt from the windows. So, that you can make a directory and all the program that you have developed using editor can be safe there.

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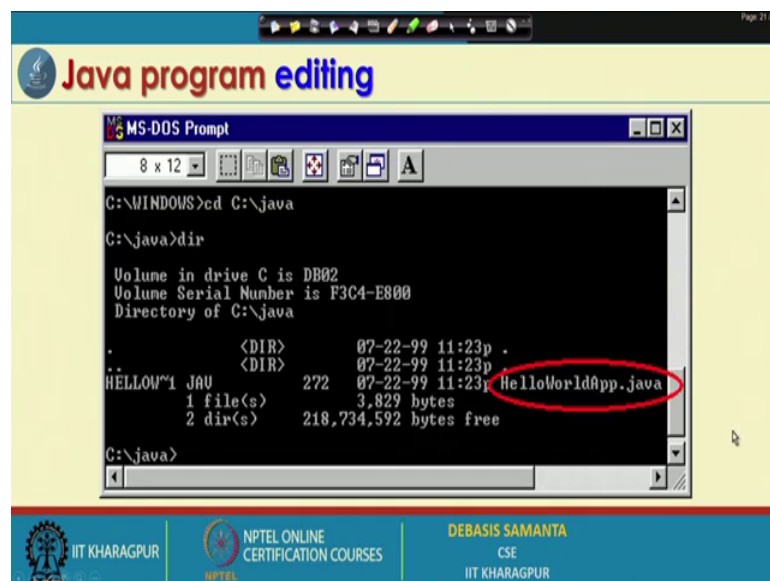
And while you save this program then a particular care ok, I mean task should be taken into consideration is that naming of the program.

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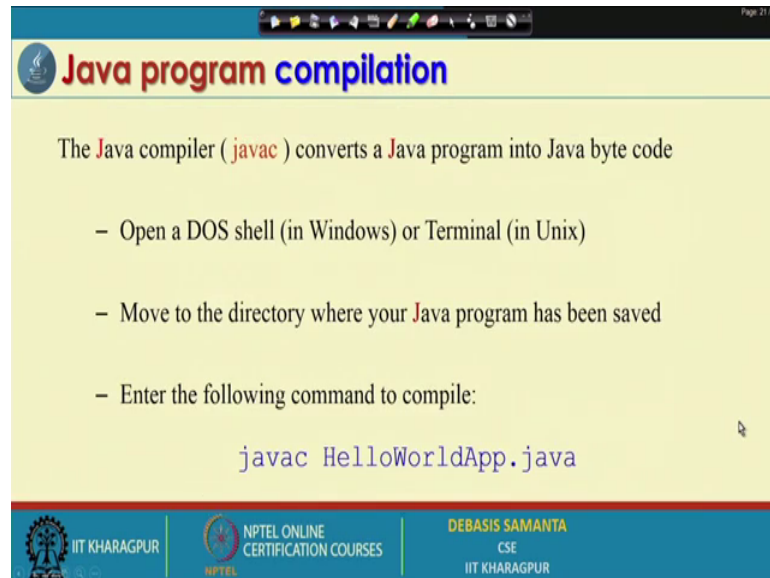
The name of the program should be same as the name of the class that you have defined. For example: in the ongoing example the name of the class that we have given HelloWorldApp. So, the name of the program; that means, this program should be saved as a HelloWorldApp and one more important thing that you should know is that extension. For example, in case of C program the extension should be dot c whereas, in case of java the extension of the program should be dot java; that means, the program in java should be saved as dot java file.

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So, and then the directory that you can see; here after saving you will be able to see this kind of program has been safe in your current working directory.

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The slide is titled "Java program compilation" and contains the following text:

The Java compiler (`javac`) converts a Java program into Java byte code

- Open a DOS shell (in Windows) or Terminal (in Unix)
- Move to the directory where your Java program has been saved
- Enter the following command to compile:

