Problem Solving through Programming In C
Prof. Anupam Basu
Department of Computer Science & Engineering
Indian Institute of Technology, Kharagpur

Lecture – 22
Example of IF-ELSE

Till now, we have learnt about some constructs of programming. To implement some very generalized structures, programming structures, right. What are they? First, we have seen, how we can do Branching, right.

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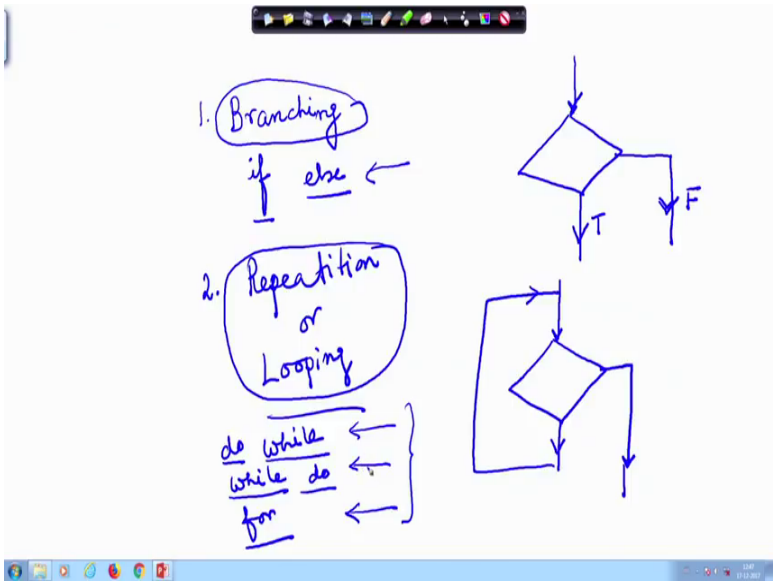

And Branching means that whenever there is a sequential flow, we take a decision pop or we come to a decision box and depending on whether the result is true or false; we take different paths right. That is what we have seen and that is implemented by if else statement right.

We have seen that and the other thing that we have learnt is repetition or looping all right. That means, we have come to a particular point, we take a decision and based on the decision, we decide whether we will go back to an earlier point or we will continue forward. So this is, this repetition we have we could achieve by While statement, do While statement or While do statement or for statement. So, if else and do while, while do, for all these are constructs in the C language.

Whereas, the concept of Branching and Repetition or Looping is general for most of the programming languages. So, these are general concept, while this is a specific construct corresponding to the C language. Now to start our journey into the world of real examples, let us first start with the school level equation solving.

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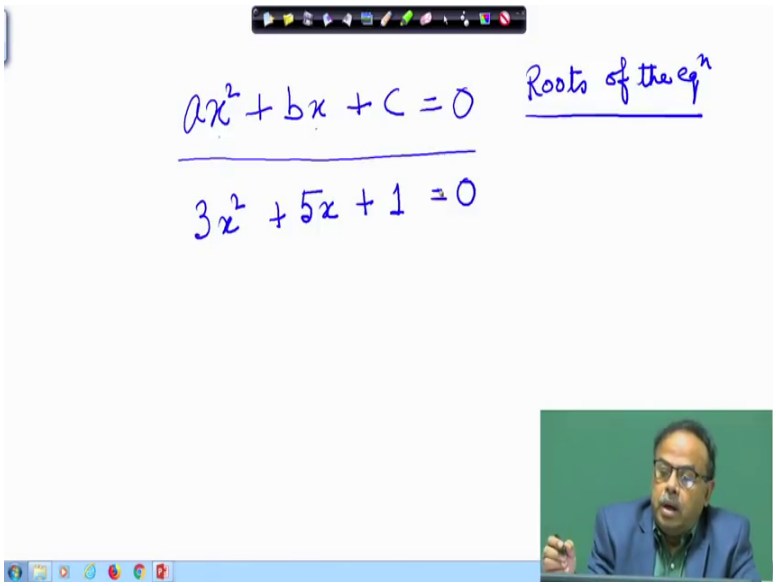

When we try to solve a quadratic equation of the form ax square plus bx plus c equals 0. We tried to solve it, means we wanted to find the roots of the equation. Roots of the equation of this form and what are the roots? The roots are the values of x that will saw, that will satisfy this equation.

