Business Analytics for Management Decision
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Lecture - 17
Inferential Analytics (Contd.)

Hello everybody, this is Rudra Pradhan here, and welcome you all to BMD a course and we are we are here today for unit four lecture, and that to the discussion is an inferential analytics. In fact, in this series we have ten lectures and this is the second lecture of this particular you know series and that to raise the problem.

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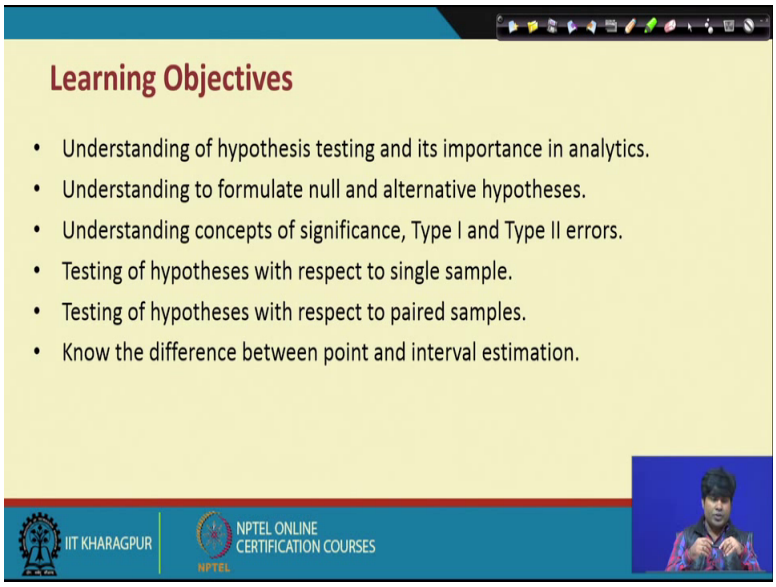

So, in the first case we have populations, and then we have to draw samples and through some sample statistics we have to compare, and you know conclude the population statistics. That means, it is the kind of you know the confidence we have to create on the basis of you know sample and population. So, the usual procedure is that; so your sample statistics should converge to population statistics, and we are here to see the kind of you know structures how to justify this; that means, whether you know the sample statistic will be converging population statistics or there is a kind of you know difference.

So, if it is converging so that means, we have to actually justifying the particular effect, and if there is there is no kind of you know convergence that means, the sample statistic is not converging towards you know population statistics, then there is a difference and

that difference we have to highlight what is the kind of you know inference, and for that what should be the managerial kind of you know implications.

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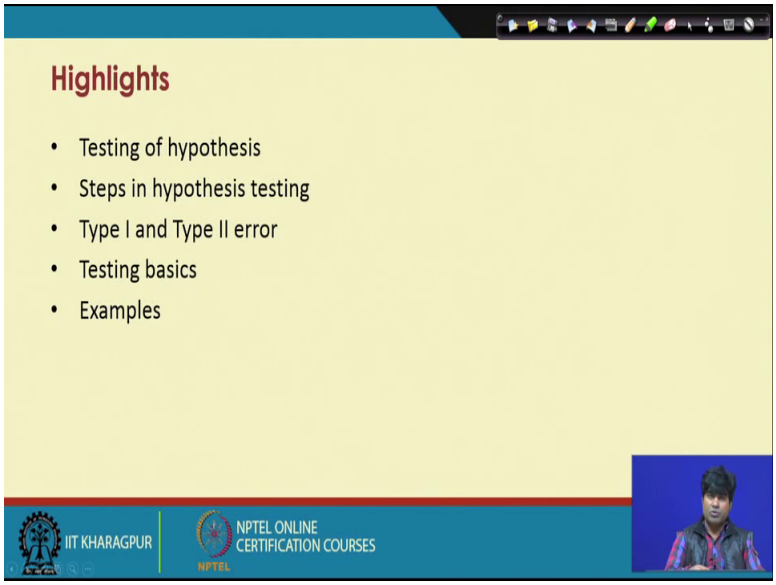

So, now we have actually discussed in details about the particular structure. And in this lectures we will again you know repeat the a typical structures like, you know testing of hypothesis steps in hypothesis testing, type 1 error, type 2 error, and some of the basics behind the testing procedures and certain examples.

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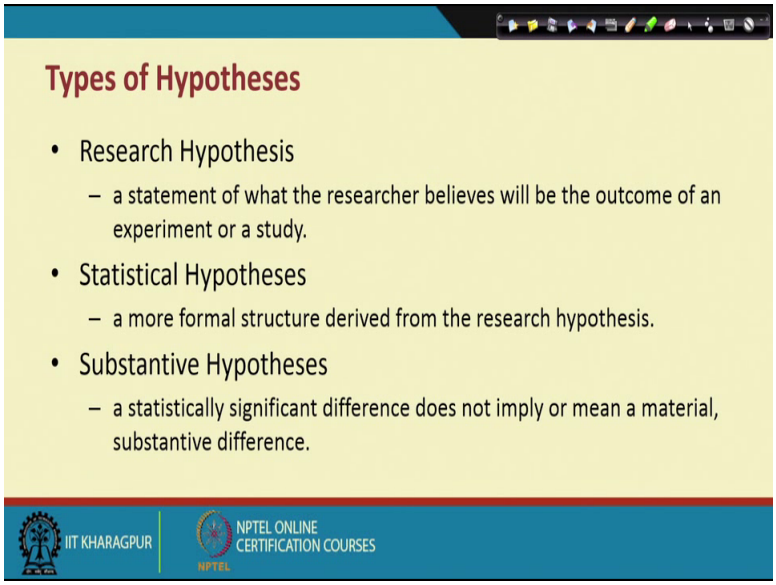

And any kind of you know investigation process. So, the idea is that idea is just to you know verify the kind of you know facts, and hypothesis you know in the kind of you know or simple structures we can say that you know it is a statement, which is not verified and we are here to verify the particular structures. It can be represented in the three different ways. So, the first structures may you know we can say it is a kind of you know research hypothesis, and the structure is that you know it is a statement of what the researcher believes will be the outcome of an experiment or a study.

