**An Introduction to Programming through C++**
**Professor Abhiram G. Ranade**
**Department of Computer Science and Engineering**
**Indian Institute of Technology Bombay**
**Lecture 14 Part – 3: Advanced Features of Functions**
**(Default values to parameters)**

Welcome back. In the last segment we talked about the lambda expressions. In this segment, we are talking we are going to talk about how to specify default values to some parameters of of a function.

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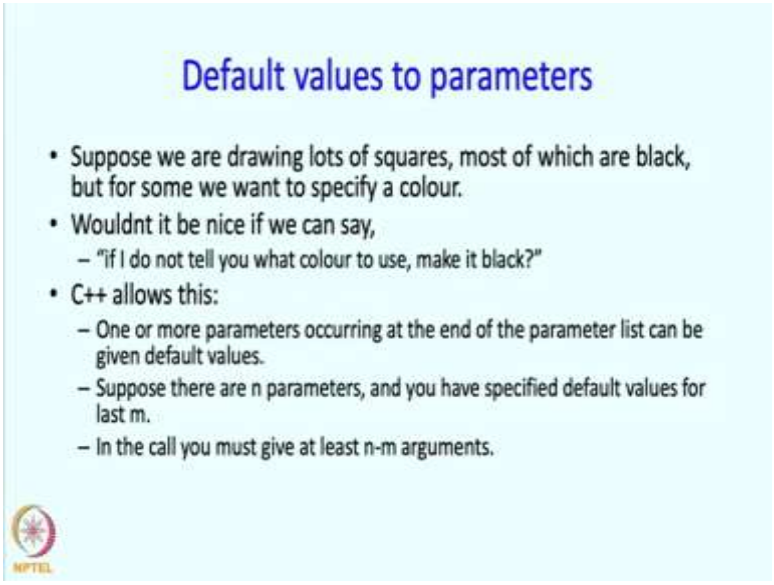


So as a motivating example suppose we are drawing lots of squares, and say most of these squares are black but maybe for some we want to specify a color, wouldn't it be nice if we can say if I do not tell you what colour to use, make it black. C++ allows this, okay so here is how: one or more parameters occurring at the end of the parameter list can be given default values, you can choose. If you have 10 parameters, you may say that the last 3 will have these default values. So if there are n parameters and suppose you have specified the default values for last m, in that case you must give in your call, you must specify at least the remaining, the values for the remaining arguments. So, again say I have 10 parameters and I have specified default values for the last 3, then in my call I may specify at least 7 values and these values will go to the first 7 parameters. Well, what happens if I specify 8? Then, instead of using the default value of the 8th parameter, I will use the 8th value that I specify. What happens if I use 9? Then, instead of using the default values for 8, for parameters 8 and 9, I will use the 8th and 9th values that I specify. So, in general if you give n-m+r arguments then the last m-r will be, will take default values.

And r of the arguments for which default values were supplied will not use the default values but instead will take the values that you have supplied. So I am going to do a somewhat elaborate example, so it is kind of squares but these circles are simpler than squares and therefore we are going to use a circle example.

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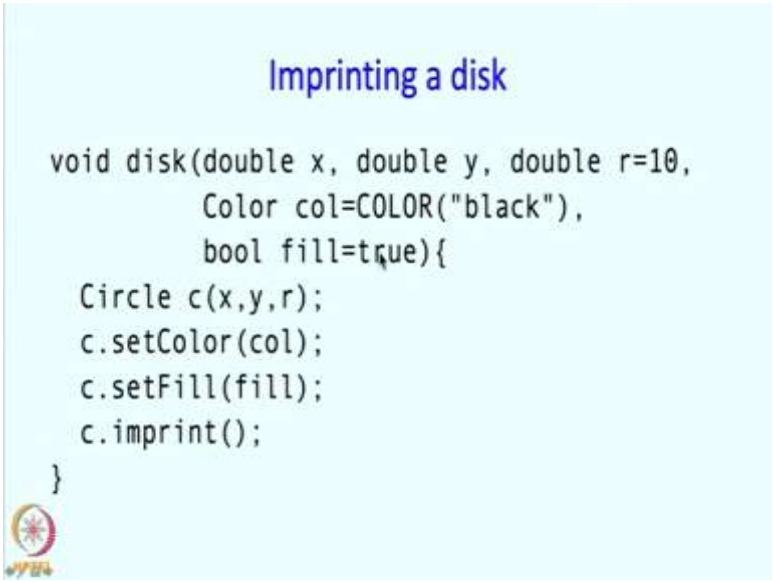


