

Programming In Java
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Lecture – 03
Java Tools and Resources

So, we have learned about a very basic things about the Java in the last two lectures. Now, we will see exactly what are the tools and resources that you should have in your own custody so that you can develop your own program brand your own program, test your own program and all these things. So, today's lecture includes what are the Tools and Resources that you can think. So, that you can use in and then you can prepare your programming environment.

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The slide is titled "Tools available for Java programming" and contains the following information:

- **Java Software Developer's Kit (SDK) : [Java™ 2 SDK](#)**
 - SDK from *JavaSoft*, a division of Sun Microsystems Inc.
 - Contains the basic tools and libraries necessary for creating, testing, documenting and executing Java programs.
- **[Java™ 2 SDK, Standard Edition](#)**
 - <https://java.sun.com/j2se/1.4.2/docs/index.html>
 - Official site for Java™ 2 SDK, Standard Edition

The slide also features a small video inset of Prof. Debasis Samanta in the bottom right corner and logos for IIT Kharagpur and NPTEL at the bottom.

So, Java programming tools first I would like to discuss about it. Now, one very interesting thing about is that everything is free; that means, Java tools those are freely available, you can download it from the net and then you can use it.

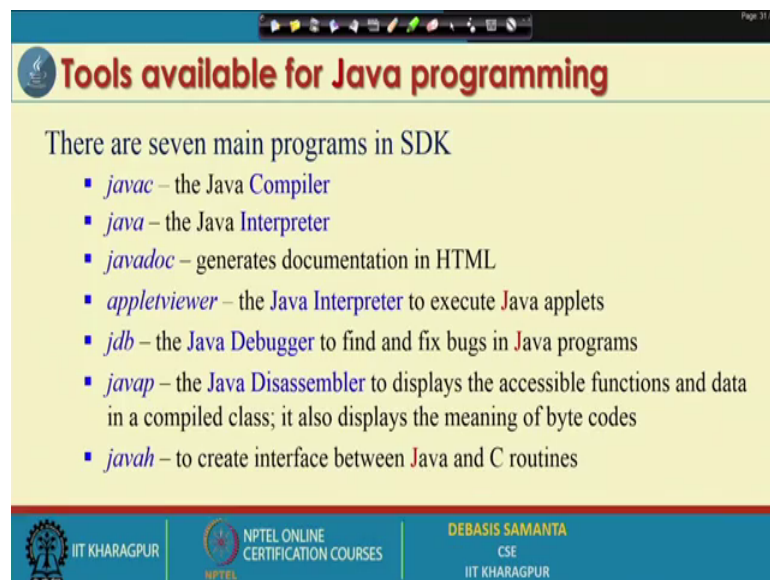
So, what the thing it is required is that you should have your own machine a laptop, whether it is windows it is Macintosh or it is Solaris absolutely it is not an issue you just have it. And then you can download the program from the different links. So, I will tell you the different links that is available, and then we can use it. So, basically the JDK; once I told you the JDK is called the Java development kit. This is the basic building

what is called the blocks, or basic building tools basically we can load it. And once you load it you can install it.

So, JDK can be load directly from the Java source, JavaSoft you just simply in the Google give you the index JDK. And then you can find lot of links and there are free links all that means they are freely downloadable. And so, far the JDK is concerned there are many versions one is called the SDK version and JDK version.

I should not suggest you to download the SDK, SDK is for the advanced programmer it is called the super development kit, who there are many features unnecessarily make your system slow so, better not to use it. And so, far the JDK is concerned which was introduced in 1996 first time, after that lot of versions are available till time. The latest version that you can have 11, but for beginners the basic programmers right you should use the JDK version 8, JDK version eight is most versatile most matured and then it is easy to use. So, I should suggest you to download the JDK version 8 in your machine and then install the same in your machine.

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The slide is titled "Tools available for Java programming" and lists seven main programs in the SDK. The programs are: *javac* (Java Compiler), *java* (Java Interpreter), *javadoc* (generates documentation in HTML), *appletviewer* (Java Interpreter to execute Java applets), *jdb* (Java Debugger to find and fix bugs in Java programs), *javap* (Java Disassembler to display accessible functions and data in a compiled class), and *javah* (to create interface between Java and C routines). The slide footer includes logos for IIT KHARAGPUR, NPTEL ONLINE CERTIFICATION COURSES, and DEBASIS SAMANTA CSE IIT KHARAGPUR.

So, this will completes the Java software for your working that is all. Now, next let us see what are the things there in your JDK tool. JDK is a basically a bundle; that means, it contains many programs. Now, here I have listed the programs those are there in JDK, I can say the JDK or SDK there are both are the things are same so, there in fact seven programs.

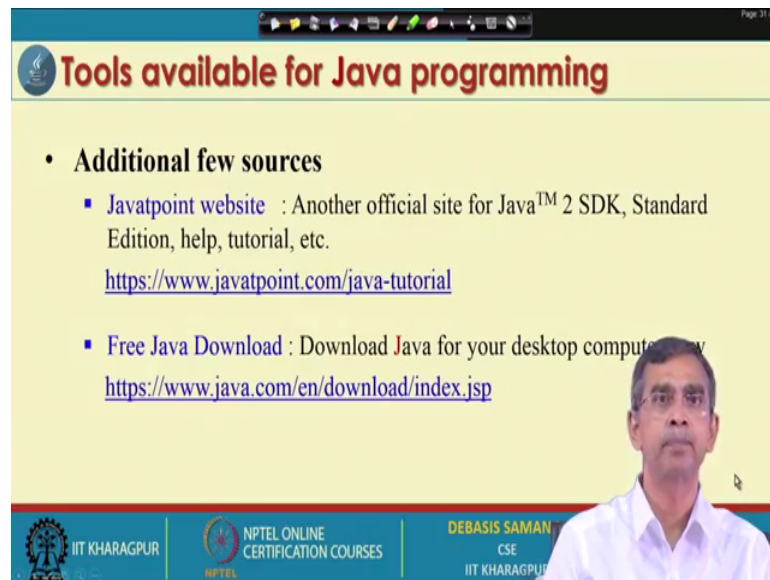
I have already discussed about one program; that means, to how to translate a dot Java file into dot class file it is called the javac. So, javac is there it is basically Java compiler, then Java one another command we have used to run the program it is called the Java interpreter. So, these are the two programs very used frequently used in that is there in bundle in JDK. Other than this for some large program software development where we have to have a documentation; that means, different documentation for large software is required and there is a tools available for that is called the Javadoc using Javadoc you can do very quiet and comfortable documentation in your own program so that the program written by you can understand by any other programmer, who wants to extend your program all these things. So, in a team work if you want to do develop a program Java doc definitely suitable and you should know it.