For example I can have 3x square plus five 5x plus 1 equals 0 all right. What are the values of x that will solve that will solve this right. So, we knew.

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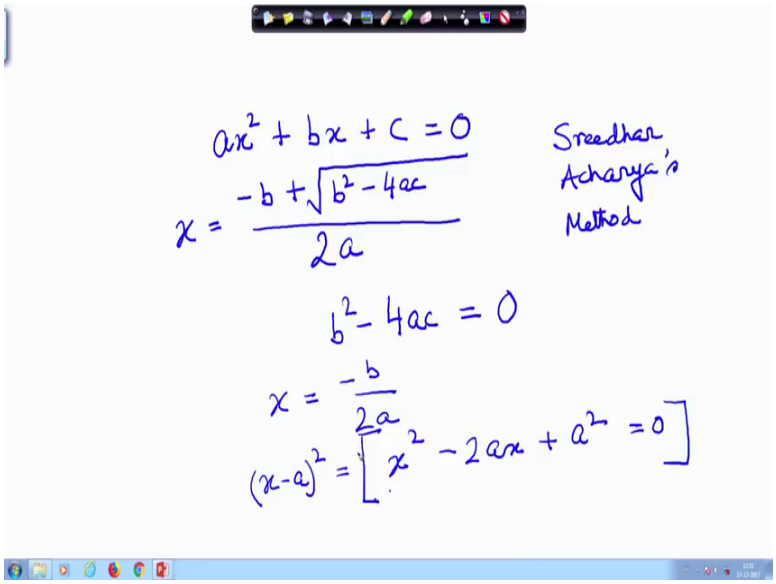

We know that, we can solve this general equation by the well-known Sreedhar Acharya's Method; that is x is minus b plus minus root over b square minus 4ac divided by 2a. By this, we can find the roots of this equation and since it is a quadratic equation how many roots will be there? There will be 2 roots. We also know that if b square minus 4ac is equal to 0 then, this part will be 0. What will be the roots? Roots will be minus b by 2a only.

So, there will be 2 roots which are equal. The same roots. For example, if I have x minus a whole square that is equal to x square minus 2ax plus, what will that be? Plus a square right. Now if I saw and if I say that this is equal to 0, from here I say that this is equal to o, if I solve it I will make this as x minus a whole square and; that means, x assigned a will be the root right. That means, x minus a is 0. So, x both the roots will be equal. So, if I have root over b square minus 4ac equal to 0, in that case I will have both the roots equal.

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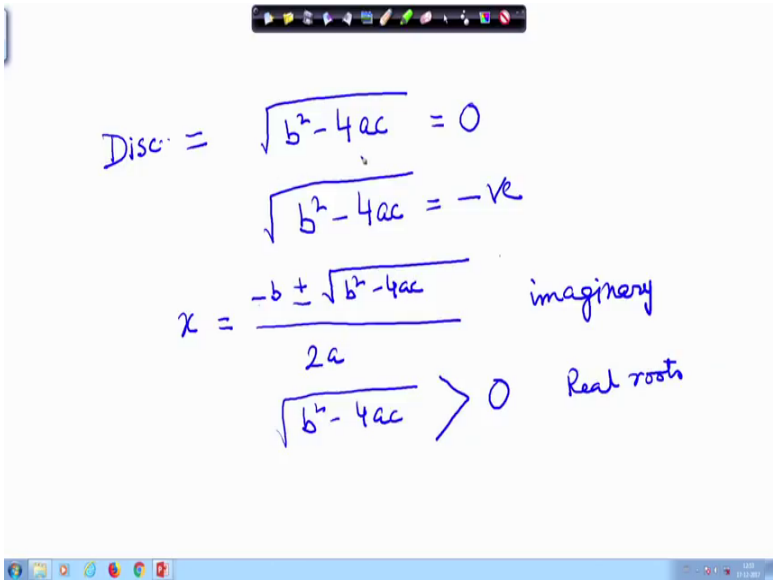

If root over b square minus 4ac is negative, we know then, our roots which are minus b plus minus root over b square minus 4ac by 2a; if this part is negative, then, the roots will be imaginary right. If b square minus 4ac is greater than 0, then, we will have Real roots right and the Real roots will be minus b plus this and minus b minus this by 2a. So, that will be that is a school level knowledge that we have.