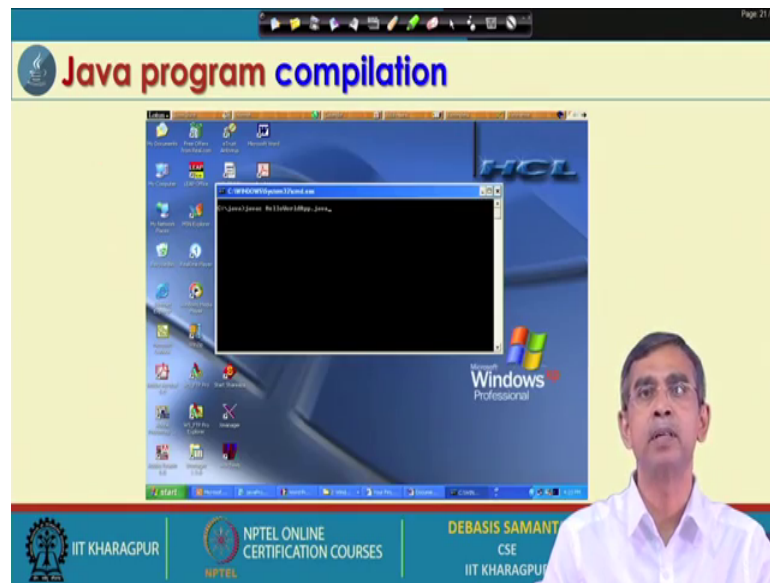
```
javac HelloWorldApp.java
```

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So, once so this is basically the task of editing; that means how you can type your program using an editor like say gedit or edit or Notepad or MS-Word. Now, I will come to the discussion of how you can compile this program that mean translate this program. As you know the java file is basically is a high level program that mean program written in a high level language. So, this program in order to execute it should be translated into a machine level code binary code form.

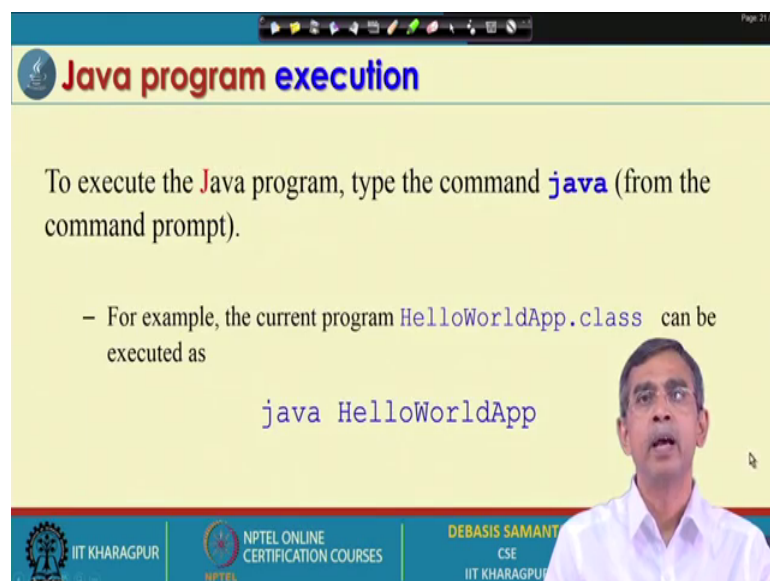
Now, I will discuss about how this can be I mean compiled or translated. Now, for this translation there is a program provided by the java developer and the name of the program or you can say the command is called java c javac it is called the javac; it is basically short form of java compiler. So, you can use javac as a command and then type this javac followed by the name of the java file. For example, javac HelloWorldApp dot java. So, if you run this and if there is no error in your program then java will compile this program successfully.

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So, this is a command that you can use from your command prompt, Windows or from your Unix terminal the program. And, once the program is successfully compiled this dot java file will be converted into one file having the same name as the name of the java file earlier, but the extension is different. The name of the file with executable code is called dot class. So that means, HelloWorldApp dot java will be translated into a code a file is called HelloWorldApp dot class.