So the goal over here is that we want to draw a circle or really a disc because it is meant to be, it could be a solid disc, a filled disc. So what is the function? What is the function call? Well, we are going to first specify the center of that circle and then where the parameter requires us to specify the radius but by writing equal to 10 we are saying that look, if the user does not supply if the call this parameter is not, value is not given then the value 10 should be used. Then there is an additional parameter where you may specify a colour but if you do not specify anything, the colour black is assumed. And finally there is a parameter 'fill' which is going to be true if you omit it, alright. And what is going to be drawn? Well, first of all a circle is going to be drawn. Then we are going to set its color to call, the color the parameter over here. Now the actual value that we are going to use could be black or the actual value that you specify in the call and finally we are going to decide whether that circle should be filled with that color or not. And whether to fill it is going to be dependent on this parameter. If you did not specify an argument corresponding to this parameter then it will be filled. Otherwise, it will not; if you specify a false argument it will not be filled. Alright. And then finally that circle that you drew whose colour you set and you decide that to fill it or not fill it will be imprinted. So you remember that if you call a function then at the end

everything that is created inside this function goes away. But if you imprint it then that imprinted picture will stay on the screen.

So I am going to show you the code which uses this.

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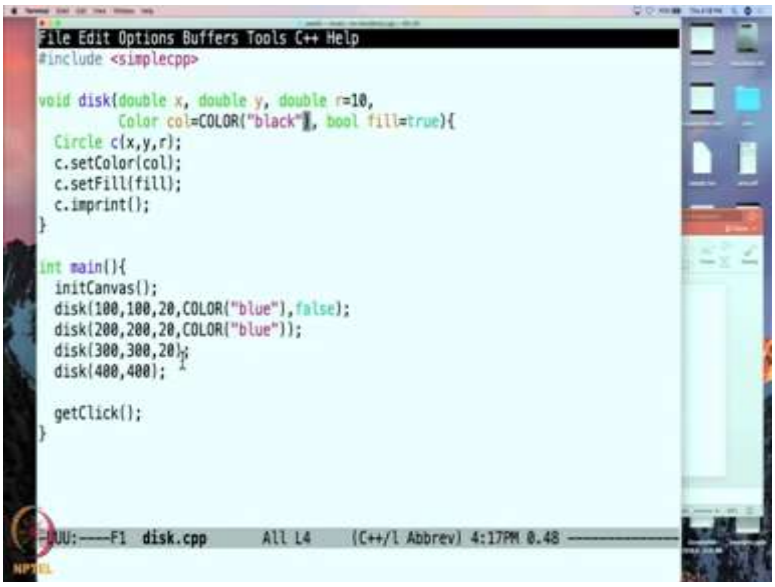


Alright. So, it is the same function first and now I am calling this function with different number of arguments. So first I am going to call it with 100, 100, 20 which says that the center is going to be at the coordinates 100, 100 and the radius is 20. And then the color is going to be blue and the fill value is going to be false. I have specified all the parameters I have given arguments corresponding to all the parameters, so this should produce a blue circle but which is not filled and of radius 20. Now here I have changed the center position, radius remains the same and color remains the same but I have omitted the last argument. So I have only given 4 arguments but if only 4 arguments are given then this last argument is taken as true. So this should produce a blue circle which is solid with color whereas the first one should be a blue outline but no color inside, then have a circle with center 300, 300 and radius 20. So what will this do? Well, only 3 arguments have been specified. So, this argument is specified, this argument is specified, this argument is specified.

The last 2 arguments are not specified, so the default values will be used, so the default value for this is color black and the default value for this is true. So, this should draw a solid black disc centered at 300, 300 with radius 20 and what does this draw? Well, even this is not specified, so this if this is not specified the radius is 10.

The last call will draw a disc centered at 400, 400; its radius will be 10, its color will be black and it would be filled. So let us see and then the program will wait until you click so that you can see what you have drawn. So, let us see what this how this works out.

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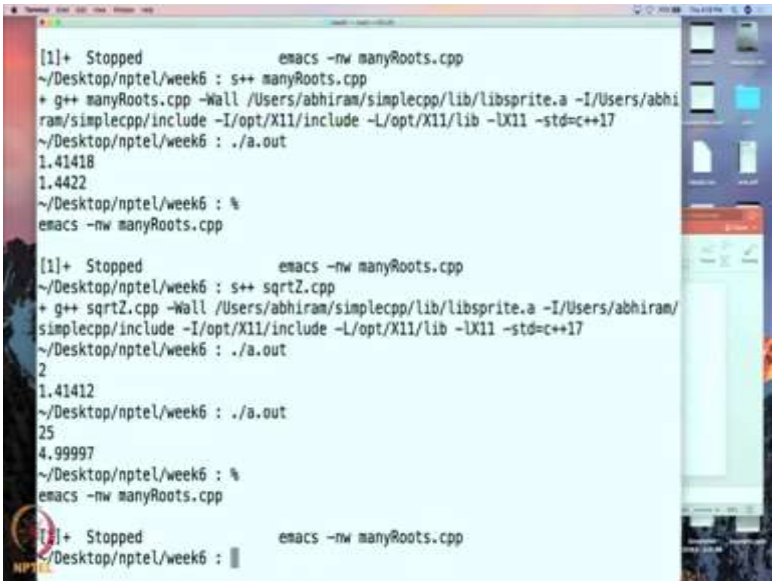


So let us compile it and run it. So, exactly as what as we thought, so we have a blue disc here but not solid, then a blue disc then a black disc and finally when we just supplied the center even the radius was taken from the default value and that was so we have a smaller a smaller disc which has been produced.