Then appletviewer is very another program and appletviewer is basically to run the Java applet. Regarding Java applet we will discuss about it is just like a browser program. So, it basically run html file actually which contains some Java code in it. So, appletviewer is to basically running Java applet a special kind of Java program, which is basically suitable for window programming, or is a graphical user interface program development.

Then the Java debugger. So, if you have very large set of classes in your program, sometimes it is not giving the desired output. Then you may have to debug; that means, find the error where it is there. So, for this debugging the JDK provides you a very efficient and then handy tool set it is called the JDK this is for the Java develop Java debugger for fixing errors in the program. And then Java disassembler it is called the javap that is basically dissembling, if you want to make the program if it is very complex and large program into several components. So, javap will basically allow you to dissembling your program into small program sets and then it is also a tool that you can use it and then do it.

And then javah is the one another facilities included in a JDK. And it basically help us to create an interface between Java and other programming particularly C routine or C++ routine, here basically javah is used suppose some part of the program you want to develop in C. And then another program part you want to develop in Java. And then both the things are needs to be interfaced together. So, that they can work together so, in that case you can use javah is a facilities that is bundle there in JDK.

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The slide is titled "Tools available for Java programming" and lists two additional sources:

- **Additional few sources**
 - **Javatpoint website** : Another official site for Java™ 2 SDK, Standard Edition, help, tutorial, etc.
<https://www.javatpoint.com/java-tutorial>
 - **Free Java Download** : Download Java for your desktop computer
<https://www.java.com/en/download/index.jsp>

The slide also features a video feed of a man in a white shirt in the bottom right corner and logos for IIT KHARAGPUR, NPTEL ONLINE CERTIFICATION COURSES, and DEBASIS SAMAN, CSE, IIT KHARAGPUR at the bottom.

There are few more resources that you should consult while you learn this [FL] programming and, also attend this course and one is a very important link it is called the very popularly it is called the javatpoint is a tutorial point. So, it has very large set of examples and than illustrations and, then only the missing is that they do not discuss about the theory or any concept.

They have just simply programs a sea of programs we can say, that you can download from this run in your environment and by the way you can learn a lot of course, but without knowing theory and then principle and concept learning on the program is not suitable. So, this is not so suitable for the beginners of course, but you can at least have some hands on of some programming from this source. So, it is a javatpoint and Java another few I mean documentation that you can download from the sum Java website itself.

So, there are many documents very vast document of course, sometimes if you are to learn this program in a small means say maybe in 3 months or 2 months, then learning all those things is really not suitable. And this documentation is of course, good and is preferable for the advanced programmer.

So, if you are not an advanced programmer, then all this program should not be utilized at the moment. Later on whenever you learn some basic things, then you can use it then as a run as a more advanced step.

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Resource for Java programming

- There are many resources for learning Java
 - **The Java™2 Tutorials**
 - The Java tutorials are practical guides for programmers who want to use the Java programming language to create applications.
<https://java.sun.com/docs/books/tutorial/index.html>
 - **Sun Developer Network**
 - Sun Microsystem's official website listing down all the API documents, Java Technologies, books and other resources.
<https://java.sun.com/reference/docs/>

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And there are few more resources that is also available which you can consult, that is again from the sun Java website itself this is a very authenticated document actually there is no error in the documentation. So, is a error free documentation and then very professionally maintain the documentation, this is from the Java dot sun dot com is from the sun original websites. And there is another sun developer network is also available for many other resources.

This is also from the sun Microsystems official website, where the documentation regarding many packages. Actually Java also the JDK includes many other packages, those packages are called API. Now regarding this packages this package is basically a library. So, if you want to know about this libraries and what are the classes are there in the libraries and what are the functions methods or operation that all classes we will do for you, then the API documentation. Those API documentation also you can have it from Java dot sun dot com website. So, these are the very two important links that you can have it.

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The slide is titled "Packages in Java" and discusses the API (Application Programming Interface) in the Java SDK. It lists the following packages:

- The API enables Java programmers to develop varieties of applets and applications
- It contains **nine** packages
 - *java.applet* – for applet programming
 - *java.awt* – the Abstract Windowing Toolkit for designing GUI like *Button*, *Checkbox*, *Choice*, *Menu*, *Panel*, etc.
 - *java.io* – file input/output handling
 - *java.lang* – provides useful classes like to handle *Object*, *Thread*, *Exception*, *String*, *System*, *Math*, *Float*, *Integer*, etc.

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Now, I was talking about in API and its full form is application programming interface. Now, Java is great because of these APIs, the Java API is basically a very big one voluminous resource. And in fact, there are I mean nine packages and each package consists of a huge number of classes and their definitions and then their use.

So, all these classes you can use in your program; that means, it basically supports. So, there are nine packages there and then all packages are basically categorized to sub-different tasks. Now for example, there is one package called applet. So, this package is usually called Java dot applet. So, this package is basically suitable for writing applets in writing applet manual programming in applets.

So, applets as I already told you, an applet is for designing graphical user interface, graphical user interface means button, then checkbox, call window, then text field area, all these things. So, this is basically the applet packages will help you to create the graphical user interface very easily, without knowing details about how they are doing it, it's just like a magic if you run, know that ok. This is the one class that you should use to create your own button and then use it and then run it like this one.

Now, so Java applet is the one right is for applet programming and regarding applet programming, applet programming is a very past concept of course, and we will learn shortly. And then there is another package the name of the package is called Java dot

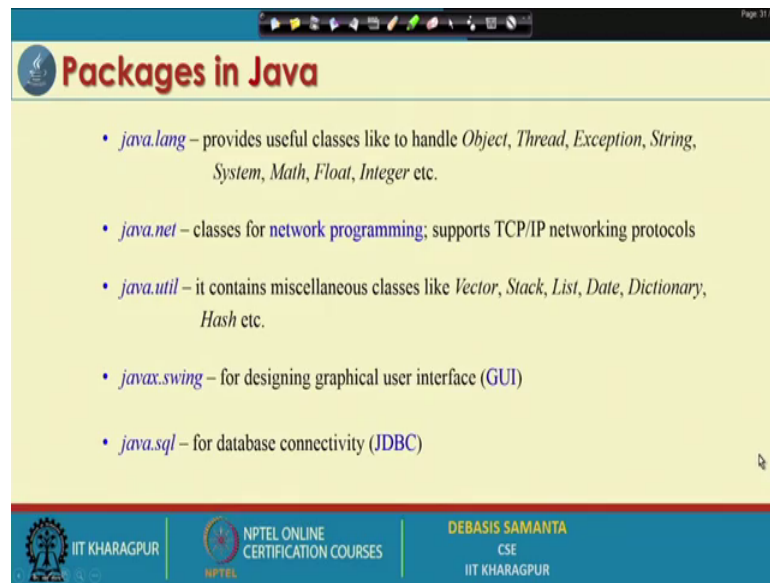
AWT it is called the Java abstract windowing toolkit. So, abstract windowing toolkit is basically another extension or is a basically support to develop GUI programs.