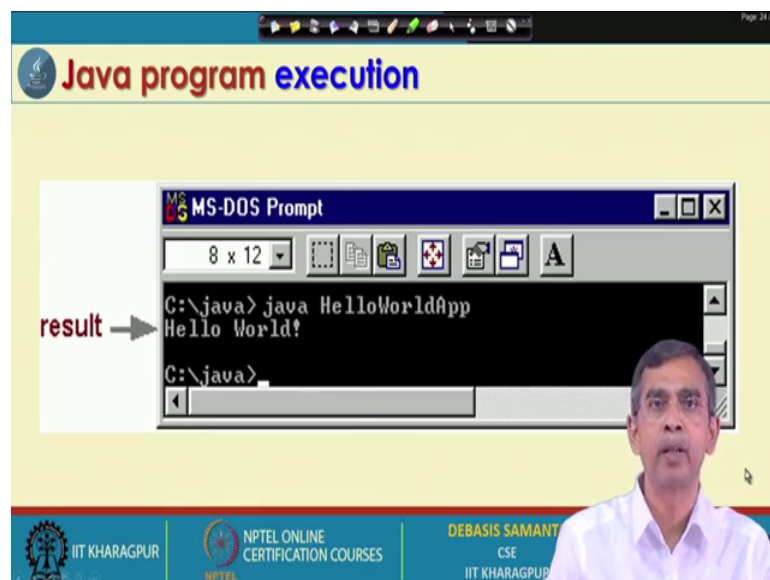
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So, this is basically the task that the compilation we will do for you and then running that mean execution. So, the class file that you have already created you can execute the same file from the same directory, if you type the command from the directory. So, the class file which is belongs to the directory say you are working directory and then from the directory if you run this command, like the then it will run the program.

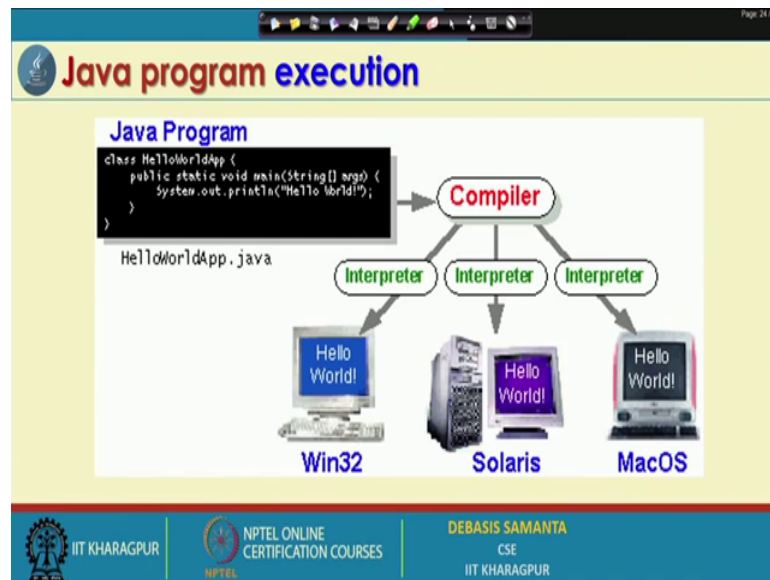
And, here you see while you run this program you do not have to specify the dot class, just simply name of the file without any extension it will run your program. And, if there is no error during runtime also sometimes error is there then this program will produce the output on the screen or it will be store the output. So, we learn about how to edit a program, then how to compile it and how to execute the program ok.

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So, the concept is pretty simple and it needs few I mean practice to cope with this.

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So, in our one demonstration we will give you enough program so, that you can practice of your own. Now, before going to our next discussion I just want to highlights few things about. I several times told about that programming is a platform independent whereas, C programming is not; what it does mean actually. So, here the meaning can be understood here. For example so, this is the program that you have written using any editor Notepad like and then name of the program is HelloWorld java. And, this program is translated by a compiler called java c this one.

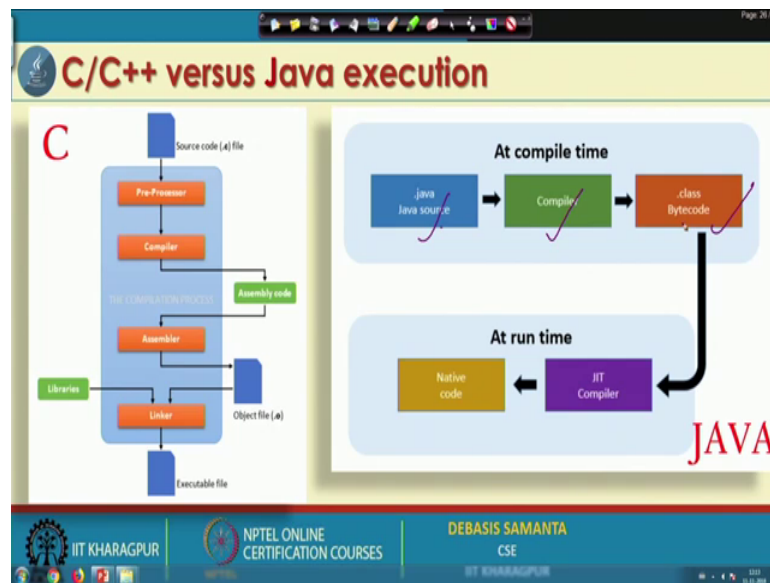
Then platform independent it does means that the same file that you have developed should be executed in one machine we say Windows 32, in another machine we say Windows 64 or in another machine say Solaris or is a MacOS or like that. So that means, the program which is compiled successfully should be executable in any operating system whether it is Windows or it is Unix or it is MacOS, then it is called the platform independents. So, that concept is basically possible here. This means that the file that we built by compiling that mean dot class file is basically one sort of thing which any machine can understand it ok.

