Problem Solving through Programming In C
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Lecture - 03
Flowchart and Pseudocode

In the last lecture we had concluded with a term called Algorithm.

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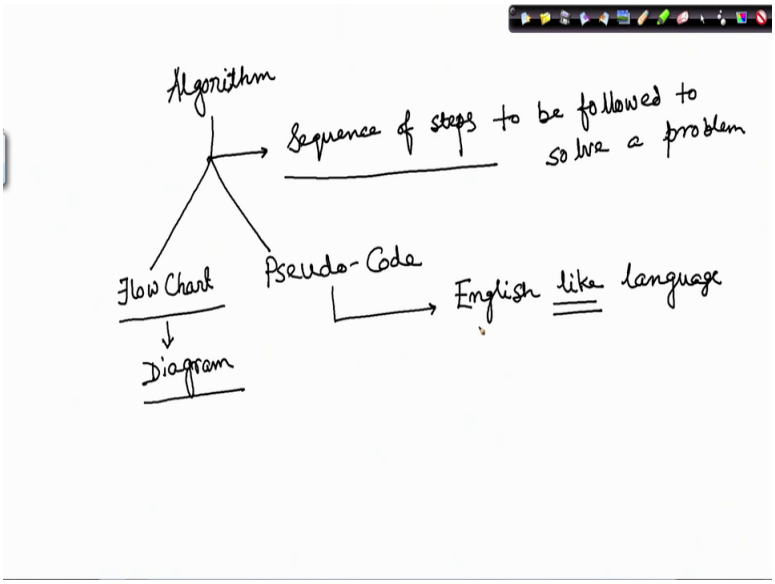

And we said that an algorithm means a sequence of steps that are followed to solve a problem; to be followed to solve a problem. Now the question is that how do we express an algorithm, how do we express the sequence of steps how do we express, that there can be different ways of expressing it right. So, usually ultimately we will have to write a program for this.

So obviously, program is the final form of expression of the sequence of steps, that we want to reach to, but even before that I mean a program is for communicating the sequence of steps to a computer, but even for our human exchange, we may like to express; what are the steps to be followed. There are 2 distinct ways by which an algorithm can be expressed one is flowchart another is pseudocode.

Now, a flowchart as the name implies is a diagrammatic representation of the sequence of steps it is a diagram. And pseudocode on the other hand is an English like English or

whatever in human language English like not exactly English, we can take a lot of liberty we will see how to when I express the sequence of steps, English like language to express the sequence of steps. Now we will show both the flowchart and pseudocode with respect to some of the problems that we had discussed earlier.

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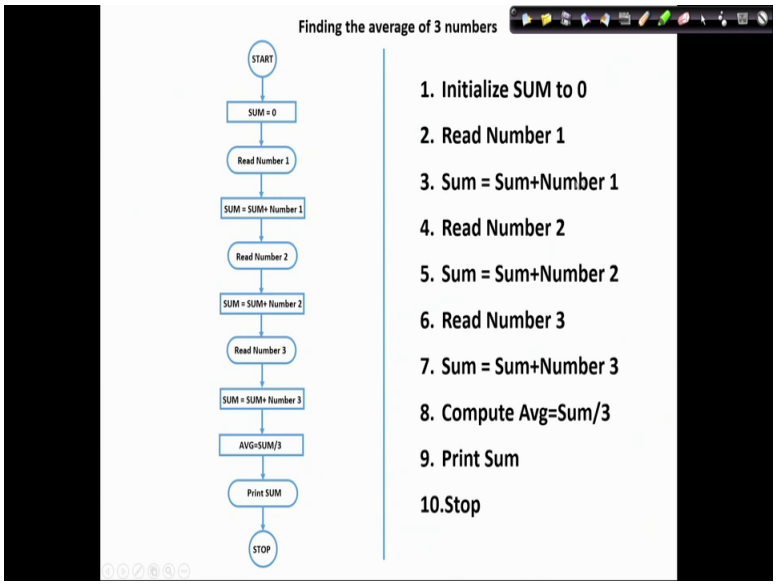

So, let us start with this finding the average of 3 numbers. This is the simplest possible way simple simplest possible problem that we can solve. So, we will start with the first we will start with the start node, we are trying to draw flowchart. So, once we draw this start. Then next will be sum assign 0. Now what all of us know that in order to find the average of any number set of numbers, we have to first add those numbers. So, the addition result is stated as sum. So, here we are when there is no number that has been we have already taken into account, we initialize the sum to be 0. So, right now sum is 0 right next what we do is we read the first number read number one.