So, it is basically you know it is a proper statement, and you know a researcher or you know the analyst. So, has to think and you know design accordingly. So, this is you know as you as usual you know actual kind of you know thought process, then statistical hypothesis will be a formal structure, and that is basically derived from the research hypothesis. And the 3rd one is the called as you know substantive hypothesis it is the kind of you know structure between you know, statistical hypothesis and research hypothesis; that means, we like to we like to just you know, justify that you know what is the actual kind of you know believe and what is the correct kind of you know scenario with respect to the sampling.

So; that means, we are observing certain things and then with the basis of you know samples and you know sample statistics or the kind of you know experimental process we have to see. So, whether the sample statistic will be exactly following the kinds of you know expectation as per the as usual expectation you know whether there is a fact or you know something difference. So, we are here to check all this difference.

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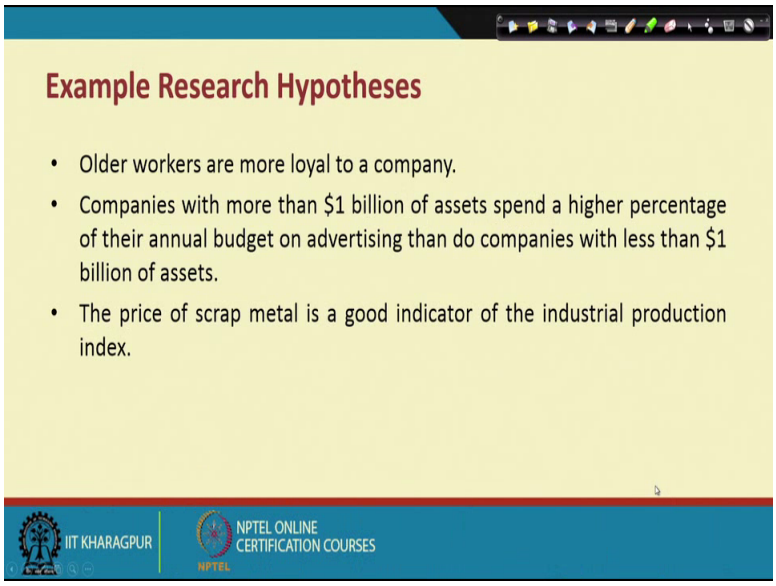

Then you know so, in the mean times I will give you certain examples what is the a structure of you know research hypothesis. So, research hypothesis means a some of the examples like you know older workers are more loyal to a company, and companies with more than you know 1 billion of assets spends lot on you know advertising compare to companies with having you know less than 1 billion of you know assets.

So, similarly the price of you knows scrap metal is a good indicator of the industrial production index. So, you know this is just kind of this is just like you know observations. So, the observation need to be verified, and then we like to know the kind of you know statistics or the you know the empirical process through which we have to you know justify the you know structures.

So, whether the observations are you know correctly specified or there is a need of some kind of you know modifications so, the inference you know which we have to draw from this process, we will be helpful for you know taking the decisions about this problem.

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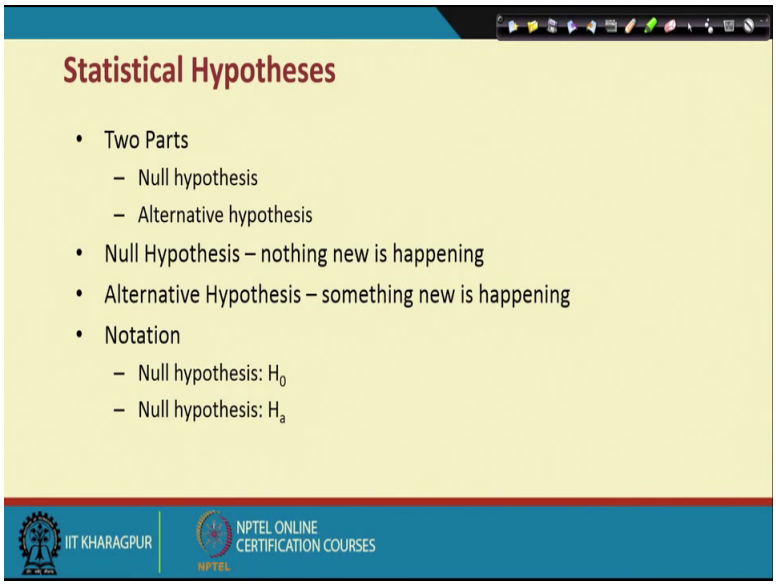

And in the process of investigations so, we like to use actually 2 hypothesis. So, the first 1 is called as you know null hypothesis, then the counter part is called as you know alternative hypothesis. So, in the case of null hypothesis, so the idea is that you know means the representation is a it is nothing new or in the case of alternative hypothesis there is a something new.

