IIT Madras

ONLINE DEGREE

Programming in Python
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Dot Product

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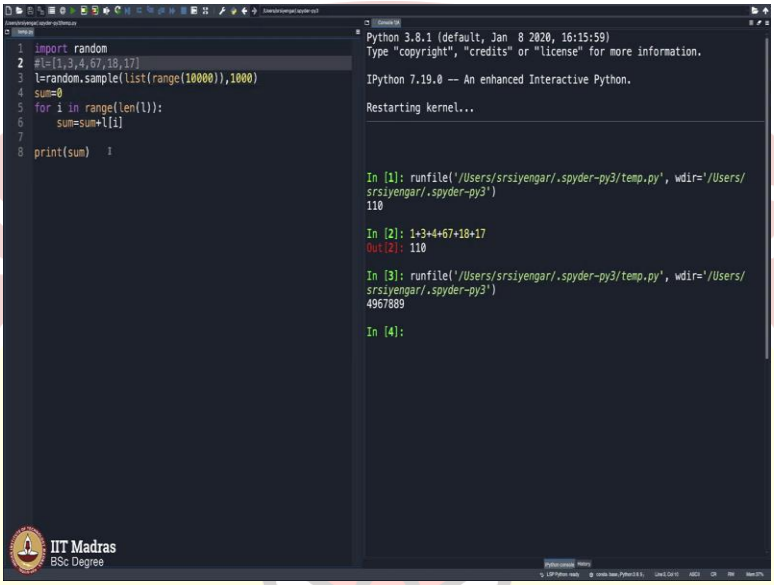

Consider a small list, not necessarily sorted and find the sum of all the elements in this list and that is going to be very easy, as you know, all that we can do is create a for loop for i in a range length of l. We say sum equals sum plus l of i and we start with sum equals 0. So, you are familiar with this now, so I will not explain this in detail, I will simply go ahead and then print the answer.

Let us see if it does, if it is indeed hundred and ten, how do we check that? Type it manually, 1, 3, 4, 67 plus 18 plus 17, 110, so you probably are wondering why would we do this when the program itself is saying, I am just cross checking.

You can further ask me Sir why do you cross check you can directly type like this and then find out the answer but then I am teaching you programming. Sir, why to do programming for something as simple as this, when we can do it over a terminal like this or a calculator. Again, this is like saying the conductor comes and asks you for your ticket and you show a pass and you also show a couple of tickets that you have bought just in case the pass is, you lose the pass, that is a standard joke, suppose it is a PJ right now in this context.

But then you see the point, the point is that this list need not necessarily be this small, it can be very, very big. Let me try writing a big list, l equals random sample list of range of some hundred thousand elements and then comma, I will pick some hundred elements from here maybe, thousand elements from the ten thousand elements and what is to be done here? I should say import random, perfect.

So, now I will try to find the sum, this l can remain like this or I can comment it not a problem, I will try to see if I can find the sum of this. You see, very quickly it shows us the answer, in no time it showed us the answer. The point is that certain things that can be done easily by a human being, if things get complicated in terms of the input the human being will not be able to do it but the computer can do it.

But that aside what I wanted to tell you people here, point to be noted is I use a variable sum and I keep adding sum equals sum plus l of i, I go slowly over the list adding one by one. So, for example, sum equals 0 and then sum equals 0 plus 1, sum equals 0 plus 3, sum equals sum plus 3, sum equals sum plus 4, sum equals sum plus 67, sum equals sum plus 18 and so on and you get the answer, that is the logic that we use.

The word logic means a technique through which you translate the typical human common sensical intelligence to a piece of code. So, why are we doing this? I am doing this not because this is not done, in fact this is done more times than it was required so I did this because I am going to teach you people something a little more complicated.

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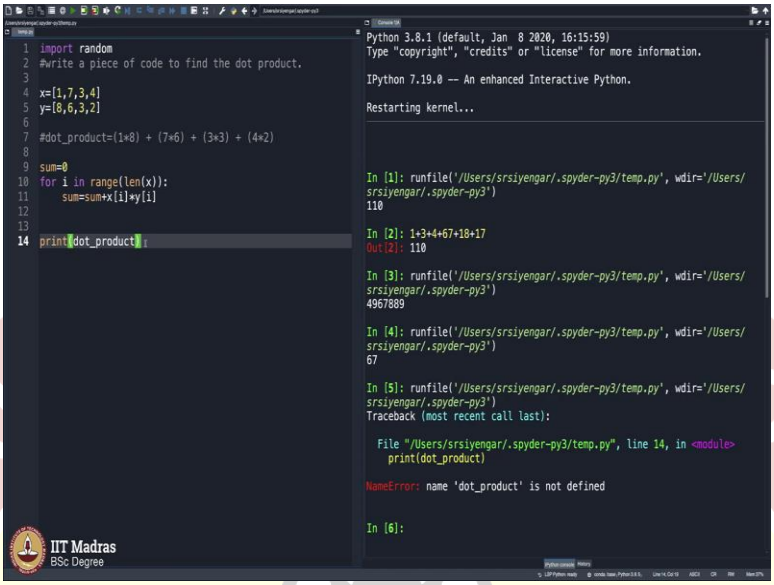

