

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

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.

(Refer Slide Time: 00:53)



Tools available for Java programming

- **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](#)
 - Official site for Java™ 2 SDK, Standard Edition

Page 31 / 31

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES | DEBASIS SAMANTA
CSE IIT KHARAGPUR

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.

(Refer Slide Time: 02:54)

The slide has a yellow background. At the top, there is a navigation bar with icons for back, forward, search, and other presentation controls. The title 'Tools available for Java programming' is displayed in red font, accompanied by a small icon of a computer monitor. Below the title, a bullet-point list details the seven main programs in the SDK:

- *javac* – the Java Compiler
- *java* – the Java Interpreter
- *javadoc* – generates documentation in HTML
- *appletviewer* – the Java Interpreter to execute Java applets
- *jdb* – the Java Debugger to find and fix bugs in Java programs
- *javap* – the Java Disassembler to displays the accessible functions and data in a compiled class; it also displays the meaning of byte codes
- *jvah* – to create interface between Java and C routines

At the bottom of the slide, there is a footer bar with three sections: 'IIT KHARAGPUR' (with its logo), 'NPTEL ONLINE CERTIFICATION COURSES' (with its logo), 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.

(Refer Slide Time: 06:24)

The screenshot shows a presentation slide with a yellow header bar containing the title "Tools available for Java programming". Below the title, there is a bulleted list of resources:

- 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>

At the bottom of the slide, there is a footer bar with three logos and names: IIT Kharagpur, NPTEL Online Certification Courses, and a photo of Debasis Saman with his name and affiliation.

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.

(Refer Slide Time: 08:06)

The slide has a yellow header bar with the title "Resource for Java programming". Below the title is a bulleted list of resources:

- 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 Microsystems's official website listing down all the API documents, Java Technologies, books and other resources.
<https://java.sun.com/reference/docs/>

At the bottom of the slide, there is a footer bar with three sections: IIT Kharagpur, NPTEL Online Certification Courses, and a photo of Debasis Samanta.

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.

(Refer Slide Time: 09:18)

The screenshot shows a presentation slide with a blue header bar. The title 'Packages in Java' is displayed in red at the top left. Below the title, the section 'API (Application Programming Interface) in Java SDK' is shown in bold blue text. A bulleted list follows, detailing the nine packages included in the API:

- 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*, *Pannel*, etc.
 - *java.io* – file input/output handling
 - *java.lang* – provides useful classes like to handle *Object*, *Thread*, *Exception*, *String*, *System*, *Math*, *Float*, *Integer*, etc.

At the bottom of the slide, there are three footer sections: 'IIT KHARAGPUR' with its logo, 'NPTEL ONLINE CERTIFICATION COURSES' with its logo, and 'DEBASIS SAMANTA CSE IIT KHARAGPUR'.

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

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

So, applets as I already told you 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 is 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.

(Refer Slide Time: 13:13)

The screenshot shows a presentation slide with a blue header bar. The title 'Packages in Java' is displayed in red text on the left side of the slide. Below the title, there is a bulleted list of Java packages:

- *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](#))

At the bottom of the slide, there is a footer bar with three sections: IIT Kharagpur logo, NPTEL Online Certification Courses logo, and a name DEBASIS SAMANTA from CSE IIT Kharagpur.

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.

(Refer Slide Time: 15:47)

The screenshot shows a presentation slide with a blue header bar. The title 'Other third part tools for Java programming' is displayed in red text on the header. Below the title, there is a section titled 'Java IDE (Integrated Development Environment)' in bold blue text. Under this section, there is a bulleted list of five Java IDEs:

- 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)

At the bottom of the slide, there is a footer bar with three sections: 'IIT KHARAGPUR' with its logo, 'NPTEL ONLINE CERTIFICATION COURSES' with its logo, and 'DEBASIS SAMANTA CSE IIT KHARAGPUR'.

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.