So; that means, you know no new things are you know happenings or you know something new you know is there. So, we like to you know just check the difference whether it is the fact or not the fact so that means, so the game between you know null hypothesis alternative hypothesis to justify the fact. So, we start with something kind of you know positive, then we will see what is whether this positive still happenings or there is some kind of you know other way around, and a usually in the research kind of you know investigations. So, we denote you know null hypothesis will be H 0 and the counterpart alternative hypothesis will be H a.

So, that is called as a H a alternative hypothesis and H 0 is the null hypothesis. So, in any kind of you know investigation you know investigation process. So, the first step is to said the a null hypothesis and alternative hypothesis, then the investigation starts on the on the basis of you know null and alternatives. So, we have to see the particular you know sampling structure the kind of you know test statistic and the kind of you know

procedure through which you have to test the test the things, and then we will conclude or we will get some kind of you know inference.

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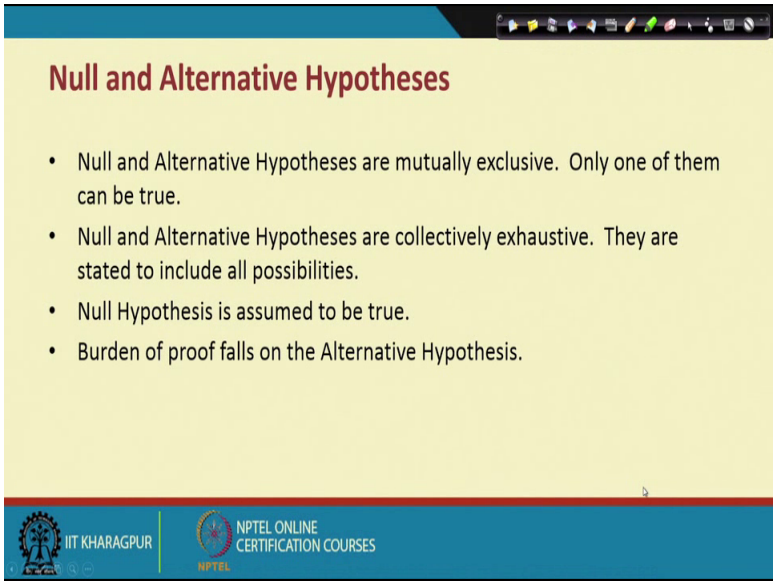

So, it is basically the comment behind the observations and a the a typical you know structure is a like this, null hypothesis an alternative hypothesis are you know usually mutually exclusive so; that means, only 1 of them can be true at a particular point of time, and in the case of you know you know against in the case of you know null and alternative. So, they are you now collectively exhaustive so that means, they are stated to include all possibilities. So, another feature is null hypothesis assume to be true; however, the proof actually falls on the structure of you know alternative hypothesis.

So, you know before we start the process. So, you should have clarity between the null hypothesis and alternative hypothesis. So, technically or you know practically 1 can be true at a particular point of times. So, we like to check which 1 is the true so, whether it is null hypothesis true or alternative hypothesis true.

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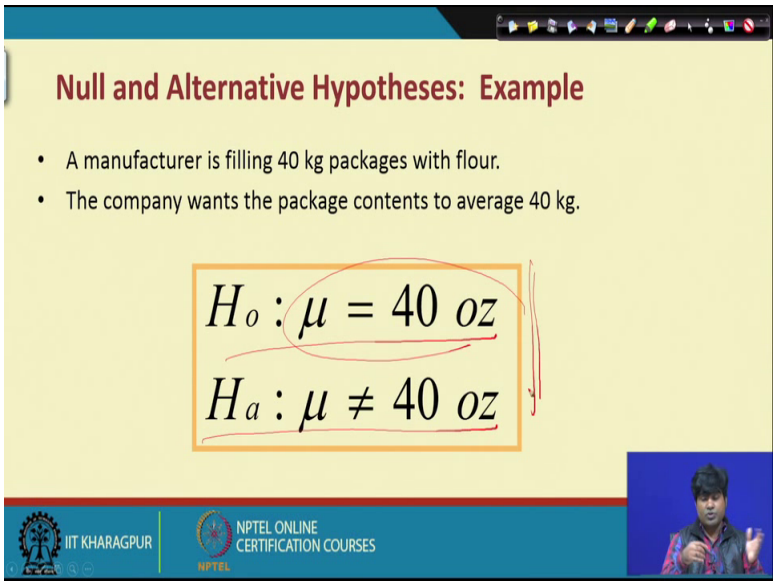

So, now, in the process of investigation null and alternative hypothesis, we will have 2 different concepts all together again. So, particular structure is called as you know 1 tailed test and the counterpart is called as a 2 tailed test. So, then the standard examples we can fix like this, let us say H 0 is a H 0 is a mu equal to 40, and the counterpart mu not equal to 40.

So; that means, when we are putting mu equal to 40 and mu not equal to 40 this specifically you know or this you know specifies that you know it is a 2 tailed structures, but if it is not 2 tailed structures, then it will be 1 tailed test. So, it will be either in the left hand side of the game, or right hand side of the game. So, what is exactly the left hand side of the game and right hand side of the game so, I will let you know through you know the structure called as you know normal distributions.