Now, what does this read mean? Read means who is reading whom do you want to read; who ever who ever will be finding the average he or she will have to read the number. If I ask a human being to do that the human being will have to know the number. So, if I show that number on a piece of paper writing 5, he will read that number 5 and will say. So, 5 is the first number then I show the second number 7, 7 is a second number in that way that is the significance that is the meaning of this read.

Now, in our case ultimately the computer will read it, and earlier we had talked about um the input often we had discussed about this, this is also known as an input mechanism. So, it is reading the number, now here I would like to state a few things that is.

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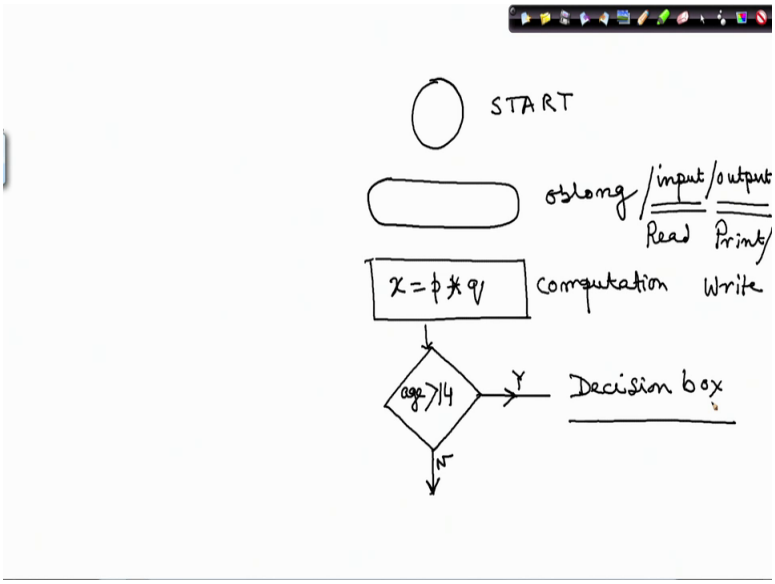

Say a flowchart has got some basic fundamental elements, this one you have already seen that is a start symbol.

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Now this figure is known as oblong.

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This figure is a rectangle. Now this oblong is actually used for input and output power I mean specification wherever I need to do some input or the system provides me some output let me explain. So, input I have already explained that when I am writing some number for you to read or for the; anybody will do the computation to read that is the input. And you know all of you that we have got some input devices the most standard input device is the keyboard using which we can put in the data. the output is after the computation is done the system will or system will give me the output or if it be a human being who is doing the computation, he or she will be telling me the output that is the result. So, that is known as output.

So, while drawing a flowchart sometimes we will write read for this input, and maybe print or write for output. Now this diagram is essentially the computation box. So, whenever we do some computation, that we show in this sort of a box for example, we can say x is p multiplied by q something like this. Or the other very important block is the decision blocks block which looks like this a diamond now here what we do we just take decisions depending on some conditions. Depending on some conditions I will either take the left path or the right path. So, for example, I can say whether the age of a boy is greater than 14.

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If the age of the boy is not greater than 14 he is not allowed to go to a film. So, if it be no, then he cannot go to see a particular film, and if it be 14 or greater; that means, it is greater than 14, if it is yes then he can go to a film. So, we come to this particular point and make a decision looking at this out of scenario. So, this is known as the decision box.

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Now, these are the basic 4 elements of any flowchart. Now, we will again come back to our flow chart. So, you can see here that sum is 0 and the number that has been read is the first number right. Now suppose that number that was read is 5; so some number. So, next what I do is, I add that particular number with the sum. So, now, if the sum was initially 0; so I add 5 with sum. So, if becomes the total sum becomes 5. So, next what should I do after I computed the sum, then I read the second number because I have to read 3 numbers and find the average. I read the second number and then I add the second number with the sum the first number was 5.