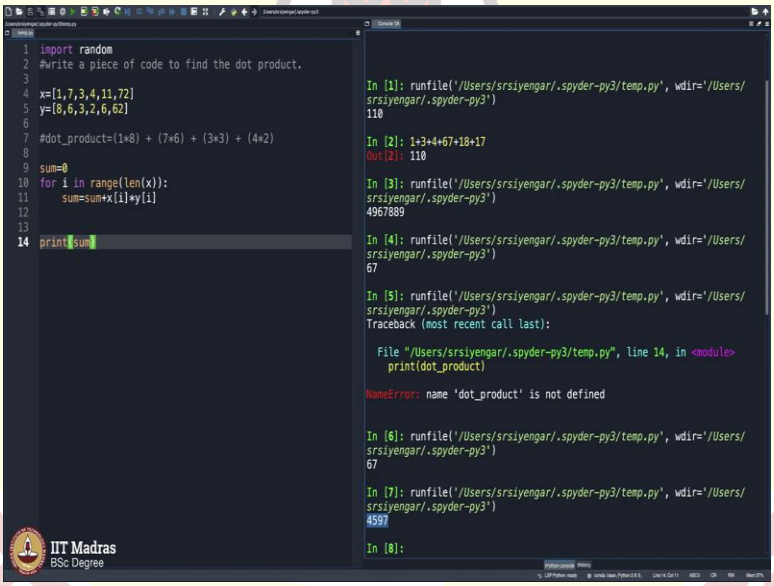

What we will do is write a piece of code to find the dot product of two vectors, I mean it sounds complicated but I believe you all know what I am trying to say, it is very simple, if in case I said x equals 1, 7, 3, 4 and y equals 8, 6, 3 and 2, the dot product of these two things is basically you take 1 multiplied by 8, the dot product is simply 1 times 8 plus 7 times 6 plus 3 times 3 plus 4 times 2, it is a wise idea to put brackets, otherwise you should be very familiar with operator precedence. If I sound very complicated then you have not watched the previous week's videos as simple as that and nevertheless you do not need that right now I am just kidding.

So, what I do is dot product is equal to so much, it is component wise multiplication and then you add things up, print dot product and you get the answer 67. So, but then I want to do it the programmatical way, I want to do it programmatically. How do I do that? How do I put this into a for loop right now?

Why are we discussing this as we have been discussing, as we have been saying we are preparing you with the programming language, so that you can understand the deeper delicacies of data sciences and in data sciences one very important entity that you will see over and over and over again is a matrix.

So, for the next three four videos we are going to discuss about a program, a couple of programs that involves matrices. For that, I need to introduce you people to what is a dot product, dot product simply means this, it has some very wonderful meaning, it basically tells you the angle between these two vectors, if I sound very complicated do not break your head, you will get to know of it eventually as you study more subjects.

So, basically dot product of x and y is simply multiply them component wise and then add them it will be a simple small number. So, let me now try to write a piece of code which does precisely this and let me check whether I get 67 or not. For that I will first comment this and then go ahead and then type a piece of code, how will the code look like.

For i in range, len of x what I do is I multiply x of i with that of y of i and then add that to sum while I initialize sum to 0 exactly the way I did the previous code, I am not going to explain more on this, pause and then stare at this, this is precisely doing what is being done here but then there is an advantage here, although it is three lines here versus only one line, there is a huge advantage here if you can tell me what is the advantage.

Let us see what has gone wrong here, of course you should not print dot product, you should print sum, 67 yes, it is the same answer. But then if I come here and include more numbers this will not work, this code will not work, you have to again add 11 into 6 plus 72 into 62 here but then this, you do not have to do anything and it works, the answer is 4597 and now you understand why we use looping structures which we have told you already but then I mean something in action, this is very fairly sort of simple but we are going to get things, get to see things a little more complicated than this.

I am going to take you all towards matrix multiplication, that is sort of a pinnacle of using a nested for loop, it involves some thinking, it involves some patient time that you must spend, think of what is the logic and then try to write a code, this is the first step towards it, we just now finished a small piece of code for dot products.

Also please note here, a final word of warning, this does not work if these two things are of different sizes, they should be of the same size. In fact, you can indeed write an if loop here and check if they are of the same size or not and then print a error message saying that they are not of the same size and that you are exiting. All those things can be done but then we will keep it simple and assume that they are of the same length. Anyways, we finished with dot products right now let us go ahead and try to see a little more about matrices.