Then another package regarding input output handling, you can recall the different way the input can be considered, input from the mouse, input from the microphone, input from the document, input from the handwritten, gesture whatever it is there so, input from an image input from network so, how to deal with so, many versions of input. So, there is a package dot io package Java dot io which basically help you to take the input from many sources and then use in your program process it and then produce output according to the requirement.

So, Java dot io is basically suitable. Java dot lang is a another package which is basically frequently used package; that means, one program which always required one package that is a Java dot lang package, you cannot write any program without Java dot lang package. As this package is very important and essential and in all program it is required. So, it is not required to be explicitly imported that mean it will automatically included in your program, even if you do not input. However, other packages if you want to use it, then before using they should be imported in your program.

I will tell you how to import a package in your program or a particular class which belongs to a particular package in your program. So, that the concept; that means, a particular facility is that that can be imported in your program whereas, Java dot lang is a default package that can be imported automatically, and it basically give you the basic programming facilities that you can have if you have this Java dot lang package.

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The slide is titled "Packages in Java" and lists five packages with their functions:

- *java.lang* – provides useful classes like to handle *Object*, *Thread*, *Exception*, *String*, *System*, *Math*, *Float*, *Integer* etc.
- *java.net* – classes for **network programming**; supports TCP/IP networking protocols
- *java.util* – it contains miscellaneous classes like *Vector*, *Stack*, *List*, *Date*, *Dictionary*, *Hash* etc.
- *javax.swing* – for designing graphical user interface (GUI)
- *java.sql* – for database connectivity (JDBC)

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So, out of nine packages we have discussed 5 there are; few more important packages are there few more packages like Java dot net, net is basically the package suitable for network programming. Networking is a very important one features in Java programming. So, we can have the Java dot net package to develop our network protocol network programming, socket programming like this and Java dot util; util it is basically one advanced one programming which basically gives you many what is called the built in data structure.

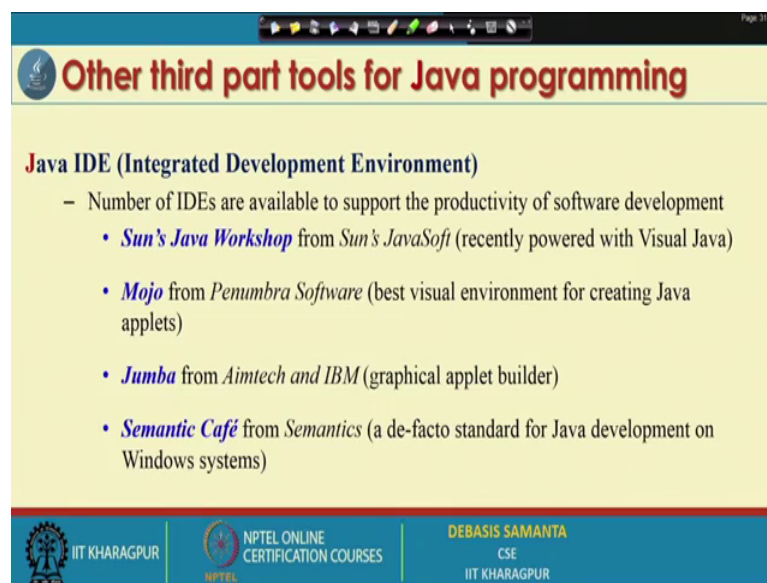
As you know data structure is a very important concept for programming; that means, you have to store the data in an efficient way, how you can store the data in an efficient way data structure tells about it. The many data structure like stack queue linked list vector all these things are readily defined in the package Java dot util one important dictionary data structure is called dictionary; that means, you can maintain a dictionary for any language to any language or dictionary for medical vocabulary or whatever it is there.

So, the dictionary data structure is already there, data structure means how to define the structure and then what are the operation already defined in that package. So, you just know about, that what are the facilities available and then you can plug in your program and then use it.

Then the one advanced packages those are there in Java latter on it is included, early in earlier version it was not Java version 5 onwards this package is used it is called the swing, swing just like AWT. But it is more interesting and more lovely things there in Java programming, Java swing basically another extension of AWT abstract windowing toolkit for supporting GUI development.

And for Java database connectivity there is one package it is called the Java dot SQL. So, this using this package, you will be able to connect to a remote server database from your application. So, these are the different packages, which are available in Java environment. And if you once install JDK with all programs that we have already discussed like javac, javap, and javaap, javah all these things in addition to this all this API also will be install automatically.

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The slide is titled "Other third part tools for Java programming" and lists several Java IDEs. The content is as follows:

Java IDE (Integrated Development Environment)

- Number of IDEs are available to support the productivity of software development
 - *Sun's Java Workshop* from *Sun's JavaSoft* (recently powered with Visual Java)
 - *Mojo* from *Penumbra Software* (best visual environment for creating Java applets)
 - *Jumba* from *Aimtech and IBM* (graphical applet builder)
 - *Semantic Café* from *Semantics* (a de-facto standard for Java development on Windows systems)

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So, in JDK is basically contains everything. Now, we told about the free softwares that is available all this softwares are free; however, as the Java is very popular and then many software developer many software engineering firm, they develop the program in a large scale, large scale to support the program many and sophisticated programming environment is all already available in the market. However, it is not free costly. There are few software development environment it is called IDE the full form is integrated development environment.

So, there are lot of IDEs are available for example, from sun microsystem itself one IDE is available, but it is not free of cost is a for the commercial purpose only called the Sun's Java workshop. It is very good one environment which can help you to develop your program very easily and in a user friendly manner. Mojo is the one good I mean comma popular one software development environment, it is from the penumbra software is a company basically suitable for creating Java applets.