(Refer Slide Time: 17:59)

The slide has a blue header bar with the title "Other third part tools for Java programming". Below the title, under the heading "Web browser", there is a bulleted list:

- 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>)

At the bottom of the slide, there is a footer bar with three sections:

- IIT KHARAGPUR
- NPTEL ONLINE CERTIFICATION COURSES
- DEBASIS SAMANTA
CSE
IIT KHARAGPUR

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.

(Refer Slide Time: 19:57)

The screenshot shows a presentation slide with the title "Few more from Java professionals". It contains two sections, each with a software name, a link, a brief description, and an icon.

- Net Beans** - <https://netbeans.org/downloads/>
- This is one of the most commonly used IDEs for Java and some major languages.

- NotePad++** - <https://notepad-plus-plus.org/download/v7.5.8.html>
- This is a very advanced and handy NotePad, it has several built-in tools and functions for making programming easy.

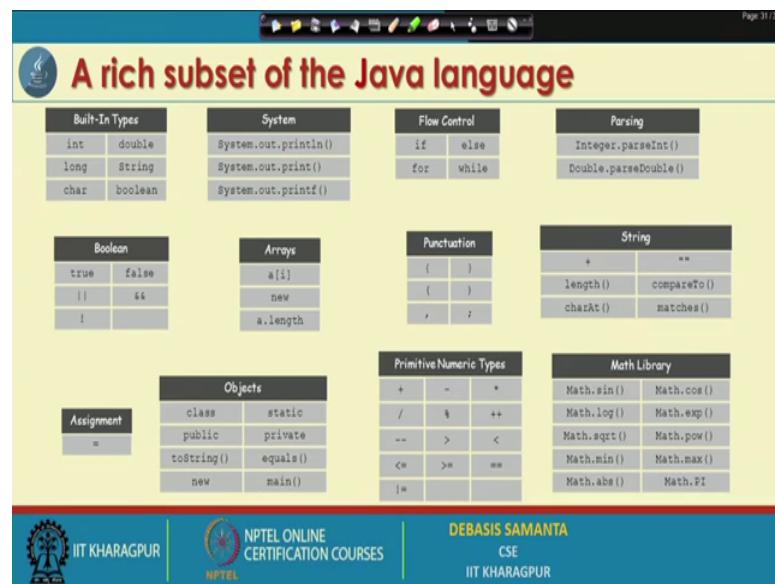

At the bottom, there are logos for IIT Kharagpur, NPTEL Online Certification Courses, and a contact for Debasis Samanta.

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.

(Refer Slide Time: 21:31)



The slide title is "A rich subset of the Java language". It contains a grid of tables illustrating various Java concepts:

Built-In Types		System		Flow Control		Parsing	
int	double	System.out.println()		if	else	Integer.parseInt()	
long	String	System.out.print()		for	while	Double.parseDouble()	
char	boolean	System.out.printf()					

Boolean		Arrays		Punctuation		String	
true	false	a[i]		{	}	+	" "
	&&	new		()	length()	compareTo()
!		a.length		,	:	charAt()	matches()

Assignment		Objects		Primitive Numeric Types		Math Library	
=		class	static	+	-	*	
		public	private	/	%	++	
		toString()	equals()	--	>	<	
		new	main()	<=	>=	==	
				=			Math.sin(), Math.cos(), Math.log(), Math.exp(), Math.sqrt(), Math.pow(), Math.min(), Math.max(), Math.abs(), Math.PI

Logos for IIT Kharagpur and NPTEL are at the bottom left. At the bottom center, it says DEBASIS SAMANTA, CSE, IIT Kharagpur.

Now, I am 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.

(Refer Slide Time: 21:50)

The slide has a title 'Built-in data types in Java' at the top. Below it is a table showing primitive data types and their sizes:

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

To the right of this table is a text block: '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.'

Below this is another table:

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

On the right side of the slide, there is a video player showing a man speaking. The video player has a progress bar at the bottom.

At the bottom of the slide, there are logos for IIT Kharagpur and NPTEL, and the name 'DEBASIS SAMANT CSE IIT KHARAGPUR'.

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.