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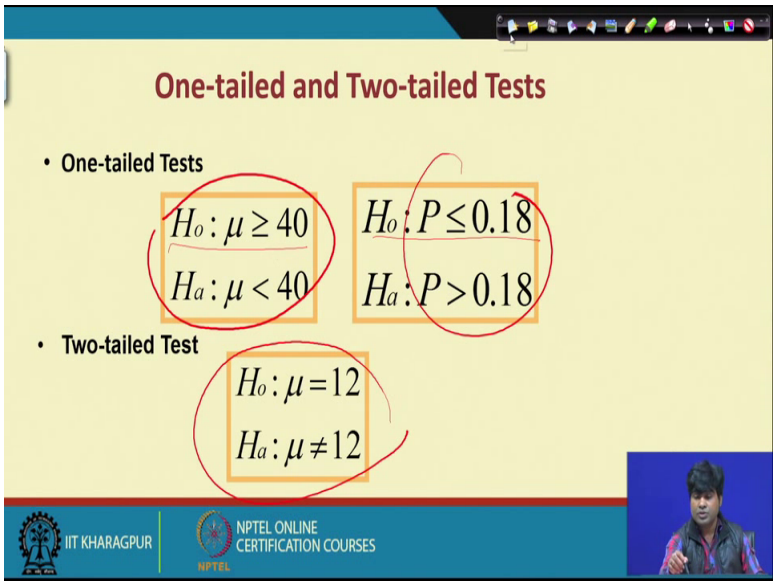

So, now here is we know all this three you know structures you know we can describe. So, the in the first case in this first case this is 1 kind of you know 1 tailed test, and this is another 1 tailed test so; that means, if it is not 2 tail. So, either we are you know targeting in the left hand side, or we are targeting in the right hand side. So, if there is no such a specification, then we will targeting both the sides in that case the particular structure will be 2 tailed tests so that means, the difference between these 2 for you know setting null and alternative hypothesis like this.

So, the comment on you know null hypothes null hypothesis. So, that is actually when we are putting greater than equal to so this is this is a 1 particular specification, then by default the counterpart will be less than 40 and when we are specifying H 0, H 0 P less than equal to you know some sample structure then obviously the counterpart will be P greater than, and if not then we can state that you know mu equal to you know something then the counterpart mu not equal to something. That means, in this case we are putting mu equal to 12 and by default the counterpart will be that is the alternative hypothesis will be mu not equal to 12.

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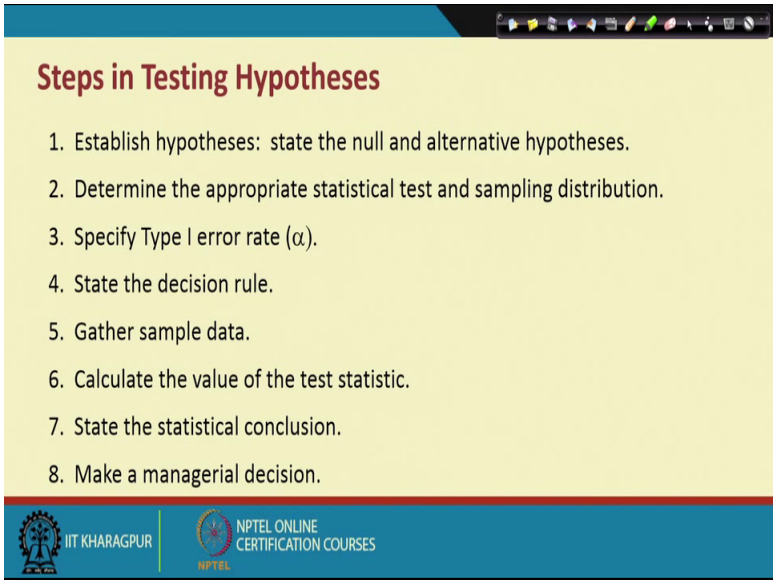

So, now corresponding to this; so what will we do? So, I will show you through particular structures, but before we go to that particular structure about the; that means, the normal distribution structures. So, I will let you know the steps and on the basis of this test I will tell you the particular you know structure, through which you have to you know comment on the null hypothesis and alternative hypothesis; that means, it is a typically a decision making process. So, the decision making process is like this you know we start with a kind of you know problems, and then we have to justify your observations and that observation need to be tested empirically.

That means, whatever observation we are you know expecting or you know predicting, whether it is correctly specified or some there is a kind of you know difference. So, we need actually some kind of you know analytics through which you have to take decisions. So, the procedure of you know taking decisions and that to with the help of you know inferential analytics,, and that to with the help of you know hypothesis testing is like this. So, there are all together 8 steps we have to follow to get the inference and then comment on the null hypothesis and alternative hypothesis. So, the first step is so, establishment of H 0 and H a. So, that means, that is the specification of you know null hypothesis and alternative hypothesis.

So, first you define problems and then you know exactly what is the specification of you know objective, and on the basis of objective we have to formulate the null hypothesis hypothesis, and then by default it is counterpart will be fixed a and that is what it is called as you know alternative hypothesis. And then in the second step we have to apply

the appropriate or you have to choose a particular you know test statistics. As we have already discuss there are 4 test statistic we are supposed to apply when some kind of you know verification is required. So, that is with respect to z test t test chi square test, and f test. And again so, we have to connect with you know sampling and sampling distribution.

Then in the third step we have to specify the concept called as you know type 1 error that is the you know structure of you know or value of the alpha, that is the probability level of significance through which you have to take a decision on the acceptance of null hypothesis or acceptance of you know alternative hypothesis. Then we in the first step we have to take or you have to call you know call for you know decision, and then in the 5th step so, gather the some sample data, and on the basis of sample data in the step 6 we have to calculate the test statistics. Then finally, in the 7th steps so we have to go for some kind of you know statistical conclusions.

On the basis of test statistics and the kind of you know observation which we have actually stated in the form of null and alternative hypothesis. So, then in the mean times in the last steps we have to takes managerial decision on the basis of you know statistical conclusion, which we have drawn from the samples and through the sample statistics. So, now means test statistics.