Now, if I want to apply this knowledge, to write a program, that can take as input any equation of that form ax square plus bx plus c and find its root. How will the program look like? Suppose, I want to write such a program and now, henceforth in my discussion about this problem I will called, I will call this b square minus 4ac to be the Discriminate, I write it for short, Disc, as the Discriminate. Because that is, what is telling me discriminating between the roots Disc. So, whenever I refer to Discriminate; that means, I am talking of b square minus 4ac.

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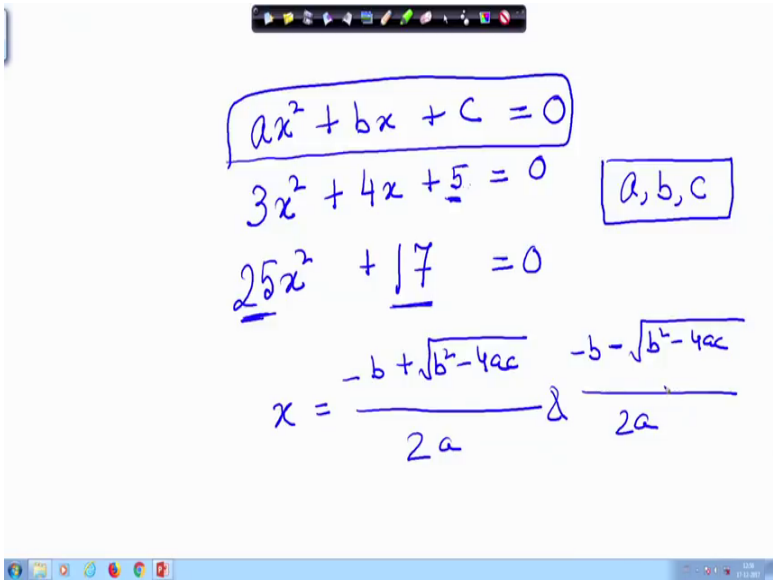

Now, I want to write a generalized program, for finding the roots of ax square plus bx plus c; so, equal to zero. So, I want to write a program that will be equally applicable to solve this root, this equation, solve this equation or 25x square plus sorry here I should not write c, let me put it something like 5. 25x square plus 17 equals 0 or any such equation. So, you see here what is the coefficient of x? Coefficient of x square is 25. What is the coefficient of x. In this equation it is 0, that is why this term has vanished and what is the value of c here? It is 17.

Whereas, in this equation the coefficient of x is 3, x square is 3, the coefficient of x is 4 and the constant term is 5. So, since I am going to solve any general equation of this form, how can I define the specific equation? An equation of this form can be specified by specifying the coefficients. So, I have to accept the values of a, b and c from the user and you can see that the root is dependent on the value of these coefficients, because we know the root x is minus b plus root over b square minus 4ac by 2a and minus b minus root over b square minus 4ac by 2a.

So, the roots are determined only by the value of these coefficients. Therefore, the 1st step that I will have to do here we can start with a flow chart.