Similarly, Jumba is from Aimtech and IBM it is also one environment suitable for Java applet programming. And the best I ever seen is called a semantic cafe, it is a very well known very popular and very sophisticated one programming environment it is called the semantic cafe. So, if you can afford you can purchase a semantic cafe right and then install in your machine, this software include everything your JDK the API the other programs and what is not. So, it will help you a lot debugging, testing, maintaining everything put together is a very nice programming and environment semantic cafe, but it is not free commercially the cost is too much actually individually level it is very difficult to afford.

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The slide is titled "Other third part tools for Java programming" and is part of a presentation (Page 31/31). It discusses the requirements for a Java environment, specifically mentioning the need for a Java-enabled web browser to support Java applets. It lists three popular Java-enabled web browsers: HotJava (from JavaSoft), Netscape Navigator (from Netscape), and Internet Explorer (from Microsoft). The slide also includes logos for IIT Kharagpur, NPTEL Online Certification Courses, and the presenter, Debasis Samanta, CSE, IIT Kharagpur.

Other third part tools for Java programming

Web browser

- Java environment requires Java-enabled web browser to supports Java applets
- Few (free) popular Java-enabled web browsers:
 - *HotJava* from JavaSoft web site (<http://java.sun.com>)
 - *Netscape Navigator* from Netscape home page (<http://home.netscape.com>)
 - *Internet Explorer* from Microsoft's web page (<http://www.microsoft.com>)

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So, these are the tools I should say the third party tools for Java programming environment. And there are few tools also available for browsing the softwares; that means, as you know the Java is suitable for internet programming and internet

programming means lot of webpage programming ja JSP Java script or Java browser related programming.

So, there are lot of browsers are also required, earlier when Java was introduced initially all browsers like internet explorer, then all these things are supporting. Nowadays all this browsers stop supporting Java browsing, there are some security issue that is why. So, all browsers cannot support your Java program to browse it directly actually, but the other way it can browsed and it can be executed. There are many security reason that is why the different browser has stopped running the Java program remotely actually.

And initially hot Java actually was introduced as a very beginning when the Java was introduced for the browsing purpose only, but the hot Java is also still available and you can use it, but hot Java is not so popular like Mozilla, Safari or Internet Explorer is popular Netscape Navigator also available as a browser it is windows NT environment or some other Unix environment net score navigator is available. This also supports Java in a full phase.

So, these are the browsers that you can think about it, but while you learn Java programming you usually use applet viewer as a Java browsing. So, for learning and practicing the applet viewer is fine, but whenever you have to deploy the program, the shape and different technology different concept needs to be followed. That will be discussed later on, but here till time we will not discuss about any other browser whenever we have to run Java applets or Java program we will follow applet viewer as a applet browser.

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The slide features a yellow header with the title "Few more from Java professionals" and a small logo on the left. Below the header, there are two main sections. The first section is for Net Beans, with a blue cube icon on the right. It includes the text "Net Beans - <https://netbeans.org/downloads/>" and a sub-point: "- This is one of the most commonly used IDEs for Java and some major languages." The second section is for NotePad++, with a green hexagonal icon on the right. It includes the text "NotePad++ - <https://notepad-plus-plus.org/download/v7.5.8.html>" and a sub-point: "- This is a very advanced and handy NotePad, it has several built-in tools and functions for making programming easy." At the bottom of the slide, there is a blue footer containing three logos: IIT KHARAGPUR, NPTEL ONLINE CERTIFICATION COURSES, and DEBASIS SAMANTA CSE IIT KHARAGPUR.

There are few more important resources available I am not sure whether it is available in a free version or not. There are obviously, a free is software available not in the full functionality for enable net bean. Net bean is very famous for building very large software it is just an IDE integrated developing environment.

It is free if it is available; obviously, not all features cannot be available, but it is at least some essential features you can have it so, it is an IDE. So, at least some IDE freely if it is available, then it is net bean you can install and then run your Java program using this net beans. And one editor I should mention it which is very good one editor and very sophisticated and versatile editor it is called the Notepad++.

Because you have to run the program, you have to save the program and those for typing the program all those things should be as fast as possible. So, that efficiently you can do it. So, Notepad++ is highly recommendable. So, that you can download it Notepad++ again is a free software. So, you can download freely and install in your machine and then use as a default editor. You can make the editor as a default this one. Now so, we have learn about the Java language Java tools and Java resources that you should hold, before you just warm up yourself into the Java programming environment and become a Java programmer.

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The slide is titled "A rich subset of the Java language" and contains the following categories and items:

- Built-In Types:** int, double, long, String, char, boolean
- System:** System.out.println(), System.out.print(), System.out.printf()
- Flow Control:** if, else, for, while
- Parsing:** Integer.parseInt(), Double.parseDouble()
- Boolean:** true, false, ||, &&, !
- Arrays:** a[i], new, a.length
- Punctuation:** { }, (), , ;
- String:** +, **, length(), compareTo(), charAt(), matches()
- Assignment:** =
- Objects:** class, static, public, private, toString(), equals(), new, main()
- Primitive Numeric Types:** +, -, *, /, %, ++, --, >, <, <=, >=, ==, !=
- Math Library:** Math.sin(), Math.cos(), Math.log(), Math.exp(), Math.sqrt(), Math.pow(), Math.min(), Math.max(), Math.abs(), Math.PI

At the bottom, the slide includes logos for IIT KHARAGPUR, NPTEL ONLINE CERTIFICATION COURSES, and the name DEBASIS SAMANTA, CSE, IIT KHARAGPUR.

Now, I am I just want to mention about few things, which is basically in Java commonly occur. So, sometimes you have to face all this thing again and again. So, these are called the subset of the language subset. In fact, a rich subset of the language, it is not possible to cover in one slide or in 5 minutes discussion it require in fact, the full discussion and we will learn all this subsets of the Java language one by one.

So, there are many built in data types, like Boolean, integer floating all these things, there are many system functions like println printf and all this thing. For example, in our program we have face that system dot out dot println this kind of things are there. So, many frequent and then common things are there. So, this slides includes the many common things those are there in your Java programming Java programming, or while you writing Java program you have to use it. Obviously, for the first time programmer all those things little bit looks like very difficult to understand, but once you are practiced it and then involved it. So, you will be slowly habituated all this term.

So, these are the subsets and I just want to skip this subset discussion, because it will be learned slowly, but consistently we will learn it, ok.