If it is not platform independent this means that compiler will compile one code which basically only one particular machine can understand it. So, C compiler is basically the different C compilers are there or the translating the program into the different machines that is why it is totally platform related. That means, the same machine which basically

compile for this machine cannot be executable into another machine. Maybe high level language program same, but the ultimate executable thing is basically different.

So, that is why the C programming cannot provide us the platform independent concept, but here is basically because of the concept of dot class. Now, here again question is that what is the special thing in the dot class.

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So, that that idea is basically the concept of dot class is basically one code which basically any machine can understand; that means, this executable code is basically developed targeting a virtual machine. Now, regarding this concept we will discuss in details whenever you will discuss about the platform independent issue in more detail manner. Now, is a programming language and mainly it is an object oriented programming language. Like there is another object oriented programming language, before came into the market that time another programming is also very popular; it is called the C++.

The programming is basically is an extension of C, C is a function oriented whereas, C++ is object oriented, but the two programming language all though object oriented programming has radically many different features are there. So, let us quickly see what are the difference the between the two programming environment C or C++ and Java. Now first of all so far the program building and software development is concern they follow the complete different task; the task that that is followed in C, C++ is shown here.

So, here if you write a program that is you call the program file, source file it is and then source file has certain preprocessing; that means, it will link and if it is any library and everything.

So, they first undergo through preprocessing and then finally, pre proposed things will be compiled. And, then after the compilation it produce the assembly code. Assembly code is basically the program in numeric at, sharp like this one. Then the assembler will be there which will basically translate the assembly code into the assembler ok, using assembler into the machine level. And here these assembler is basically different assemblers are there in the different what is called the architectures. Similarly, the different compiler because the different machine, different architecture, different operating system follow the different assembly code.

And then different hardware, the microprocessor follow the different machine level code from the same assembly language programming actually. So, the assembler will convert a high level program written in dot C or dot cpp C++ and then finally, produce an object file. And, sometimes these object file may take some help of some libraries or build in program. So, this is a built in program that needs to be link and finally, the executable file will be created. So, this is the way the conventional C or C++ programming works for us; that means, from writing from program to executing a program. Now, let us see the same thing how it works in system, environment; it is in fact pretty simple.

It is not so, complex task rather it basically these are java file program written in java dot java file and then there is a compiler. These compiler is same compiler, what about the machine you use (Refer Time: 18:57) not an issue. This compiler will translate into dot class file, dot class file in technology it is called the program not in binary form or not in machine level code rather it is in the form of code it is called the byte code. It is look like 1 0 0 0 1 1 like this one machine level code, but its formats its syntax is totally different.