(Refer Slide Time: 24:47)

The Java character set

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

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

IIT Kharagpur | NPTEL ONLINE CERTIFICATION COURSES | DEBASIS SAMANT CSE IIT Kharagpur

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 complied.

(Refer Slide Time: 25:47)

The screenshot shows a presentation slide titled "Identifiers in Java". The slide content includes a bulleted list of rules for identifiers and a photo of a man in a white shirt speaking. The footer features logos for IIT Kharagpur, NPTEL, and the speaker's name, Debasis Samanta.

- **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!

DEBASIS SAMANTA
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.

(Refer Slide Time: 27:24)

The screenshot shows a presentation slide titled "Datatype declaration rule". Below the title is the subtitle "Declaration and assignment statements". A code block contains the following Java code:

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

At the bottom of the slide, there is a footer bar with three sections: "IIT KHARAGPUR", "NPTEL ONLINE CERTIFICATION COURSES", and "DEBASIS SAMANT CSE IIT KHARAGPUR". On the right side of the footer, there is a video feed of a man speaking.

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.

(Refer Slide Time: 18:15)

The slide is titled "Array in Java". It features a diagram of an array named "marks" with indices labeled 0, 1, 2, 3, 4 on the left and n-2, n-1 on the right. Below the array, the expression "marks.length = n" is shown. A text box contains the definition: "An array is a **finite** **ordered** collection of **homogeneous** data elements." Below this, a bulleted list outlines three tasks: "– Declaration of an array.", "– Allocate memory for it.", and "– Loading the values into array." The footer of the slide includes logos for IIT Kharagpur and NPTEL, and credits to 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.

(Refer Slide Time: 28:55)

The slide has a title 'Creating an array' at the top. It contains two main sections: 'Declaration of array' and 'Allocate memory for an array'. Under 'Declaration of array', it shows the syntax <type> <arrayName>[]; with an example: int x[];. Under 'Allocate memory for an array', it shows the syntax <arrayName> = new <type> [<size>]; with an example: x = new int [100];. A handwritten note highlights the 'new' keyword and the size '[100]'. The slide footer includes logos for IIT Kharagpur, NPTEL Online Certification Courses, and Debasis Samanta, CSE, IIT Kharagpur.

So, those are the things that you can quickly learn about it. So, if you declare an array say x, then the syntax 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.

(Refer Slide Time: 30:07)

The slide has a blue header bar with a logo and navigation icons. The main title 'Creating an array' is in red at the top left. Below it, the text 'Define and allocate memory together' is displayed. A code snippet follows: <type> <arrayName> [] = new <type> [<size>];. An example is shown: int x [] = new int [100];. In the bottom right corner, there is a video frame showing a man speaking.

Page 32 / 32

Creating an array

Define and allocate memory together

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

Example:

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

IIT Kharagpur | NPTEL ONLINE CERTIFICATION COURSES | DEBASIS SAMANT CSE IIT Kharagpur

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.

(Refer Slide Time: 30:26)

The slide has a blue header bar with a logo and navigation icons. The main title 'Storing elements in array' is in red at the top left. Below it, the text 'Initialization of Array' is displayed. A code snippet follows: <arrayName> [<subscript>] = <value>;. An example is shown: x [5] = 100;. Another example is shown: for (int i = 0; i < 100; i++) x[i] = <value>;. In the bottom right corner, there is a video frame showing a man speaking.

Page 33 / 33

Storing elements in array

Initialization of Array

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

Example:

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

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

IIT Kharagpur | NPTEL ONLINE CERTIFICATION COURSES | DEBASIS SAMANT CSE IIT Kharagpur

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.

(Refer Slide Time: 30:34)

The screenshot shows a presentation slide with the following content:

- Title:** Storing elements in array
- Text:** Initialization of array: An alternative way
- Syntax:** <type> <arrayName> [] = { <list of values> };
- Example:** int x [] = {12, 3, 9, 15};
- Note:** Here, declaration, allocation of memory and array initialization all are done at once.
- Footer:** IIT Kharagpur, NPTEL Online Certification Courses, Debasis Samanta, CSE, IIT Kharagpur

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.