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Built-in data types in Java

In Java, every variable has a type declared in the source code. There are two kinds of types: **reference types** and **primitive types**. Reference types are references to objects. Primitive types directly contain values.

| Type | Size |
|---------|---------|
| boolean | 1 bit |
| byte | 8 bits |
| char | 16 bits |
| short | 16 bits |

| Type | Size |
|--------|---------|
| int | 32 bits |
| long | 64 bits |
| float | 32 bits |
| double | 64 bits |

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So, these are the basically standard data types, if you know C programming then you definitely know that what is a data types like, they are called the built in data type or primitive data type like Boolean. Boolean is a data type by which we can declare one variable, which record only 1 bit to store. And then byte: byte is a new data type which is there in Java in C++ also it is there, and there char is also there in C programming in Java and short is there. In addition to this there are few more data types like int, long, float, double if you know C programming then you can see that. These are the few data type which is there in Java also there in C.

And actually if you know C programming then learning C++ programming is very easier. And if you know C++ programming, then learning Java program is also very easier. Anyway, but if you do not know C++ programming absolutely it is not an issue, but there are many things are very common. So, for the syntax the commands and all these things, those are there in C programming also there in Java programming. So, it is an added advantage for the C programmer to cope with the Java programming environment.

Now so, far the data type is concerned all these data type that we have discussed call the built in data type, or simply they are called primitive. Because those are the data type already developed by the compiler, compiler can understand automatically you do not have to bother about anything about all this data type. Other than built in data type that is

more interesting to learn and you should learn it more skillfully so, that you have you are an expert in Java programming is called a reference data type.

Reference data type basically define your own data type our own type of data. As I told you object is also one type of data. So, the reference type it is called, or is called the abstract data type, or customer defined data type.

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The Java character set

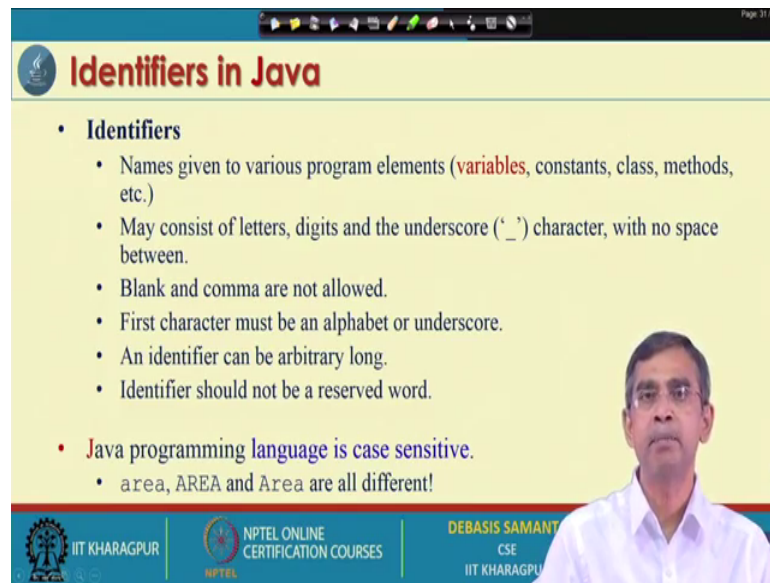
- The **J**ava language alphabet
 - Uppercase letters 'A' to 'Z'
 - Lowercase letters 'a' to 'z'
 - Digits '0' to '9'
 - Java special characters:

| | | | | |
|---|---|---|----|---|
| , | < | > | . | _ |
| (|) | ; | \$ | : |
| % | [|] | # | ? |
| ' | & | { | } | " |
| ^ | ! | * | / | |
| - | \ | ~ | + | |

So, regarding reference data type we will discuss in details in this course we learn about what are the reference data types are there, and how it can be developed, how it can be used how it can be manipulated modified everything right now. So, far the Java character sheet; that means, if you want to write a program, which character you should use which character you should not use.

Now, if you see the keyboard the qwerty keyboard that is there, lot of characters are there, but all keys you should not press to type your program. There are definite sets uppercase letters A to Z they are permissible the lowercase letter any a to z you can use in your program writing, any digits 0 to 9 you can use and in addition to this A to Z and the numbers, you can use some special character sets which is listed there in this table. So, these are the characters that you can use, other than this characters. If you use any other characters, then your compilation will be erroneous that there will be a error while the program is compiled.

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The slide is titled "Identifiers in Java" and contains the following content:

- **Identifiers**
 - Names given to various program elements (**variables**, constants, class, methods, etc.)
 - May consist of letters, digits and the underscore ('_') character, with no space between.
 - Blank and comma are not allowed.
 - First character must be an alphabet or underscore.
 - An identifier can be arbitrary long.
 - Identifier should not be a reserved word.
- **Java programming language is case sensitive.**
 - area, AREA and Area are all different!

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

Now, I can define; that means, naming of variables or class or methods, it should follow certain rule. The same rule that is followed in C program also C language, also applicable in java. That means, the name should be given to a programmer a program elements like variable, constant, class methods etcetera. The names may consist letters digits and underscore with no space in between.

That is very important and then blank and comma are not allowed, while you are naming a variable, or identifier or any type. The first character must be an alphabet or underscore. If you start a variable name or class with say number it sometimes gives an error, I mean it easily give an error in some compiler definitely advanced features it may not give, but it is usually not advisable to follow, then and I write an and name of the variable can be of any length there is no limit.

But again, unnecessary giving very large name to a variable or type is not a good. So, you should give very short name, but meaningful name. And I and one more thing that you should take into account is that the Java programming language is case sensitive. This means that if you declare a variable name as small x and then same variable other variable name as capital X, they are basically two different variable name.