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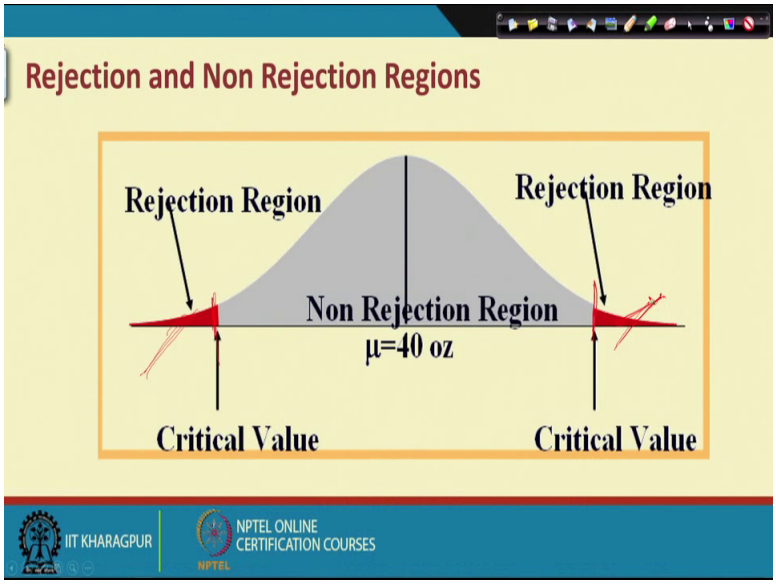

So, now in the in the process of this investigations so, the usual testing structure is like this and we have actually a specified 8 steps and the 8 steps can be actually graphically located like this. So, the first you know structure is the setting of the null and alternative hypothesis and then you know structure or inferential analytics role is a to check or to you know take the decision whether to accept the null hypothesis or to accept the alternative hypothesis, that is the statement or the observations which you like to target.

So; that means, in the in the kind of you know business problems, we are detecting a kind of you know problem and whether that problem is actually fact or not fact we have to test empirically and the process through, which we will be you know test that is nothing called as you know inferential analytics and here in the in the process of this investigations. So, we have actually the kind of you know fixation of you know alpha that is the type 1 error. So, the red part sis nothing, but you know alpha structures that is you know type 1 error fixations.

So, what is actually type 1 error and type 2 errors so, in the next slide I will be highlight, but as per the particular you know steps which I mentioned in the previous slide. So, we have we have actually a prepaid structured here, and in the structure so, this is the alpha fixations and it in this case it is you know you know both the sides, that is what the 2 tailed structure and the particular you know structure is called as you know critical value, and this side also critical value. So, you know the critical value structure is actually obtained or you know it can be actually highlighted here on the basis of your alpha specification corresponding to a test statistics and the sample size that is nothing, but called as you know degree of freedom.

So that means, technically to get the critical value you must specify thse alpha component we you must specify the test statistics, and then we have to get the degree of freedom. So, that is the adjustment between the variables involvement and the sample size. So, once you specify all these things then you are in a position to find out you know critical value. So, now once you know specified the critical value, then the critical value then the critical value left side so, will be called as a rejected zone and similarly critical value in the right side you know above the right side of this particular zone is called as you know rejected zones.

Then in between critical value you know this side in the right person, and this critical value in the left person is called as you know accepted zones. So, now the idea behind this particular testing or inferential analytics is to see, where is the position of test statistics. Whether it is coming under the accepted zones or whether it is coming under the rejected zones so; that means, on the basis of you know sample samples so, you have to find out the sample you know statistics, and then you have to see the locations with respect to this particular you know testing kind of you know structure.

So, if you are testing structure is like this so that means, your test statistic is coming in the red sides both the sides, then it is actually rejected zones so that means, the rejected zone means it is the question of you know rejecting the true null hypothesis. And if you are not rejecting the true null hypothesis then it will be in the accepted zones. So, in that case we have to accept the you know you are not in a position to reject the null hypothesis so, you have to finally, accept the alternative hypothesis; that means, what we have already highlighted in the you know previous slides that you know at a particular point of time 1 must be true.

So, both cannot be go simultaneously if you are you know rejecting the true null hypothesis, then you will be conclude as per the particular you know structures if not then you have to accept the alternative hypothesis, then you have to just you know take the decision in the you know opposite directions. So, accordingly the test structures will be like this. So, then I will take you to the kind of you know structure here.

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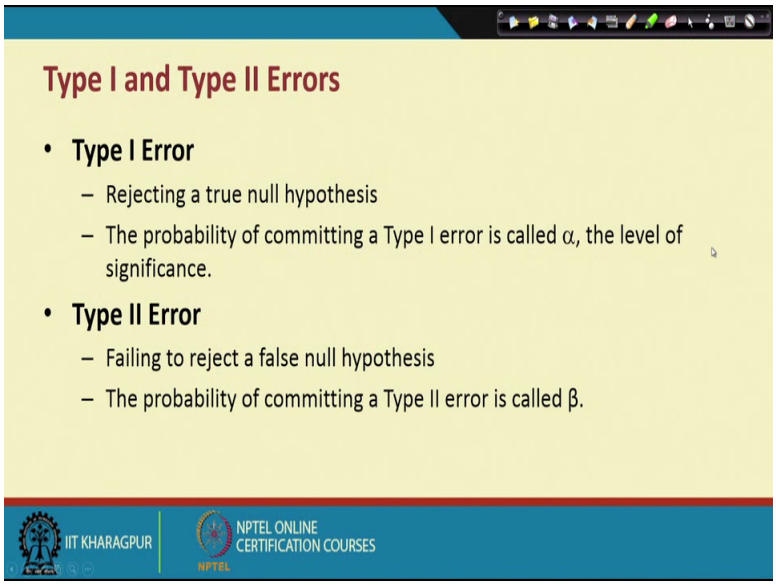

The concept called as you know type 1 error and type 2 error. So, the concept of type 1 error, and type 2 error is nothing, but you know rejecting the true null hypothesis or you know accepting to the false null hypothesis.

