

module_prob3_lecture14

Mon, 2/7 10:37AM 11:49

SUMMARY KEYWORDS

expectation, squared, excel, probability, sum, formula, variance, compute, multiply, values, cells, square root, summation, E^2 , columns, discrete random variable, paste, B9, google sheets, remember

SPEAKERS

Sumon Majumdar

S

Sumon Majumdar 00:05

So in this clip, we'll be using Excel to compute first expectation and variance of a given probability distribution. And then later on, we'll be using, again, Excel and Google Sheets to figure out the binomial and the poisson probe. So before we get started, I want you to remember two things. One is the formula for expectation. So the formula for expectation is given by this, which is the summation of x times the probabilities, right, so we want to multiply all values of x with the corresponding probabilities, and then sum up over those. And secondly, the formula for the variance, which is given by expectation of x squared, minus expectation of X whole things. So now let's use these in Excel. So here's my Excel file. So if you notice on the first column, and the first two columns in the here, I've put down various values for X . So X can take values like 25, 10, 12, 13, and so on. And these are the corresponding probabilities. So point one five is the probability of 25 point 0.07 is the probability of 10, and so on. So if you summed up all of these probabilities together, they should add up to one, because that constitutes all the possible outcomes. So if we did some, from B, to that's the starting point, up to be 11. Those should add up to one. So now, if we want to compute the expectation of x , so remember, it is X times P of X , and then we have to sum up all of those. So first, let's do that. So let's compute X times P of X . So see...e to sorry, you have to use that equate-equation sign to denote that it needs to compute that. So E2 right, so that's 25 star E2 that'll be its corresponding probability, that will be X times PX . And now we need to use, we need to paste that same formula in all of the cells below it. Either you can use the copy, and then the paste formula to do it, or an simpler way is to just drag, drag and low here, and that will paste that formula into all of the cells below. So for example, if you look at this, this will be equal to A, this is A9 times B9. So this is this times this, right? So all of these cells now give you X times P of X . And now when we want to get the expectation, we just need to sum up all of those X times P of X . So to sum from C2, up to C 11. So this here is the expectation of X . Now suppose so this is how you find expectation. Now, suppose you want to find the variance. So remember, for the variance, the formula is expectation of X squared. So how do we get expectation of X squared, so the way we do it is that we need to take the square of X and multiplied by the corresponding probability. So here, what I'm going to do is I'm going to take $E2$ n squared. And then I need sorry. So putting in enough brackets here, and then I need to multiply it by the corresponding probability, which is indeed two. So this is this squared, X squared times P of X . And then again, I want to copy that formula and paste it into all the cells below it. Right, so these are all. So

here, it will be this squared times the probability. And then if we want to get the expectation of x squared, we just need to sum all those up. So it will be the sum from D2 up to D11. So this is expectation of X squared. Now variance, remember what is variance, it is expectation of X squared. So it's this much minus is the expectation of X , but whole thing squared, right, so we need to now square this. So what I'm doing is I'm taking the expectation of X , squaring it, and subtracting it from expectation of x squared. So if I do that, that'll be the here. So this here is the variance. This here is the. And you can do the same thing here for another series, right. So this is another set of, so this is a different distribution, right. So this is a much bigger set of x 's, right, and these are the corresponding probabilities. And let's say you want to find the expectation of X and the variance of X , you do it exactly the same way that we did, did for this example here. So what we're going to do is first multiply x times P of x . So that's key to start the probability, which is L two. And then we are going to copy and paste that formula and all of the cells here, an expectation is just going to be the sum of all of these, so it's going to be m two, up to 21. So that's here is the expectation of this particular random variable. Now, to find the variance, we need to first find the expectation of x squared, so we need to do the squared and multiply it by the probabilities. So here is my x , I need to first square it. So we're just going to be careful here. So we're going to take this key to square it. And then I'm going to multiply it by its corresponding probability, which is two. And then I'm going to copy and paste that formula and all the columns here. And then if we add this up, this is the sum of and to two and 21. That gives me expectation of x squared. And remember, what is variance? So variance is this, and 22. That's expectation of X squared minus the expectation of X whole thing squared, right? So m 22 is the expectation of X . So I need to take that and square. So this here is the variance of this particular set of X 's. Now, so this is how to find the expectation of X and expectation and the variance. What if we want to find the expectation of something else? Let's say you want to find the expectation of square root of x . So how would you find expectation of square root of X ? It's exactly the same way, instead of x multiplying p of x , what we now need to do is we need to take the square root of x multiplying the p of x . So let's do that here. So, so I'm going back to my original set of X 's right? So if I want to get so if I want to take the this, right, and I want to take the square root of that. So I can do square root two. I'm going to put an extra set of brackets because I always like to be careful. And then I'm going to multiply this by Probability and the probability is here, that speed. And I'm going to do that for all the axes. And then if I sum these up H2 to H 11. So this here is the expectation of the square root of X . Similarly, you can find expectation of any other function of x , maybe the cube root of X , or cube of X , or the lawn of x , or any other crazy function that you'd like. So this is how you can use Excel to easily compute the expectation and variance of a set of a discrete random variable. And this especially is useful when X can take a lot of values, right? with Excel, it's very easy to do that. And you follow you can follow exactly the same procedure, also in Google Sheets, because that has the same type of multiplication, same type of summation, same type of copy and pasting of formula as Excel. So it's very easy to do to do these things in Excel, and it will save you a lot of time, especially again, if you have a large distribution with a lot of values of x that you attract.