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```
int a, b = 0;
a = 123;
b = 45;
int c = a + b;
System.out.print("The sum is" + c);
```

So, the case sensitive means the capital letter and small letter matters a lot and here is a free example right. The how you can declare the different type of variable for example, int a b we declare the two variable name as a and b. And, then b is initialized 0 like this 1 and then the system brought print is a system one statement by which we can print one message.

And whatever you want to print you should enclose in a sin double quote, if you type anything double quote it will print (Refer Time: 27:54) bottom on the screen. Then if you want to print anything else, then you have to write plus, then what are the other things. So, if you to the sum is the value of C then the syntax is like this one. So, all this things we will discuss whenever we will discuss the program it is there.

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The slide is titled "Array in Java" and features a diagram of an array named "marks". The array is represented as a horizontal row of cells. The first five cells are labeled with indices 0, 1, 2, 3, and 4. The last two cells are labeled with indices n-2 and n-1. Below the array, the text "marks.length = n" is displayed. The slide defines an array as a "finite ordered" collection of "homogeneous" data elements. It lists three tasks for manipulating an array in Java: Declaration of an array, Allocate memory for it, and Loading the values into array. The footer includes the IIT Kharagpur logo, NPTEL Online Certification Courses logo, and the name of the presenter, Debasis Samanta, CSE, IIT Kharagpur.

Now, I will quickly come to the discussion about array is a one very important structure in java. And array is basically instead of only one variable value or elements, we have to store a number of elements into a location or chunk or memory, then it is called the array is a basically finite set of is a collection of finite set of elements of same type; that means, integer or integer character or character float or float.

Now, we will quickly discuss about how an array can be declared in Java. And then once you declare an array. Then it is also your responsibility to allocate the memory for the array. So, how you can allocate the memory for an array and then how you can load the values into the array.

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Creating an array

| Declaration of array | Allocate memory for an array |
|---|---|
| <code><type> <arrayName>[];</code> | <code><arrayName> = new <type> [<size>];</code> |
| Example: <code>int x[];</code> | Example: <code>x = new int (100);</code> |
| <code><type>[] <arrayName>;</code> | |
| Example: <code>int [] x;</code> | |

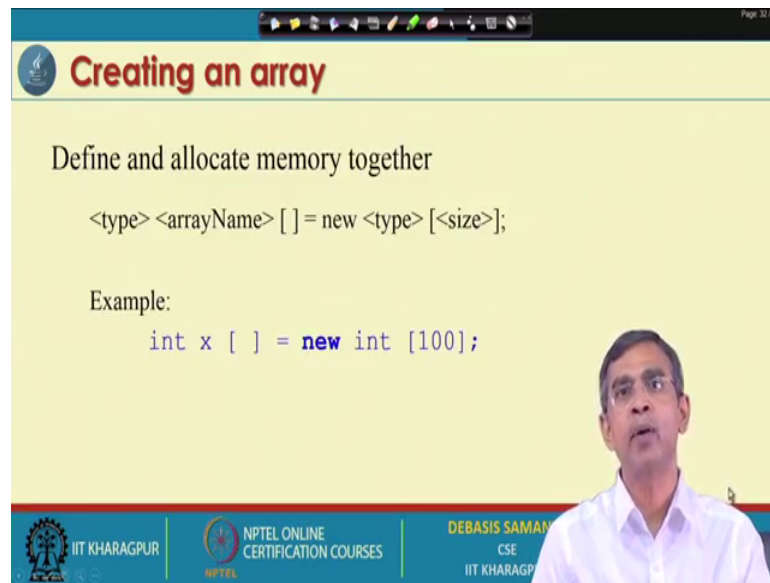
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So, those are the things that you can quickly learn about it. So, if you to declare an array say x, then the syntax it is there int x within square brackets. And then termination symbol is semicolon that you have to meet it. So, that is also alternative int square bracket x also the same way people can use it; that means, x is an array of integers.

Then one you declare an integer array, then you have to allocate the memory, for the allocation there is a operator it is called the new operator is called the memory allocator operator. So, you have to use the new and the syntax is like. So, if you new and then type; that means, what type of data you want to store and then this is the size and then this basically is the location where it is stored.

Basically the x is a array, this basically allocate the memory for storing 100 integers right. So, this is a way that the integer can be stored into an array of size 100.

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Creating an array

Define and allocate memory together

```
<type> <arrayName> [ ] = new <type> [<size>];
```

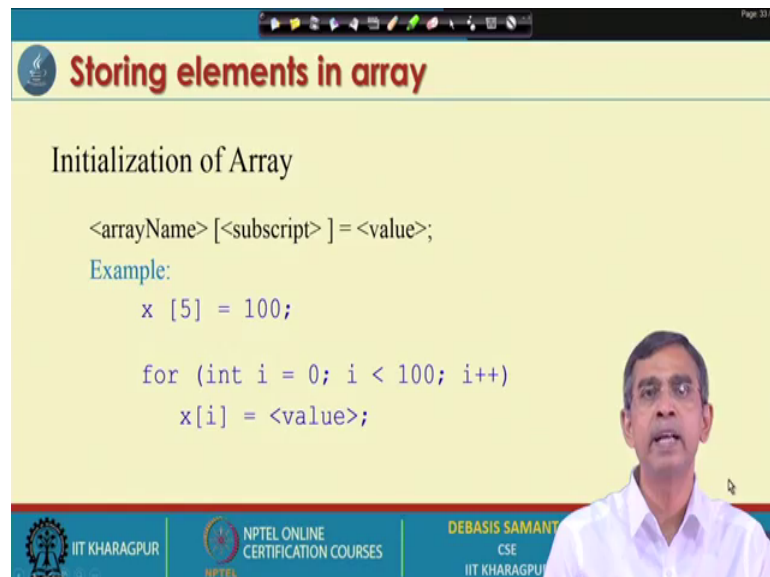
Example:

```
int x [ ] = new int [100];
```

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So, this is the way and then one shortcut also in one go you can define it like this, `int x new int this;` that means, the memory allocation as well as defining an array can be done in one go. So, this is a shortcut syntax for this. So, this is a syntax that you should use to declare an array of any size whatever you want.

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Storing elements in array

Initialization of Array

```
<arrayName> [<subscript> ] = <value>;
```

Example:

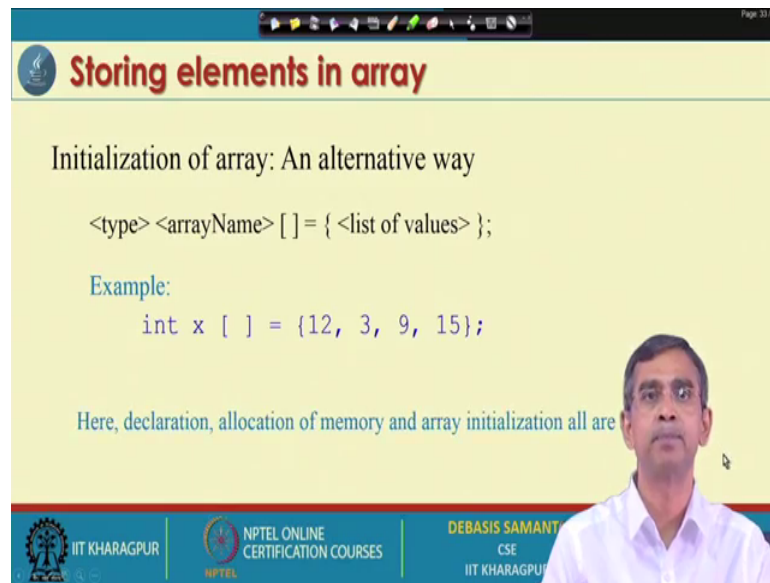
```
x [5] = 100;
```