That means when you have actually setting the null hypothesis. So, you know it is you know it is the true or it is the kind of you knows false that means it is a statement which we are you know putting. So, this statement which you are putting by default will be represented as a called as you know null hypothesis. So, this statement may be true maybe false so, that is why we will give 2 options.

So, that is how the decision making will be taken care. So, null hypothesis true and false, and then you have 2 options to reject and accepts so that means a it is nothing, but actually the you know square matrix of 2 into 2. So, null hypothesis true false and then null hypothesis acceptance and you know to be rejected. So, there are you know altogether 4 different options. So, then let us see what is this particular you know structure altogether.

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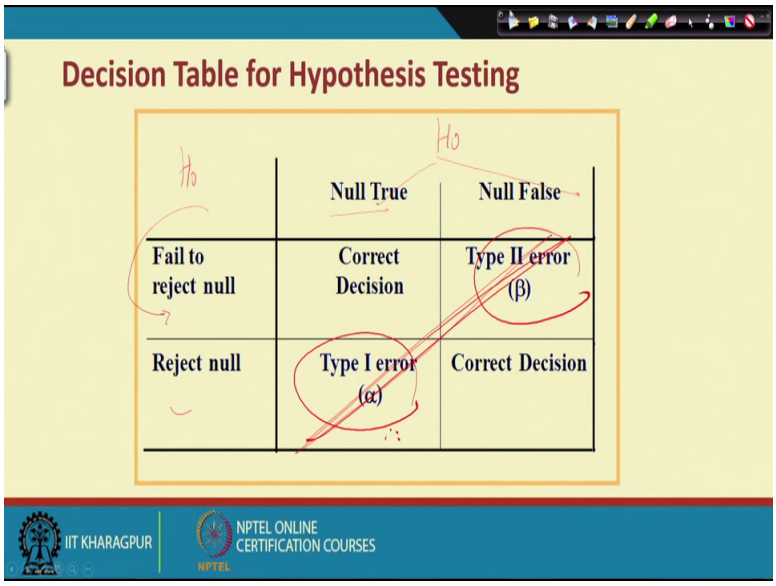

So now, in this case the structure is like this you know this is actually the comment about the null hypothesis, and here the decision about the null hypothesis. So, null hypothesis is true, and null hypothesis is false, and H 0 you know it will be rejected against you know null true, and null false. And it will be fail to reject in the case of you know true null hypothesis, and false null hypothesis so that means here in the first case H 0 is true.

So, now the structure is here fail to reject the null so; that means, you are you are not in a position to you know a reject the null hypothesis when it is true. So, the as a result it is actually declared as you know correct decision. So, now, in the counterpart you are rejecting the true null hypothesis. So, that is what it is called as you know type 1 error. So, now type 1 error which is nothing, but called as you know alpha and that is specified you know in the kind of you know normal distributions as you know alpha specification that is the point through which you have to check this significance level.

So, now in the type 1 errors the interpretation will be you know it is the rejecting the true null hypothesis and; that means, the degree through which you are rejecting the true null hypothesis nothing, but called as a alpha. And then in the case of you know false null hypothesis that is actually a type 2 error that is the concept called as you know beta. So, now, that is actually so the false null hypothesis to be you know accepted. So, that is what actually called as you know type 2 error otherwise it will be the correct decisions.

So that means, technically it is the game between this particular you know diagonal. So, here alpha is a 1 particular component, and beta is another particular component, alpha 1 is called as a type 1 error. So, here the interpretation will be it is the probability through which you are rejecting the true null hypothesis. And in this case it is the probability through which you are you know accepting the false null hypothesis. And at a particular point of time your alpha plus beta exactly equal to 1, since total probability equal to 1. So, your alpha and beta will be represented as a equal to once.

So, now corresponding to this particular you know structures, you have to go for you know empirical testing.

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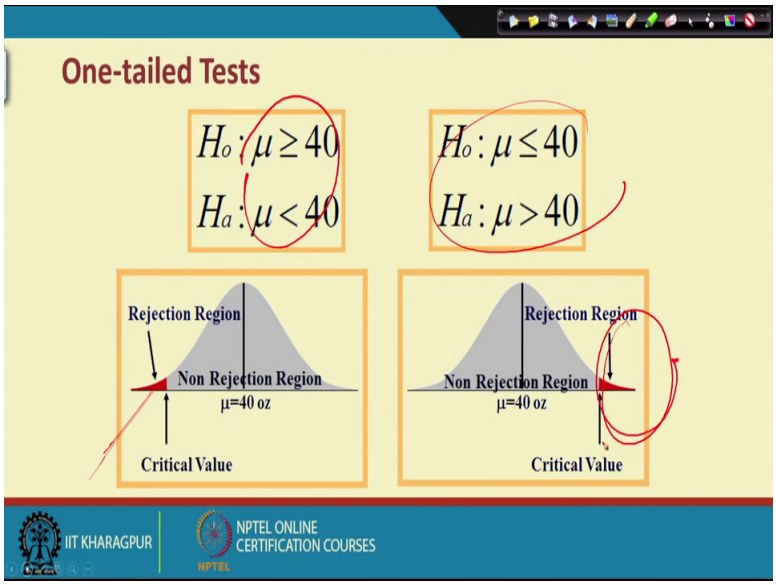

Now see here is in the red zones we first specify the alpha you know null hypothesis structure, and then specify the type 1 error that is the alpha percentage. So, alpha will be vary from actually 0 to 100 so you have to specify whether it is 1 percent 5 percent 10 percent and like this. Then accordingly you have to find out you know critical value depending upon the test statistics and you know the kind of you know degree of freedom. So, now in this case this is the typical structure called as you know 1 tailed test in the left hand side, and this is the structure is called as you know right hand side.