So, the value of sum is now 5 I have read the second number suppose that was 8, then the sum becomes 8 plus 5 that is 13. Now I come and read the third number suppose it is 3. So, I read the third number and then I compute the sum. So, I have computed 3 the sum to be 13 plus 3 16, next what do I do? I have to compute the average. So, what I do I find the AVG is by AVG? I am depicting the average, average is sum divided by 3. So, it was what was it 13 plus 3 16 divided by 3. So, it will be 5 point something. So, that result whatever I get that I will be printing. So, that is a flowchart these are the steps that I have to do.

Now the same thing I can express in the form of a pseudocode or English like language let us see how it looks like. Here you just see what I have done, I have initialize I what I wrote in the first step is this one is equivalent to this initialize the sum to 0 and then I read the first number, sum is added sum equals sum plus number one exactly what I did here read the second number then I sum equals sum plus number 2, and then I read the third number and then sum is sum plus number 3.

So, these are the steps you see exactly if you just do not look at the left part of the whole thing, if you just look at this right part you can also understand what are the steps through which I must go and. So, ultimately I compute the average which is I just write. So, it is English like compute AVG equal. So, it is not exactly English, it is English like anybody who knows English will be able to understand this. So, this is known as the pseudocode.

So, this is for the very simple problem that we are doing. Now suppose let us think off for a second that suppose instead of 3 numbers I ask you to find the average of 10 numbers how would the flow chart look like? Obviously, this same thing that I have done here read number 3 read number 4 read number 5 read number 6 in that way it will go on and on and on, had it been 100 numbers there will be even larger.

Now, can we do something better in order to I do not have so much paper to waste. So, can I write it can I express it in a much better way?

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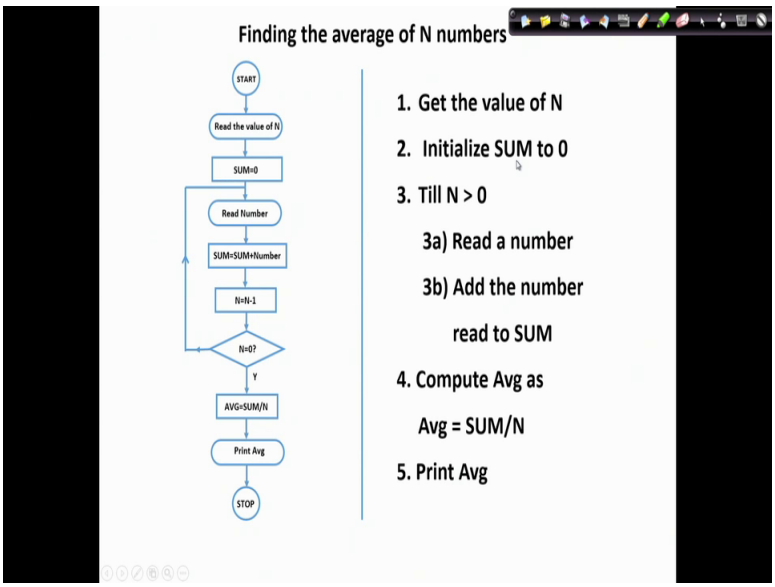

So, let us go to the next problem where we want to find the average of N numbers average of N numbers I want to find out. So, the first thing will be again start that is from where I am starting next is read the value of N. So, what is this value of N? Now if I say this value of N when I read what is this N? This N is telling me how many numbers I will be considering for finding the average is it 100 is it 1000 is it 10 whatever. So, I am that is n.

So, I am reading the value of n, now I am initializing the sum to 0 again just as before I initialize the sum to 0 and then I read now you see here I have written read number I have not written read number one earlier since I had to only do number one 2 and 3 here, there I wrote down number 1, number 2, number 3, here I am just writing read number, because I do not know how many numbers I will be reading the reason will be very clear soon.

So, next what do? I do I read the number the sum is sum plus number. So, I take the sum was 0, I take the sum and at that number which number? The number that I just now read say- I have just now read number 5. I have read just now I am sorry I just read number 5. So, I read number 5 and I have added that number with sum. So, sum is now 5, next I decrement this is a new thing that is coming up here. Since I know here at this point the user or the whoever supplied the data told me that you have to look for 100 numbers say N is 100 I have learnt that. Now, here I have read one number and I have taken care of that number because I have added that with sum and. So, therefore, I now decrement that value of N what does this signify? This signifies that I now since initially it was 100, I have to read 99 more numbers 99 are yet to go.