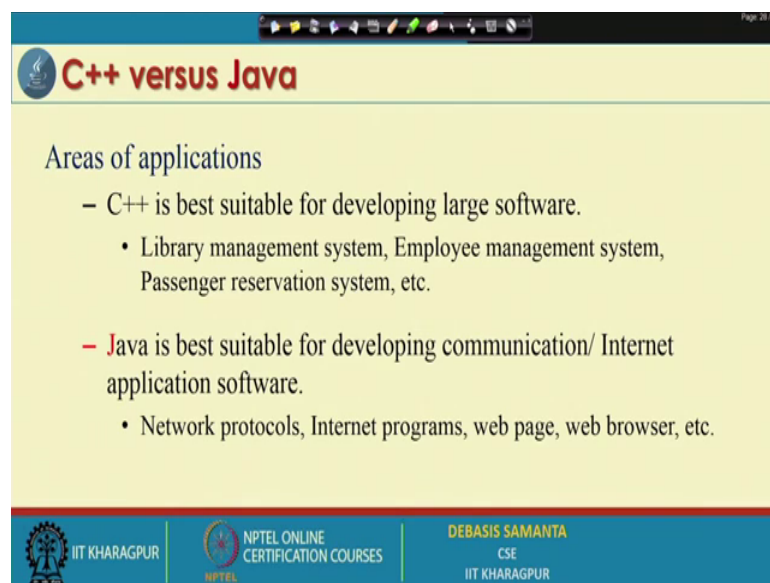
So, this is the byte code, byte code is now we can say is executive code; then in order to run these byte code we need one interpreter. So, basically this is one it is called the interpreter, in interpreter and interpreter as you know interpreter basically take one code, run it then go to the next run it like this one. So, it is an interpretative mode, it is not that the way compiler and then the executive code finally, is produced for this machine and then it will execute. Now, here you can think that here in C or C++ everything is

basically the compilation whereas, in case of two things are there both interpretation as well as compilation are there.

So, it halfway compile the program into byte code and then the next halfway it basically execute the byte code into the corresponding machine. So, here the idea about that this bytecode that will be produced is targeting an hypothetical machine irrespective of the architecture it is there. And, the interpreter for every architecture there is a corresponding interpreter. So, these interpreter know that if this is a byte code then how to work with this and then that way the machine independency is maintain here in case of environment.

So, this is the idea about the execution of the two different programming concepts for example, C C++ and apart from this thing there are few more differences are there. So, far the two programming languages both are object oriented programming languages C++ and Java, I will quickly summarize the different concept it is here.

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The slide is titled "C++ versus Java" and is part of a presentation from IIT Kharagpur. It lists the areas of applications for both languages. C++ is noted as being best suited for developing large software, with examples like library management, employee management, and passenger reservation systems. Java is noted as being best suited for developing communication and internet application software, with examples like network protocols, internet programs, web pages, and web browsers.

Language	Best Suited For	Examples
C++	Developing large software	Library management system, Employee management system, Passenger reservation system, etc.
Java	Developing communication/ Internet application software	Network protocols, Internet programs, web page, web browser, etc.

So, C++ and both are object oriented programming, but they are target are not (Refer Time: 21:38) same. For example, C++ usually preferable for developing very large software such as library management system, employee management system, then passenger railway reservation system like this. Whereas, can be used to develop all these kind of systems of course, but in addition to this is a very special programming language

which is suitable for developing particularly communication or internet application related software development.

For example if you want to develop networking technology, to develop many protocols in networking then you should use instead of C++. For internet programming; that means, how the browser work, how the remote desktop can work; all these things is best suitable. You if you want to develop the web page, the web page is a very common things nowadays many organization they maintain their web pages including many information and then many services.

So, web services for example, the bank and everything. So, the webpage you can develop and then web browser also; that means, it will browse any webpage if it is available in internet or www. So, these are the programming that you can do using programming better and in C++ sometimes they are not possible or infeasible.

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Features		in C++	in Java
Data abstraction and encapsulation		√	√
Polymorphism		√	√
Binding	Static	√	√
	Dynamic	√	√
Inheritance	Single Inheritance	√	√
	Multiple Inheritance	√	x
Operator overloading		√	x
Template classes		√	x
Global variables		√	x
Header files		√	x
Pointers		√	x
Interface and packages		x	√
API (Application Programming Interface)		x	√

So, these are the difference the task that the two programming languages is there. Now, I will just feature wise I will tell about how the two programming languages are different. Now, here I have mention few important things which are possible in C++ and which are not possible in and vice versa. Now so, far the encapsulation is concerned we have discussed about that is an object oriented programming and encapsulation is a programming features. So, both C++ and provides the encapsulation and that means, they allow us to develop our class file. Polymorphism if you see both C++ and provides

