Multivariate Procedures with R

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Lecture – 05

R as a Calculator

Hello friend, welcome to the course Multivariate Procedure with R. So, you can see that in the last couple of lectures we had a brief idea about how to work in the R software. Now definitely this R software is going to do the computation for us. So, we need to brush up our knowledge about how R does the computation. One thing I would like to address here, the way R is trying to do the computation that is little bit different than other softwares. In R we have a concept of data vector.

So, when we are trying to do the computation with a scalar and a data vector, then the scalar operations are almost the same as in the case of calculator or working on any other software. But when we are trying to work with scalar versus data vector or data versus versus data vector that means one component is say scalar and that is a data vector or both of them are data vector, then there is a small difference. The way R works it is very interesting and it is not difficult but it is the strength you will see the advantages that the way R works in the computation for the data vector with data vector that helps in the programming. Very complicated expressions which you want to compute they can be written in a very simple way.

But we need to understand how it works. So, in this lecture I am going to give you a quick idea that how R is doing the computation with scalars. My main idea is this, I just want to show you that what are the different operators, what are their different symbols and how do they operate. And in the next lecture I will try to take up the issue of data vector. So, I will try to show you here some basic computations and then I will also illustrate them in the R software also.

So, let us begin our lecture. So, now in this lecture we are going to understand that how R is going to work just like a calculator. But before that let me try to give you some basic idea that as we have already discussed this greater than sign is the prompt sign. And if

you try to see the screenshot here on the right-hand side this is here the prompt signs. Now you are well aware about this symbol.

And the assignment operators in R software they are less than and hyphen sign like this as well as equality sign like this. Now this gives an obvious question why there are two. So, now if I tell about you I am the one who has seen the birth and growth of this R software. As I told you that R was developed in parallel or in competition with the S plus software. S plus software was a good software and people wanted to develop another software which is open source freely available but it works just like S plus.

So, in the S plus the prompt sign was like this. Means I have worked in the S plus also in my beginning of my career. Then when R was developed then the same symbol was continued but later on people also introduced this equality sign. So, now at the moment both the symbols are used and you can use any one of them. So, now if I say for example if I want to write $X = 20$ then I have two options.

I can write down here $X < -20$. So, this is going to assign the value 20 to X and the same thing can be written as X equal to 20. And so, that is what you have to see. And then one thing I would like to have your attention that this blank space has no value when you are trying to do the numerical computation. If you write X = 20 like this where there is a blank space here and there or if you just write X=20 without any blank space there will be no difference.

I have written here with a blank space So, that you can look you can understand it clearly and it looks clear. And in this R software a variable can also be defined and can be stored as a variable as well as a scalar also. For example, if I say here X=20 if I write So, this is going to assign the value 20 to X. Now in the next line as we have discussed that this one-line command and multi-line commands are possible in R to write. So, if I try to write down a multi-line command suppose I want to write down here three commands here like this then in the second line I am writing here Y = X * 2, star is a sign of multiplication that we will discuss.

So, what I want I am trying to give here the value X = 20 then I want Y to be computed as 2 * X and then in the third line I want to compute Z as X + Y. So, this Y equal to X * 2 this expression assigns the value 2X to Y and this Z = X + Y this assign the value X + Y to Z. And if you try to see this operation on the R console also So, here, I am trying to write down here X equal to 20 or X equal to 20 * 2 using 2 different operators but they are the same thing. So, if I write down here Y is equal to 2 * X and then as you can see the value of Y is 2 * 20 that is 40 and when I try to write down here Z is equal to X + Y So, this will be 40 + 20 which is here 60. So, this is how this R will look like and then this hash sign.

Hash sign is used to mark any comment. For example, when you are trying to write down a program and suppose you say that okay X you are using to indicate the height and Y you are indicating the weights suppose. So, now you will be using here height and weight data and you are going to use X and Y to indicate it but now after sometime it is possible that you may forget what was your X and what was your Y. So, I can write down here like this hash and then X I can write here X is height hash on the next line Y is weight. So, now the advantage will be when you are trying to write it on the R software then R as R will not execute anything on it as soon as the R finds that the first letter is here hash then it will treat it as a comment.

So, for example if I write down here this hash mu is the mean hash X equal to 20 is treated as comment only. So, this hash sign is written on the at the first place and then the R will not execute anything. Another very important thing R is case sensitive. What does this mean? The lowercase and uppercase alphabets they are treated differently in inside this R software. So, if you try to give a variable name say X = 20 (uppercase equal to 20) and lowercase alphabet x that is a small letter x = 200, they are not the same, they are different.

The values are the same but these two variables are different. For example, I can show you here. Suppose if I take this screenshot and I have taken an example suppose if I say lowercase alphabet x = 200. So, now if you try to see the value of x this is 200. Now I try to choose here the value of capital X.

It will say that object capital X is not found. Although you have given here the value of small x but capital X is not given because R treats small x and capital X differently. And similarly, now if you write down here capital X = 300 and if you try to see the value of capital X this will come out to be 300 whereas the value of the small x will come out to be here 200. So, this is what I mean when I try to say that R is case sensitive. And this issue you have to be careful when you are trying to use different commands and packages.

For example, if there are two commands like as here matrix and here capital M a t r i x these two are different. They are not the same. That is what you have to keep in mind. Now another popular command that is here c command that is actually used to combine the numbers. For example, if you have 5 numbers 1, 2, 3, 4, 5 and you want to execute any program or any function or any syntax over all these values then how to communicate to the R software that minister R you have to execute this operation over each and every individual value.