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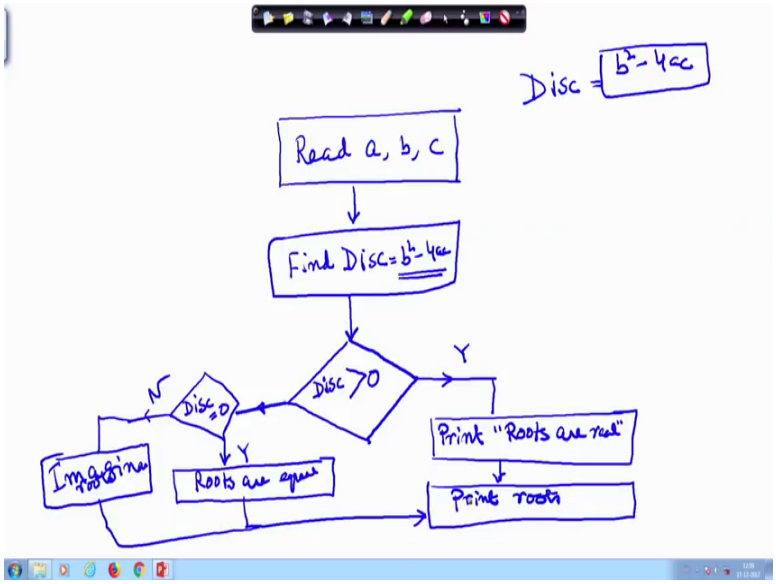

So, I will 1st, I write Read a, b, c. Read them from the user. Then, I compute, Find Discriminate equal to b square minus 4ac. I just compute this part, b square minus 4ac. Because depending on this, we will have the different values of the root or I would say all right. So now, so earlier probably I said that the Discriminate is root over b square minus 4ac. I would like to correct myself. I would say Discriminate is this part b square minus 4ac.

Because depending on the value of this, if this is negative, then, the roots will be imaginary. Because the square root of this will be imaginary. So, this is the Discriminate part. If this is 0 then, the roots are equal. If this is greater than 0 then, the roots are positive and real and if it is negative then, the roots are imaginary. So, at this point, I will make a decision. Discriminate greater than 0, yes. Then, what should I do? I will Print Roots are real and then, I will print the roots. If the Discriminate is not greater than 0 then, I come here and I check whether Discriminate is 0, if Yes then, my decision is Roots are equal and then I go and Print the roots.

If this is No, then, obviously, I will print Imaginary roots. I can see this part and then, I will go and Print the roots. That is the flow chart of the whole thing. So, I am computing this value and based on that, I am finding the roots. Now if the flow chart is clear to you, let us proceed to write the program for this. Now here, obviously, I should have said that

the Discriminate is actually this part b square minus 4ac and then, I take the square root of that.

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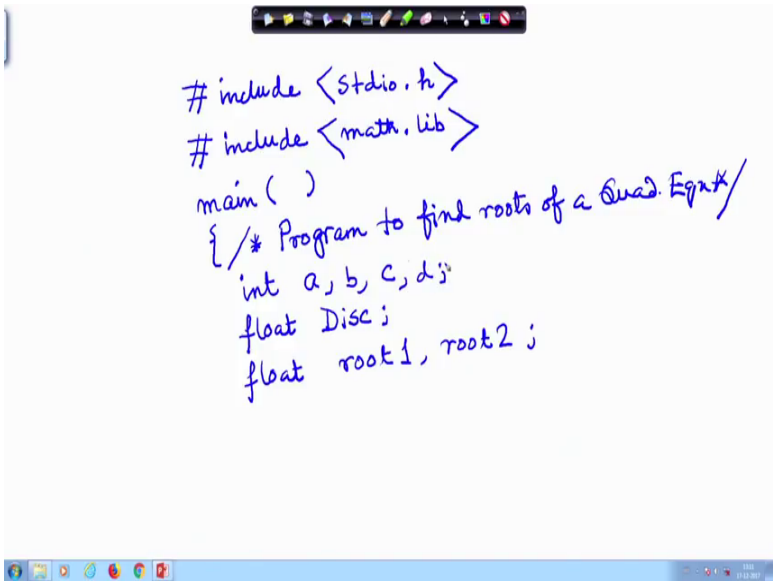

So, now if we start writing the program, if I am a nice programmer, I will always start with so, first of course, hash include stdio dot h. Then, I am including another thing which is a library called math dot lib. Dot lib stands for library. Why I am including that? I will come to that later. Now we start our program, main and we start. I can give a comment, program to find roots of a Quadratic Equation all right. So, that is a comment. So, anybody can understand, what I am writing here.