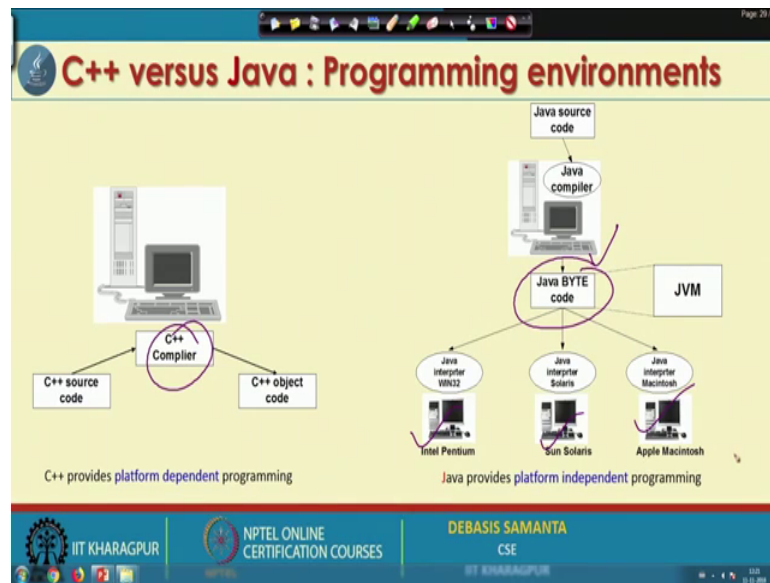
a polymorphism and binding; that means, how the different a data can be bind to the different functions or methods.

There is a concept called the binding and there are two types of binding; the static and dynamic both kind of binding is possible in as well as in C++. And, then inheritance here is bit difference between C++ and java. C++ supports are both single as well as multiple, multiple is a very complex inheritance mechanism. On the other hand does not support multiple inheritance, supports only single inheritance. And, then operator overloading this is the another important things; that means, that different operator for example, the plus plus can be used for adding two numbers, plus can be used for adding two documents like this; this is a polymer print concept actually.

So, operator overloading is a concept of polymorphism. C++ allows operator overloading whereas, Java does not allow operator overloading. And, then template classes these basically C++ allow template class; that means, one template means is basic class can be developed which basically not suitable for creating an object, but it is a template only. But Java does not give any facilities to create a template class. There are few more things like pointer is possible pointer is not possible in Java whereas, pointer is possible in C++. And, interface and packages Java is a very good one features regarding this whereas, in C++ does not have.

Now, here we can see many things; many things for example, here in C++ whereas, Java they do not have and few things of course, Java has where the C++ does not have. Now here obviously, I told you that what is the reason behind this. The reason is that Java we want to develop a user friendly one programming environment. In order to make a user programming user friendly environment the Java developer (Refer Time: 26:22) down many complicated features which basically associated with lot of errors; lot of errors in the program list to the program which is not a robust program or reliable program. So, eliminating some features which are very complex and erroneous so, we can make a reliable and robust Java programming; that is the beauty of the Java programming and that that is why Java become a great programming language is here.

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And another difference this is obviously there another see difference is there C++ again is a object oriented programming, but it is not platform independent. That mean different compiler is required to translate the C++ code into the different programming languages whereas, Java is a platform independent programming language this means that that. So, Java code will create a byte code and then byte code will be interpreted in a different programming environment. And this way the platform independent; that means, same code can be execute wherever you want to run it.

But here the different compiler is required to run your same program in the different programming environment. So, this is the idea about the two programming languages C++ and Java and the basic difference between them ok. So, we have learnt in this lecture the idea about the programming the difference steps of a programming in Java and how Java programming is difference from the C++ or C programming or other functionality programming concept.

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The slide features a yellow background with a blue header and footer. The header contains a red question mark icon and the text 'Questions to think...'. The main content is a white box with a blue border containing two bullet points. The footer is a blue bar with three sections: the IIT Kharagpur logo, the NPTEL logo and text 'NPTEL ONLINE CERTIFICATION COURSES', and the presenter's name 'DEBASIS SAMANTA CSE IIT KHARAGPUR'. A small mouse cursor is visible in the bottom right corner of the slide area.

Questions to think...

- How a Java program can include two or more classes and then compile them?
- How a browser can run a Java program?

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Now, so far we have discussed a very simple program which includes only one class. In our example we have consider a one class namely HelloWorldApp dot java, but is it possible that a program can consist of more than one classes. And, if it consist more than one classes whether the same techniques for compiling and executing is there or not or we have to follow the different concepts. And, also how a browser can execute a Java program; those are the interesting things in Java. So, all these things we will cover in our next lecture.

Thank you very much.