```
for (int i = 0; i < 100; i++)  
    x[i] = <value>;
```

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So, this way you can create an array. And once you can create an array that array can be used using for loop while loop like this one.

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The slide is titled "Storing elements in array" and discusses an alternative way to initialize an array. It shows the general syntax: `<type> <arrayName> [] = { <list of values> };`. An example is provided: `int x [] = {12, 3, 9, 15};`. A note states: "Here, declaration, allocation of memory and array initialization all are". The slide includes logos for IIT KHARAGPUR, NPTEL ONLINE CERTIFICATION COURSES, and DEBASIS SAMANT CSE IIT KHARAGPUR. A small video inset of a man is visible in the bottom right corner.

And here is also alternative way array can be declared memory can be allocated and then value can be stored at the same time.

So, this is a simple syntax that you can follow for example, here an array of x will be declared which will store; that means, size of the array is four integers. And then the element that will be stored, there is 12, 13, 9 and 15 out of which 12 is a first element and one more thing that I you should note that just like in see the array index start from 0. So, that mean first array location is 0 x 0 and then x 1 x 2 and x 3. So, total index is from 0 to 3 in this case that means four elements.

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Processing elements in an array

- **Insertion**
 - Insertion at any location
 - Insertion at front
 - Insertion at end
 - Insertion in sorted order
- **Deletion**
 - Deletion of a particular element
 - Deletion of an element at a particular location
 - Deletion of the element at front
 - Deletion of the element at end
- **Searching and Traversal**
 - Finding the smallest and largest element
 - Printing all elements or some specific element
- **Sorting**
 - In ascending order, descending order, lexicographical order etc.

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And array can be used for many purposes, we have to maintain a large pool of data. And then, that data can be used either for searching some other element, deleting some elements, sorting, searching.

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Array in Java: A quick visit

- **Declaration of an array**
Examples

```
int numbers[];  
float averageScores[];  
int [] rollNo;  
float [] marks;
```
- **Initialization of an array**
Examples

```
int numbers[] = {5, 4, 2, 1, 3};  
float marks[] = {2.5, 3.4, 4.5};
```
- **Memory allocation for an array**
Examples

```
numbers = new int [5];  
averageScores = new float [20];  
rollNo = new int [49];  
marks = new float [54];
```

What is the size of the array `marks`?
`n = marks.length`

How to define a two dimensional array?

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And then traversal and others there so array in Java can be done the way I have already told you here, here is a simple few steps further.

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Creating a 2D array

Declare and Allocate

Example:

```
int myArray [ ] [ ];  
myArray = new int [3] [4];
```

OR

```
int myArray [ ] [ ] = new int [3] [4];
```

The slide features a hand-drawn 3x4 grid diagram with the text "3x4" written next to it. A video inset in the bottom right corner shows the presenter, Debasis Samanta, speaking.

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So, that you can follow it, and then I will discuss about that array that we have discussed is one dimensional array Java can help you to have any dimensional array. Here I am going to discuss about how the two dimensional array can be declared in Java. For example, say name of the array is same myArray this are your array that you want to develop you want to maintain and this is a two dimensional.

So, for the two dimensional you have to use the two square bracket. So, this completes declaring an array of 2 D and then this basically allocate the memory. So, myArray new int here two dimensional and then for each dimension what is the size, for the first dimension 3 and then this is the 4. So, this means that it will declare an array of 3 row 3 rows and 4 column so, 3 cross 4 the name of the array is myArray.

Alternatively this is also the one way syntax that can be used to declare, define and then allocate the memory at one point.

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The slide is titled "Loading a 2D array" and "Initializing a 2D array : An example". It shows a 2x3 grid of numbers: 1, 2, 3 in the first row and 4, 5, 6 in the second row. Below the grid, two Java code snippets are shown. The first is `int myArray [2] [3] = {1, 2, 3, 4, 5, 6};` with the numbers 1, 2, 3 circled and 4, 5, 6 underlined. The second is `int myArray [] [] = { {1, 2, 3}, {4, 5, 6} };` with the first row circled and the second row underlined. A small video inset of a man is in the bottom right corner. The footer includes logos for IIT KHARAGPUR, NPTEL ONLINE CERTIFICATION COURSES, and DEBASIS SAMANTY CSE.

So, this is the way that two dimensional array can be declared likewise 2 D array the 3 D array also can be used. Now, again 2 D array initialization can be done by using for loop. The way first you have to two loops here you have to use it.

Otherwise if it is a small array, then you can use this kind of syntax for the singular one dimensional array, we have used it in the same way. If you do it like this you will see the Java; Java system will automatically store this in the first row and then this in the second row like this one, if the array is like this. Otherwise you can just make it more structure within brackets, within brackets like 1, 2, 3 this 4, 5, 6 this one.

If 1 2 3 and is a blank then that element will be null and other element will be stored this way. So, this is more compact one way, that the array can be initialize 2 D, but this is only meaning for small arrays, but not good for the large arrays, large array we have to use the loop structure to initialize the elements.

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The slide is titled "Variable sized 2D array". It features a diagram on the left showing three rows labeled x[0], x[1], and x[2]. Each row is represented by a horizontal array of boxes. Row x[0] has 2 boxes, x[1] has 4 boxes, and x[2] has 3 boxes. Arrows point from the labels to the start of each row. Below the diagram, there is a bullet point: "Creating a variable-sized 2D array". To the right of this, under the heading "Another way: Example", there are two code snippets. The first snippet shows a loop that creates a 2D array row by row. The second snippet shows a direct declaration of a jagged array.