Now, I will have to declare a number of variables. I will declare the, lets say the coefficients are all integers. So, int a, b, c. Now b square minus 4ac can be anything. So, I put float Discriminate; also float root 1, root 2; 2 roots. Next, what should I do? Let me proceed, to the next page, with this declaration, I hope you have been able to take down this declarations.

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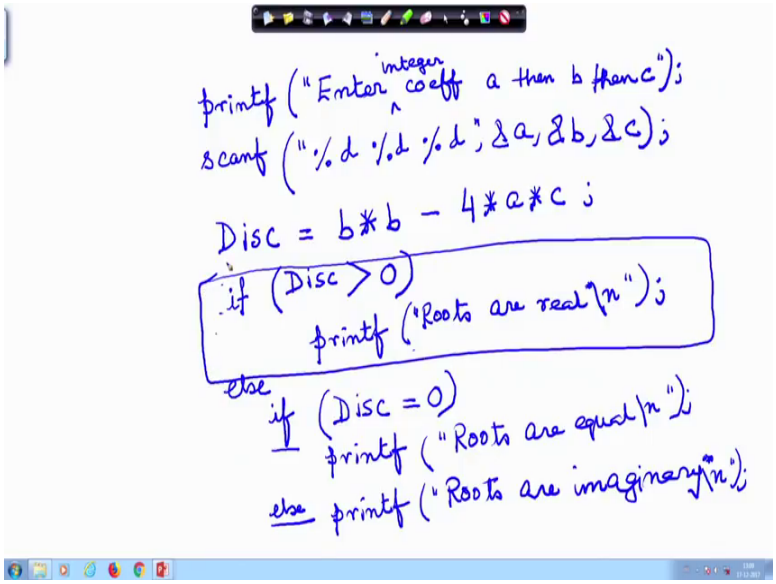

Now, lets proceed and go to the next page. I am continuing with that. I start with printf Enter coefficients a then, b then, c all right.

So, the user is told that, he is supposed to enter the coefficients now. Next thing will be scanf, since I know, I can also say that please Enter integer coefficients; I am just restricting into here like that, though its not necessary. So, scanf percentage d percentage d percentage d, and a, and b, and c. So, what I will do? My system will read the 3 integers a, b and c. Now starts the main program and as if you have studied the flowchart that I had shown, here you can see that, I have got only 1 decision box and I can proceed through that decision box. There are 2 decision boxes actually, one in this direction; another one in this direction.

So, accordingly I do not have any loop here. So, what is the construct that I will be needing here. The construct that I will be needing here is if. So, what should I do? First, let me compute the Discriminate all right. I have got this b, a and c. So, I do Discriminate assigned b square minus 4ac. So, b times b minus 4 times a times c. So, this is an arithmetic expression. I get Discriminate. Now I will have to take the path depending on the Discriminate. So, what I will write here is if then, a parenthesis for the condition if Discriminate is greater than 0, printf Roots are real and I can put a backslash in here else I have not computed the roots as yet ok.

So, let me write the else as close to the if as possible, as we have learnt about indentation. So, else if, I should have written this if also and small just for the sake of uniformity and at not only for the sake of uniformity, C is very much case sensitive. So, capital if is not if. So, if Discriminate is equal to 0, printf Roots are equal backslash n; else now this, else comes under this if, you remember that else and ifs are tied up, based on the closest the else is connected to the closest if. So, these 2 else, else the only option is Discriminate is neither greater than 0 nor equal to 0.

So, Discriminate is less than 0. Then printf Roots are imaginary and backslash n again. Now so, I have just said what type of roots they are. But I have not printed the roots as yet, we have not I have not found out the roots. So, what I can do? I can modify this a little bit or how do I find out the roots? Let me go to the next page. I do this and then, I come back to a particular stage or I can do it here itself. How would I find out the roots? Say, let me go back and do it here. Here, I have I have not written down, what the roots are?