So, now corresponding to this actually your null hypothesis is an alternative hypothesis will be like this. And this is if the null and alternative hypothesis, then you are targeting this side of you know testing's. So, when your null hypothesis like that; that means, mu

less than equal to 40 and mu greater than 40 then your testing zone will be this side so; that means, you we like to see actually whether you are you know test statistic will be in the rejected zones or if you are testing this side, then you like to check whether null hypothesis will be this side or it will be in the accepted zone.

So, this is the structure called as you know 1 tailed structures if not then we will move to a structure called as you know 2 tailed test. So, in that case both the sides says to be taken into considerations.

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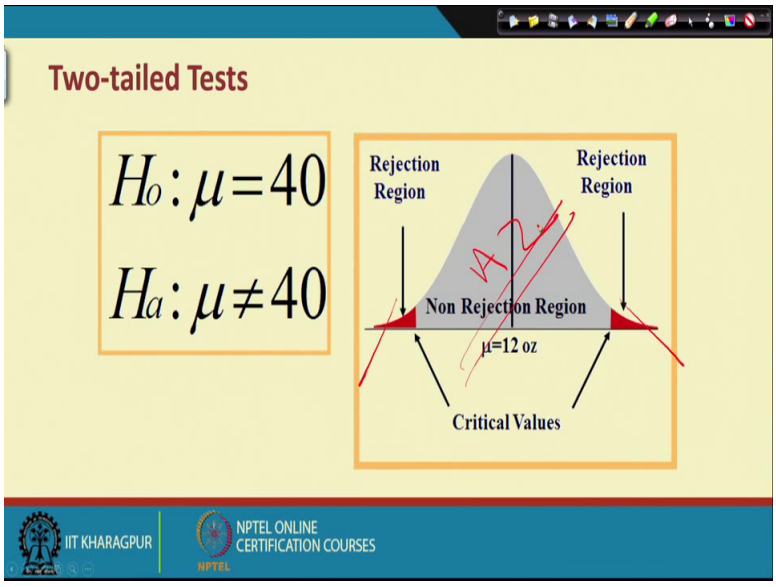

So, now in this case if you are putting alpha equal to 5 percent then you know 50 percent will be come this side, and 50 percent will be come to this side. So, as a results your you are you know target of you know testing will be this sides, and this is what actually called as you know accepted zones . So, now against you know on the basis of you know fixing null hypothesis and alternative hypothesis and the alpha fixations, you have to find out the critical value and specify the rejected zone, and specify the accepted zones, and then you have to see where is the position of your sample test statistics.

So, the position of the sample test statistic will give you the kind of you know inference, and that to comment on the null hypothesis and alternative hypothesis that; that means, whether to accept the null hypothesis or to reject the null hypothesis. So, accordingly so we have to we have to you know go for the kind of you know structure, then we will take a decision as per the particular you know problem requirement right. So, let us move to

this particular you know structure, and here is, I will give you a simple examples corresponding to this problems. So, now I will give you simple examples.

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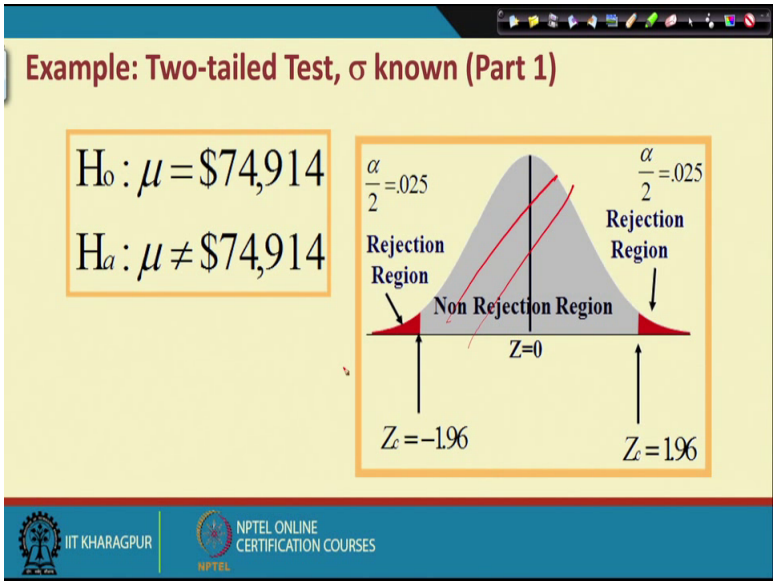

Let us say you know you know in the previous case we are fixing mu equal to 40 here, we are fixing mu equal to 74914, and then the counterpart will be not equal to 74914.