Now, I have to check have I read all the numbers, what is the value of n? The value of a N is 99; that means, N is not 0; that means, I have not been able to read all the numbers. If I have since in a decision box as I have told you just a couple of minutes earlier that I can have 2 options, I can either have yes or no answer if N is equal to 0 what does that signify? If N is equal to 0 that signifies that I have read all the numbers I have already read all the numbers, then I can compute the average as sum whatever sum I got divided by N.

Otherwise if N is not equal to 0 then let us look at here if N is not equal to 0 no then I will go back here again look at this part I will go back here again and read number. I read

that second number read and add it to sum I will go over here decrement. So, I have read to number. Now, how many are yet go 98 N is 0 no, N is not 0 N is not 0. So, I go up again I read another number add that particular number to the sum decrement N how many to go 97 is it 0? No not yet 0.

So, I go on in this way I will go on in this way ultimately after I have read the hundredth number this N will become 0. So, at that point I will come to this average and compute the average as sum divided by [noise], and then I will print the average and stop. So, see is just by this thing I am sorry just by this thing which is nothing but this is called the loop this is called a loop and using this looping repetition I could reduce the length of the flowchart the repetition of the flowchart in a very elegant way, I hope it is clear. So, the same thing can be also reflected in the flowchart.

Now compared to the with the earlier flowchart, earlier statement here when I read it only for 3 numbers, I read initialize sum to 0 read number one read number 2 and at every point I was adding it to sum, here what I do is I write it in a little bit flexible way, because when I write in a pseudocode I am not very constrained I can take the flexibility as long as I can express myself its good enough I just wrote get the value of N earlier probably I wrote read the value of N means the same thing.

So, get the value of N initialize sum to 0, and till now here I am talking of this looping till N is as long as till means as long as N is greater than 0, it will better to say as long as N is greater than 0, read a number at the number read the number that you have read to sum you read a number add the number read to sum. And one thing I missed out here and you decrement N you decrement N here you have to make N equal to N minus 1 in your note you please take it down that here it will be N n minus 1. And so this till N as long as N is greater than 0, I will be going on doing this after that I will compute average as average divided by sum average is sum divided by N I am sorry and then I will print the average. So, I can express it either in the form of a flowchart or in the form of a pseudocode.

Now, let us take a; I mean it is not very visible here, finding the maximum of 3 numbers that was another problem that we had discussed last time. What I am trying to do is I am trying to find the maximum of 3 numbers. So, how can I go about doing the flow chart?

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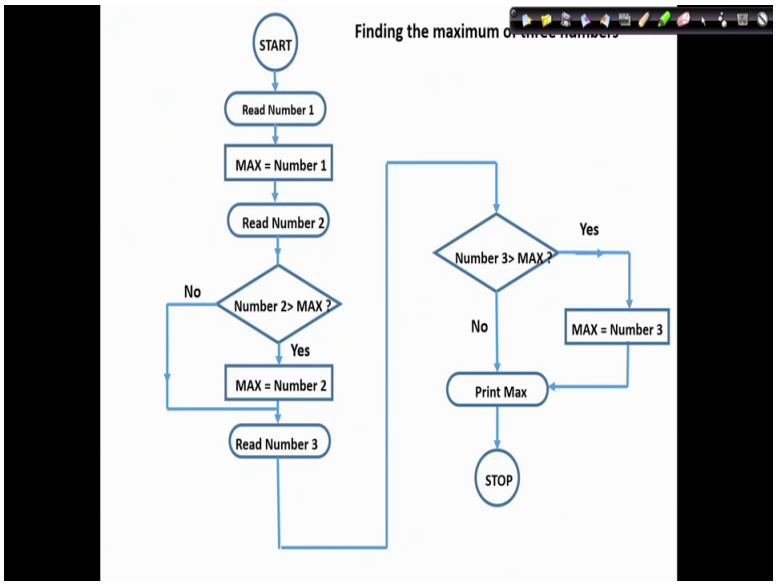

So, I start just 3 numbers not a large set of numbers, I first read the number one. Now tell me one thing when you are first read one number; what is the maximum number. Obviously, since you have read only one number that itself is a maximum only one. So, it is a single ton. So, it is the maximum. Therefore, I say that max is nothing but the first number, the number that I have read max is number 1.