How could I? Suppose I modify this part a little bit; I modify this part a little bit. So, let me modify this part, I will rewrite this part in the next page.

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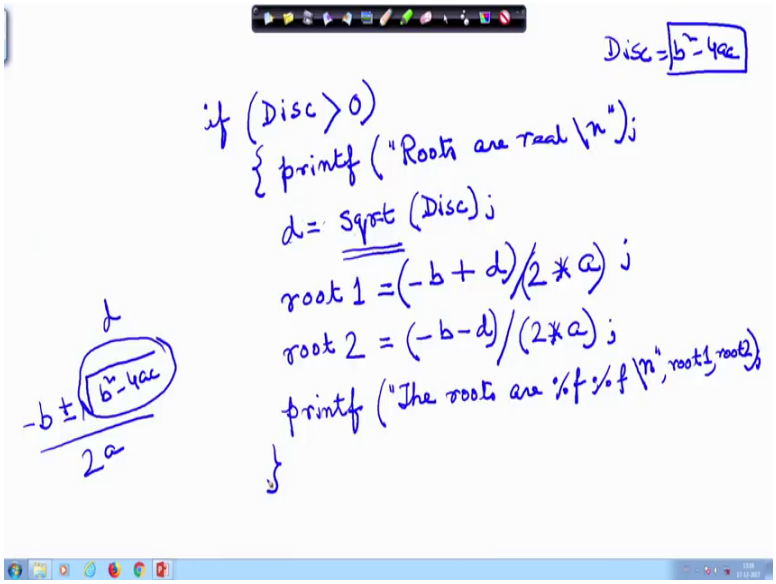

So, I rewrite it as, if Disc is greater than 0, printf Roots are real I find. Now I compute say I compute, lets call it, I should have declared this also Discriminate 1, another part that is, I had the Discriminate part. So, I can certainly make another variable. So, I add 1

more variable here, int a, b, c and here I entered another variable say d. Why, I will show later.

So, I have entered another variable d there. So, printf Roots are equal and d is square root of Disc. So, I called Disc to be b square minus 4ac. Now I am finding the root of that. Now here I have committed 1 mistake. Can you tell me what the mistake is? So, this Discriminate can be integer, but when I take the square root of that, it can be a float right and also here I have already declared, if you look at I Disc, I somehow declared Disk as float, but since a, b, c are integers, then, this will also be an integer.

So, I should correct it a little bit. What should I do? I or it really does not matter if I keep it as float. So, only thing is that I cannot keep the d here. I will have to remove this d all right and I will also remove this.

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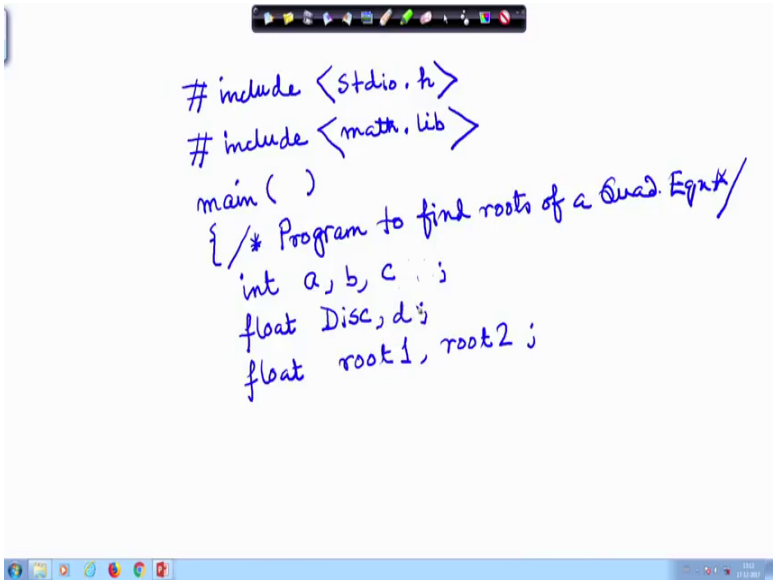

And will make this small d as a float. So, then I come here; d is square root of the discriminate. Now what is this square root? Who will compute this square root? The square root computation is done by an inbuilt function in C library. C compiler provides us with a library of some inbuilt function, mathematical functions which we can call and invoke whenever we need them.