(Refer Slide Time: 31:18)

The slide has a blue header bar with a circular logo on the left and navigation icons on the right. The title 'Processing elements in an array' is in red at the top. Below the title is a bulleted list of operations:

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

At the bottom, there are three logos: IIT Kharagpur, NPTEL Online Certification Courses, and a photo of Debasis Samanta, CSE, IIT Kharagpur. The slide is numbered 'Page 33 / 33' in the top right corner.

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

(Refer Slide Time: 31:30)

The slide has a blue header bar with a circular logo on the left and navigation icons on the right. The title 'Array in Java: A quick visit' is in red at the top. Below the title are two main sections:

- 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};
```

On the right side, there is a question: 'What is the size of the array marks?' followed by the code 'n = marks.length;'. Below this, another question is 'How to define a two dimensional array?' followed by a photo of Debasis Samanta. At the bottom, there are three logos: IIT Kharagpur, NPTEL Online Certification Courses, and a photo of Debasis Samanta, CSE, IIT Kharagpur. The slide is numbered 'Page 33 / 33' in the top right corner.

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.

(Refer Slide Time: 31:44)

The slide title is "Creating a 2D array". It contains the following text and code:

Declare and Allocate

Example:

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

OR

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

A hand-drawn diagram of a 3x4 grid is shown to the right of the code. The grid has 3 horizontal rows and 4 vertical columns. A small coordinate system is drawn next to it, with a vertical line labeled "y" and a horizontal line labeled "x".

At the bottom, there are logos for IIT Kharagpur, NPTEL Online Certification Courses, and the speaker's name, Debasis Samanta, CSE, IIT Kharagpur.

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.

(Refer Slide Time: 32:59)

The screenshot shows a presentation slide titled "Loading a 2D array". The slide content includes:

- A title "Initializing a 2D array : An example".
- A 2x3 grid of numbers:

1	2	3
4	5	6
- Two lines of Java code:

```
int myArray [2] [3] = {1, 2, 3, 4, 5, 6};
```

and

```
int myArray [ ] [ ] = {{1, 2, 3}, {4, 5, 6}};
```

Both lines have handwritten annotations: curly braces are circled, and the entire second line has a large curly brace underneath it.
- A photograph of a man, identified as Debasis Samanta, CSE, IIT Kharagpur.
- Logos for IIT Kharagpur, NPTEL Online Certification Courses, and Debasis Samanta, CSE, IIT Kharagpur.

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.

(Refer Slide Time: 34:00)

Variable sized 2D array

x[0] x[1] x[2]

Creating a variable-sized 2D array

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

Another way: Example

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

IIT Kharagpur | NPTEL ONLINE CERTIFICATION COURSES | DEBASIS SAMANTHA
CSE IIT Kharagpur

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.

(Refer Slide Time: 35:09)

The screenshot shows a Java code editor with the title "3D arrays : An example". The code defines a class named "a3DArray" with a main method. The main method declares a 3D integer array "my3DArray" of size 3x4x5. It then uses three nested loops to initialize the array elements based on their indices (i, j, k) and prints them out. A hand-drawn diagram of a 3D cube is overlaid on the slide, illustrating the three dimensions: depth (i), height (j), and width (k).

```
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();  
        }  
    }  
}
```

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES | DEBASIS SAMANT CSE IIT KHARAGPUR

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, is 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.

(Refer Slide Time: 37:09)

The slide has a title 'Example program using an array' at the top. Below the title is a Java code listing:

```
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);
    }
}
```

At the bottom of the slide, there are logos for IIT Kharagpur, NPTEL Online Certification Courses, and a name 'DEBASIS SAMANT CSE IIT Kharagpur'.

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.

(Refer Slide Time: 37:12)

The slide has a title 'Questions to think...' with a question mark icon. Below the title is a list of questions:

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

At the bottom of the slide, there are logos for IIT Kharagpur, NPTEL Online Certification Courses, and a name 'DEBASIS SAMANT CSE IIT Kharagpur'.

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.