Now, I read the second number I read the second number; now which one is the maximum if the second number is greater than the first number, then the second number will be the max. Now when I read the first number when I read the first number here, I said that to be the max. Now, after reading the second number I can compare the second number with respect to the max. If the second number is greater than the max, then what will happen then number 2 will be the max. If it is yes the number to become the max and if no; that means, what number 2 is not greater than the max then I skip this part. I skip this part and go out by this way skipping this part; that means, at this point who is the max; obviously, at this point I had number one, and number 1 is still the max I hope its clear.

Next I read the third number, again I do the same thing after reading the third number is the third number greater than what number 2 should I compare no. I should compare with the max because till now between number 1 and number 2 whatever is the maximum I have already remember that in max. So, I read the number 3 and then again

compare is number 3 greater than max, I can have yes or no. So, if it be yes then number 3 becomes the max because number 3 is greater than the maximum number till now.

And then I will proceed and if not if number 3 is not greater than max then I will. Then obviously, whatever was the max till now, that is the number one that will remain the max think of number 1 to be 5, number 2 to be 3 and number 3 to be 1 what will happen? 3. So, max is 3 sorry this was 5. So, I read 5 next I read 3 is 5 greater than 3 no. So, I kept 5 as the maximum alright, I read number 3 that was 1, I compared is it greater than the maximum which was 5 no then I print that 5 which is the maximum, but if suppose number 3 was 7. So, it is greater than 5.

So, then I can go here and update this max to be number 3 or the 7, and then I come to the print max part. So, this is a flowchart of finding the maximum of 3 numbers and consequently you can see the pseudocode of this.

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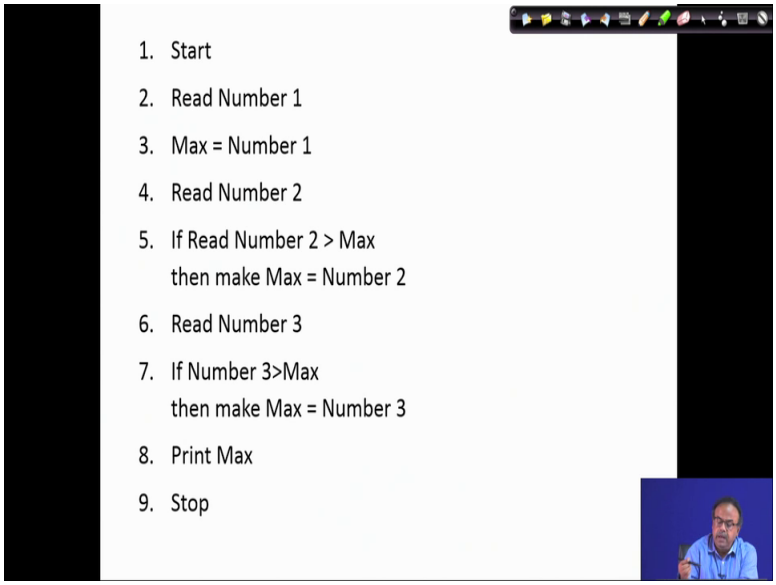

Start read first number, then I assign max to be the first number, then I read the second number assigned. Now if number read is greater than max, then I will make the max to be number 2. If the number read if the if its badly written read number it is wrong it if number 2 is greater than max then make max number 2. Then read number 3 if number 3 is greater than max, then min make max number 3 otherwise you are continuing.

So, if number 2 is not greater than max then I am reading number 3 I am not doing this part. This is another way of explaining the pseudocode. So, the same thing now we come to another variety of this finding the maximum for N positive int N positive integers, here I have taken a little liberty the finding the maximum of N positive integers, earlier I was doing it for all numbers, but just as a change. So, let us see.