So, you can see here, that is why I have included this math dot lib; that means, I will be using some library function here, dot lib means library. So, you will find in the course of

this core lectures and more examples, where you will see more number of library functions. But just for this, we need the square root function. So, I compute the square root of Disc d assign the square root of Disc and then, root 1 is what root one is minus b plus d by 2a. Is it clear? The 2 roots, one is I have my formula is b plus minus root over of b square minus 4ac by 2 a.

So, this b square minus 4ac is d here all right. So, b plus d whole divided by 2a, I should also put a parentheses here, is root 1 and root 2 is minus b sorry minus b minus d divided by 2a. Then, I have got the 2 roots and I can print here. So, I have computed the roots. So, I can either print it here. I can printf that The Roots can be float. I can say the roots are percentage f, roots are floats percentage f, percentage f backslash n and root 1 comma root 2. So, this is the whole part compound statement if Disc is greater than 0.

So, if we go up. So, I will modify this part in this way. We will also have to modify this part. What should you do? Simply, what can I do to write this? If Disc is 0 then, I will print roots are equal right, as I have written roots are real and then, I will find out; now I do not need to find out this part. So, let me just show you this part and I leave the other part for you.

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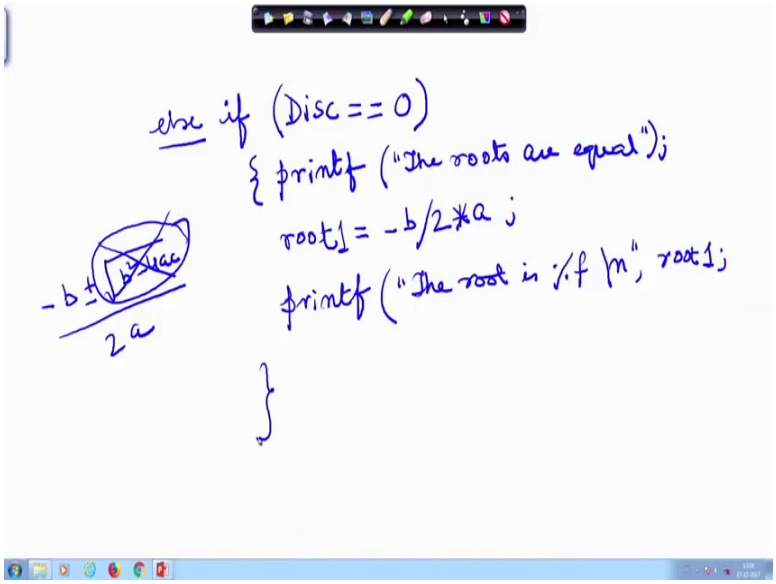

That second part, if Disc, oh my god what did I do here; this all right. It is greater than equal to, if disc is 0. Then, printf that the more than once sentences. So, this is coming else that else part, else if disc is 0; printf the roots are equal and here I donot need to

bother much I can put a backslash n, that you know by now printf The Roots are equal. Root is what?

Now, if in this, b plus minus root over b square minus 4ac by 2a, if this part is 0. Then, my root is only minus b divided by 2a 2 multiplied by a and printf The Root is percentage f backslash n root or I can say root 1, because I did not declare anything as root. So, root 1 anyone root that is same. This is this part if the Discriminate is 0. See yeah. So, I have just mentioned root 1. Why? Sorry, you see here I declared only root 1 and root 2, I did not declare any root. So, I can make root 1 root 2. Now, so this is replacing this part.

Now what will you do here? The roots are imaginary, but the same thing the values will be the same; only thing is roots are imaginary. I leave it to you as an assignment; you think off, what will you do for that part? For the imaginary part. You can understand that only thing that you need to do is to print some roots as say the real part. Real part is this and imaginary part is this. So, you think about it; we can discuss about it in the next lecture.