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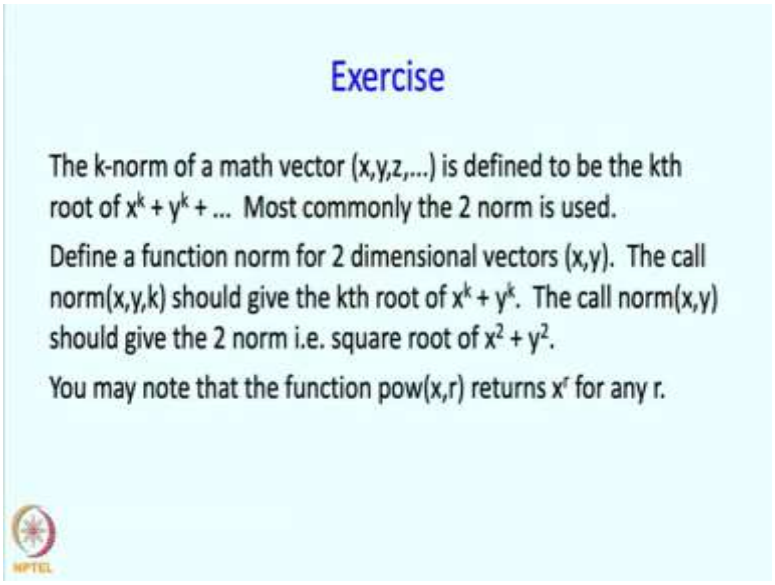


So here is an exercise based on this notion of default values, so the k norm of a math vector x, y, z whatever is defined to be the kth root of x to the k plus y to the k and so on. But most the most common norm that is used is the 2 norm, so this is kind of the Euclidean distance like thing. If I have a vector, a 2-dimensional vector x, y then the call x, y, k should really give me the kth root of x to the k plus y to the k. So, the kth root of all of this but I want to be able to make a call norm x, y without passing the last argument so that in that case the default value of k should be 2, so this should really return the square root of x square plus y square.

As I said, the default value over here is make to correspond to the to what happens most commonly and to help you write all of this, you may note that the function pow of x, r returns x to the r for any r including say 1 over 2 or 1 over k. So if you use that then this should be simple enough to write but you will have to use the feature of default values.

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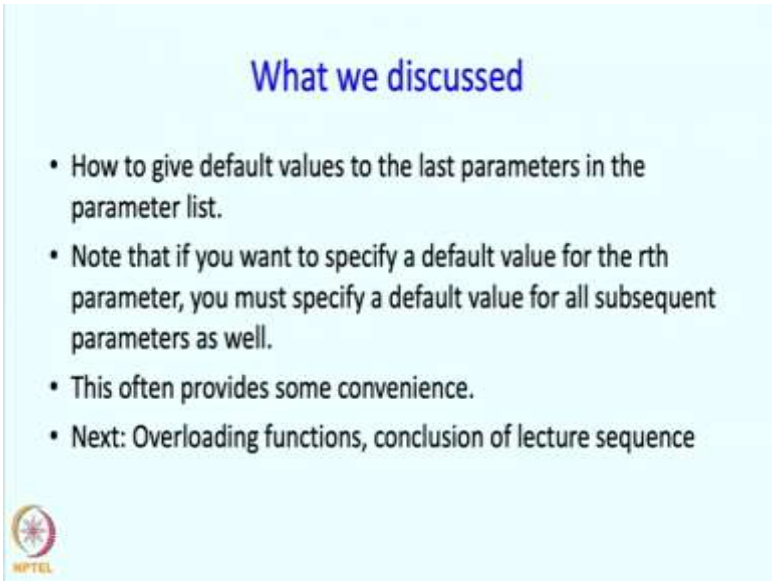


Alright, so what did we discuss in this? So we discussed how to give default values to the last parameters in the parameter list.

And one point to note in case it is not clear is that if you want to specify a default value for the rth parameter, then you must specify a default value for all the subsequent parameters as well. And as we saw this can help you write programs compactly and you can sort of make the common case a little bit simpler.

Next, we are going to talk another feature talk about another feature related to how you define functions - the so called overloading of functions and we will also conclude this lecture sequence. So we will take a quick break.