Then in order to do it we try to use here the command c that is lowercase alphabet c. So, as soon as you write here c and inside the parentheses you try to write down the values. They can be numbers, they can be characters, whatever you want. And this will then read

all the numbers. So, let me try to give you here some examples that how and what actually I mean to say.

Suppose if I want to give 5 numbers 1, 2, 3, 4, 5 to suppose I have the data vector y. I give it a name here y. So, as soon as I write y is equal to 1, 2, 3, 4, 5 it will give me an error that y is taking only value 1. After that there is some error and R cannot understand it. Even if you try to write down here the parentheses the same error will continue.

But as soon as you write down here y is equal to c 1, 2, 3, 4, 5 you will see here if you try to see the value of y it will come here. So, that means this value have been stored inside the R software. So, before I try to move forward let me try to show you these things on the R console also So, that you get more confident about it. So, now let me try to come here. So, if I try to see here suppose if I see here capital X = 200 and say small x = 300.

So, you can see here if I see here capital X it gives me here the value 200 but if I press here small x it gives me here the value here 300. And suppose if I define here another variable here y is equal to suppose here 4 into see here small x So, then you can see here y is coming out to be 1200 but if I try to change this value from small x to capital X then you will see here now the value is changed here to 800 because yeah 4 is getting multiplied by 200 or 300. Right? Similarly, if I try to define here the value of here z is equal to x + y then whatever is the most recent value that is going to be added. Before I show you that you can see here the most recent value of y here is 800 and most recent value of here x is 300. So, 800 plus 300 that is 1100 and you can see here this is the answer. Right?

Now similarly if you want to write here see here data vector suppose you want to write down here 5 values 1, 2, 3 it will say here error. Right? It will not give you any value here but if you write down here see here if you put here the parenthesis even then it gives you error but if you put here this here command here c then you can see here there is no error and if you try to see here this will come here y as 1, 2, 3. So, always remember to store the more than 1 values in the data vector format only. Right? I will try to show you that why it is advisable to use the c vector always So, that you do not make any mistake. Now about different type of mathematical operator I will say it is very simple.

You simply have to recall how does a calculator works and it works exactly in the same way. For addition you have here a plus sign, 2 + 3 will come out to be here 5. For multiplication you have a star sign which is 2 * 3 here as 6 and you can verify this command over here. Right? Similarly, if you try to do the subtraction then you have the same symbol minus which is used in the calculator and if you want to do a division then it is the same operator which is used in the calculator. Right? So, and you can see here 2 - 3 is minus 1 and 3 / 2 is 1.5.

And similarly, if you want to use any combination of these operator plus, minus, etc. that can also be used and in order to do it this R software always follow the Bode-Mass rule. The BODMAS rule which you have understood or learned in your childhood and this is followed in all the mathematical computation. Right? And here you can see here this is here the outcome. It shows you can verify that how it will look like.

Now if you want to write down here 2 cube, right? 2^3. In order to do this thing, we have to work. Here I can write down here 2^3 or I can write down here 2**3. So, single star is multiplication sign and double star is the power operator. And in both the cases the outcome is going to be the same.

You can see here 2^3 is a 2 cube which is the value here 8 and 2**3 that is again 2 cube which is the value here 8. And this is the screenshot which you can see over here. Now similarly if you want to know the value of say square root of $\sqrt{2}$, So, then in mathematics we know that this can be written here as a 2 raised to the power of 0.5.

So, this power is now 0.5 and this can be written as a 2^0.5 or 2**0.5. So, this is what you can see here. Right? $\sqrt{2}$, this is written here like this or like this, all right.

And in case if you want to find out the value of $1/\sqrt{2}$, this is your here 2^-0.5, So, which is written here here and you will get this value here. So, these things you can verify very easily in your, this R console and I will try to give you here some demonstration So, that you get more confident that how the things are going to work. Right? So, you can see here if I see here 6 + 7, this is here 13 and if I see here say 9 - 2, this is here 7. If I try to here 6 * 8, is the 48 and similarly if I try to see here 8/4 which is here 2. Right?

And yeah, means do not misunderstand me that I am trying to do here only the integer operation even if you take any number also, that will also work. For example, if I say 9/5, this will here 1.8 and whatever is the BODMAS rule, that will also work here. For example, if you look at here 7 and then here hat say 2 and then minus plus here 76 and So, on, So, it is the answer. So, in order to write this program, it is important that you understand the BODMAS rule.

And if you want to write down here the power operators, if I say 3^2 that is 3 square which is here 9 and if I write down here say 1/3^2 square, this will be 1 upon like this it will and then if I want to write down here, see here square root of this 3 that is 0.5. So, you can see here this is like this and if I want to write down here 1 upon square root of 3, So, this is here like this. Right? So, you can see here it is not a very difficult operation and yeah you are very much confident and I know that you all are knowing all these things very well but my objective was to give you a brief idea So, that you can brush up your knowledge. Right? Now with this small introduction to this that how to use the R software as a calculator, I would like to finish this lecture.

It was a very simple just a brushing knowledge and I am sure that you all know it. But still, I would say try to take some examples where you know the value and try to operate the same thing in the R software. My objective in giving this lecture was that you can brush up your knowledge that how R is working because whenever you are trying to do the calculations, you have to follow the rules of R that how the programming has been implemented inside the R software to do such mathematical computation. Now the challenge will be I want to get done something and for this I have to give the instructions to the R software and I expect that R will be doing it properly.

Properly means following the rules of mathematics. So, that is why it is important for you that your friendship and connection with the R software should be the same what is based on the mathematics. So, try to practice it and I will show you some more example in the next lecture which are related to the data vector. So, you enjoy this lecture, practice it and I will see you in the next lecture. Till then, goodbye.