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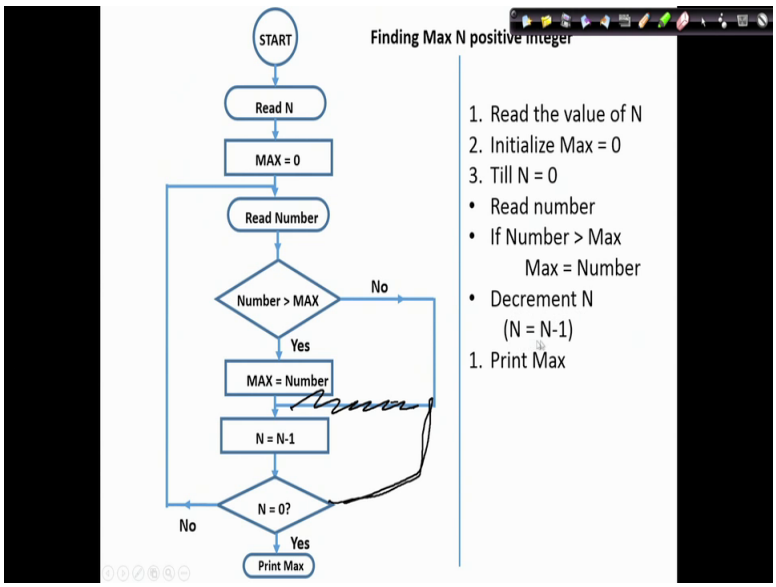

I read N again, N means the number of numbers that I want to read. Now I set max to 0 why do I set max to 0? Because I am trying to find the max of N positive integers, any positive integers will be greater than or equal to greater than 0. So, I am putting that max to the minimum value possible and then I am reading a number I read a number and if that number is greater than max, which is by default 0 I have kept it as the bottom was possibility. In all unless that number is 0 it will always be greater.

So, I will set that number to be the max, next again you remember what I did for finding the average? I reduce the value of N. Suppose I had to do find the max of ten numbers. So, N becomes now 9 and then I check. I have the max sorry this is a mistake here. This arrow, this arrow should come from this point this arrow should come from this point. So, I am just drawing it here I am drawing it here.

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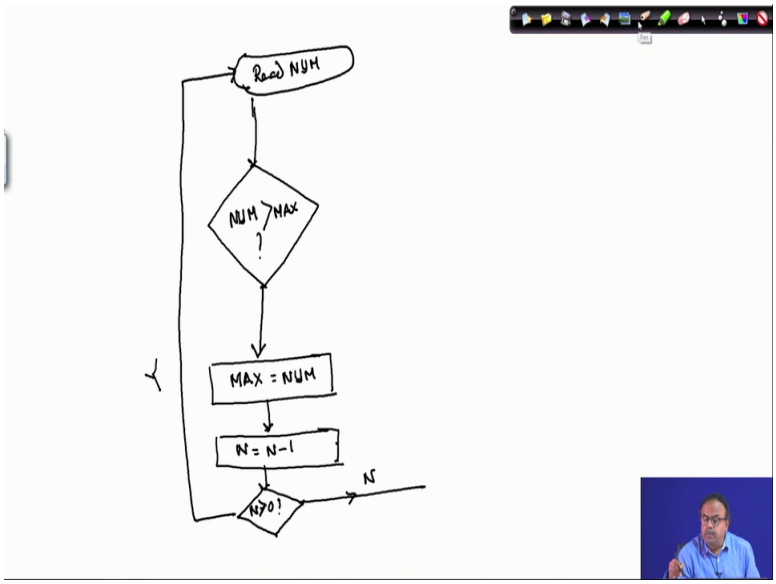

It should come like this. So, I have read a particular number and then if that particular number is greater than max, I am sorry I read a number and if that number is greater than max then I will if it is true, then I will make that number to be the max right max will be that particular number, and then I check N I have already read N. So, is N 0 then I have read one number and then I reduce N, just as I did in the earlier case and then I check any N greater than 0. If yes then I have to go back and again read a number right read number and this will go on as long as N is greater than 0. If N is greater than is not greater than 0 no then I will come and print the max.

So, there was a little error in that diagram which you will be able. So, you can see that this line should have come from here is N 0 yes then print max, otherwise this should have come from this point this is wrong. So, in this way we can again find the max for N numbers it is a flowchart. So, again I can have the pseudocode for this. So, a pseudocode for this is shown here, read the value of N here initialize max to 0, till and till N is 0 read the number if number is greater than max, max is equal to number decrement N, N is N minus one and then it will be not one here it will be again print the max.

So, in that way you have seen examples of some intermediate representation of the sequence of steps or the algorithms. We will encounter a number of algorithms in the course of these lectures. And the Next step we will see what is to be done in order that this sequence of steps can be transferred to a computer language so that; and can be

transferred to a computer so that computer can solve the problem, that we will see in the next part.