```
<type><2DarrayName>[] [] = new <type> [<rowSize>] [];  
for (int i = 0; i < <rowSize>; i++)  
<2DarrayName>[i] = new <type> [<colSize>];
```

```
int x [ ] [ ] = new int [3] [ ];  
x[0] = new int [2];  
x[1] = new int [4];  
x[2] = new int [3];
```

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And then the 2 D array with variable size also we can declare here for example, in this row only 2 column in this row 3 4 column in this row 3 column. So, that is a variable sized array also can declared and here is a quick syntax for variable sized array declaration here, basically the concept it is there. So, we can declare the 2 D array like this.

The declaration here row size is declared because the number of rows is defined here, but column size is not declared here, that that can be decided here using this one. So, for each row once it is declared using this one and then for each column can declare by rolling 1 for i is equal to 0 to i less than row size for each row. We have to run this and then these are basically name of the array, then this is the size that you want to do for example, here 2 3 4 you can mention it and then column size. So, this way you can build the array of any variable sized.

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The slide displays the following Java code:

```
class a3DArray {
    public static void main(String args[]) {
        int my3DArray [ ][ ][ ] = new int [3][4][5];
        int i, j, k;
        for(i=0; i<3; i++)
            for(j=0; j<4; j++)
                for(k=0; k<5; k++)
                    my3DArray[i][j][k] = i * j * k;
        for(i=0; i<3; i++) {
            for(j=0; j<4; j++) {
                for(k=0; k<5; k++)
                    System.out.print(my3DArray[i][j][k] + " ");
                System.out.println();
            }
        }
        System.out.println();
    }
}
```

Hand-drawn diagram illustrating a 3D array structure with axes labeled i , j , and k . The k axis is labeled with values 0, 1, 2, 3, 4. The j axis is labeled with values 0, 1, 2, 3. The i axis is labeled with values 0, 1, 2. The diagram shows a 3D grid of elements, with a specific element at (i, j, k) highlighted.

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Now, likewise the 3 D array also possible to maintain in Java also 3 D array is bit complex, we have a demonstration about 3 D array so, that we can understand here. So, a 3 D array typically just look like. So, if it is a 2 D array so, is a collection of 2 D array is basically 3 D array; that means, for each this page we can say and there is a collection of page.

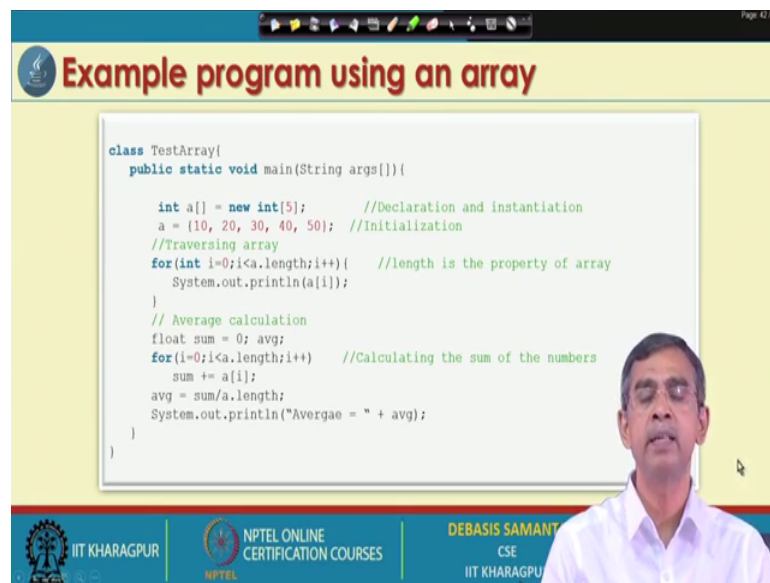
So, each elements in one page can be accessed by the number of rows and column. So, i j and then each page will be denoted by k . So, k is basically this is k equals to 0 k equals to 1 and this is equals to k equals to n if the n number of pages are there. And similarly for each page using just two dimensional concept you can access this one.

So, here is an example, this example you can follow it slowly with your own space, you can understand that this example basically how a 3 D array can be declared and its memory can be allocated. And finally, the different elements in it can be loaded. So, this the whole program you can check it slowly with your own time. And then you can also try to run it then you can understand how its there.

And here you can say for 2 D array we will need 2 loops for 3 D array we need in fact, 3 loops for. For example, in this case we use 3 for loops one loop for i for row variation, another loop for j for column variation for each row there are variation of each column. And then for each there is a column page variation.

So, this is an example so, that you can understand and you can practice it. So, we have learned about the basic few things particularly Java tools and resources and then the basic Java language subsets. And in the subsets only we have certain idea about Java arrays.

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Example program using an array

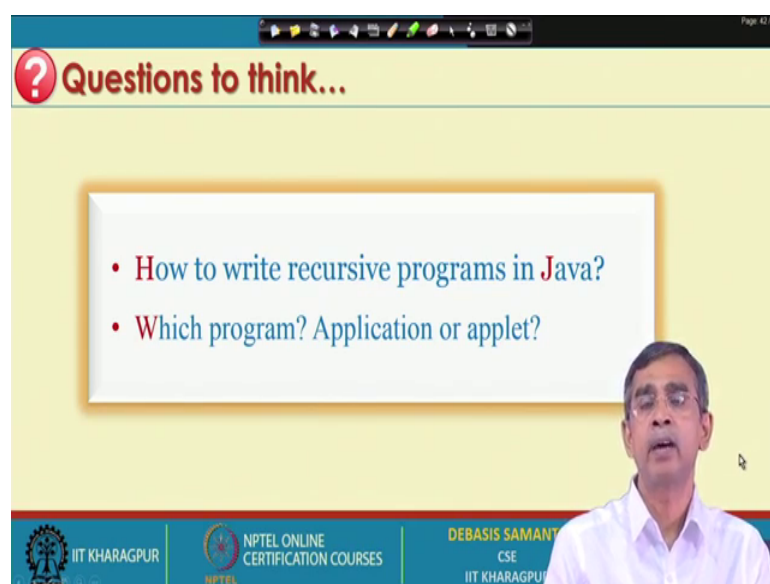
```
class TestArray{
    public static void main(String args[]){

        int a[] = new int[5]; //Declaration and instantiation
        a = {10, 20, 30, 40, 50}; //Initialization
        //Traversing array
        for(int i=0;i<a.length;i++){ //length is the property of array
            System.out.println(a[i]);
        }
        // Average calculation
        float sum = 0; avg;
        for(i=0;i<a.length;i++) //Calculating the sum of the numbers
            sum += a[i];
        avg = sum/a.length;
        System.out.println("Avergae = " + avg);
    }
}
```

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The array can be of 2 D and 3 D array like and done now next; obviously, more few more things also on the queue.

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Questions to think...

- How to write recursive programs in Java?
- Which program? Application or applet?

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That whether Java supports writing recursive program, probably you know the recursive program and if you know C programming. C programming is very good for writing recursive programs and recursive programs is basically an easy way to write very complex and difficult programming structure. Now java in fact, supports recursive program, then it is interesting to learn how we can write recursive program in Java. And then other features the input output in the Java and everything.

So, in the next lectures, we will discuss about all this advanced features in java, but before that I will discuss about applet programming. So, a quick overview of the applet programming once it is known to us. Then we can have a basic idea about the Java programming flavors.

Thank you very much.