So, this is actually you know some kind of you know examples that means, let us assume that it is the average income of a particular you know location and then we have to you know take the samples, and then check whether the sample statistic will be converge to this population statistics or not. And for that the typical structure we have to follow like this, and we have actually standard test statistic structures so that means, you know we have a Z test t test chi square and f and more or less every test structure will be follow like this you know testing procedures. So, what will you do actually in you know here. So, we have to take 1 examples, and then with the help of you know test statistic we have to see the structure of you know testing and the kind of you know inference which will get, and accordingly we will take some kind of you know management decisions.

So, now in this case so here you know we are putting alpha equal to 5 percent that is the type 1 error, and that is what actually in the testing procedure we called as you know probability level of significance. And since you know we are targeting here both the sides; that means, it is a 2 tailed representation so, by default 0.025 will become this side,

and 0.025 will be coming in the right side. So that means it is nothing, but alpha by 2 and alpha by 2.

Since alpha is 5 percent so 0.025 is left side, and 0.025 will be the right side that is the rejected zones right. And rest of the area that is the 95 percent area will be the accepted zone, so that means technically so again this the 95 percent you know area which is called as you know accepted zones, that is non rejection zones otherwise and out of which this is actually rejected zones 50 percent, and rejected zones remaining 50 percent; that means, 0.025 and 0.025.

Now, corresponding to this alpha and if you choose a particular test statistics let us say Z. So, that is the normal distribution, standard normal distributions. So, now corresponding to actually alpha you know I mean this value 0.025, then your Z value you will be represented as you know minus 1.96, and accordingly this side will be you know 1.96. So, now I will I will you know this is actually a derived, this critical value typically derive a on the basis of you know Z tables only. So, in the next slides I will show you how exactly you know exactly coming this particular you know value so, see here is.

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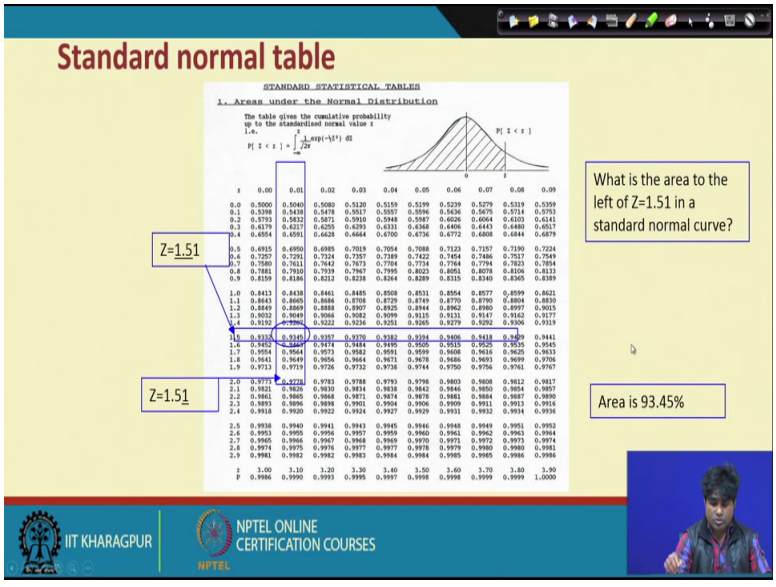

So, this is what actually the standard normal tables. So, we are targeting actually you know 95 percent and that to 1.96 so that means so, here the target is 1.96 means so this is actually 1.9 and a 6 means you will come to this side here is so that means, tech technically this person 0.975, and 0. 975 means so, if you go to the previous slide then

you can get to know you can get to know the particular you know structures. So, here you know minus 1.96 and here 1.96.

That means 0.025 so, corresponding to that particular you know value corresponding to that particular value. So, it is actually specify 0.975. So, as a result your Z value will be 1.96, and that is what the critical value all about and then on the basis of you know critical value. So, you know so, this is what do you know clearly you know specification how the you know Z critical value will be reported, and then accordingly so you can actually go for you know some kind of you know testing right.

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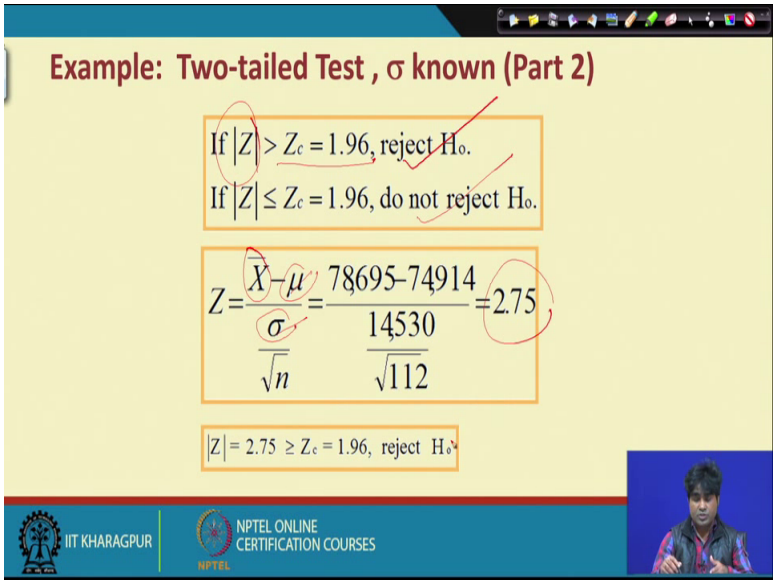

So, this is what actually the particular structure, and in the case of you know 2 tailed test fixing alpha value, then you know alpha you know followed by alpha by 2. So, the decision will be like this, you know you are null hypothesis will be rejected when you are you know Z calculated will be greater than to Z critical right. So that means, technically so, the decision will be reject true null hypothesis, when you know your test statistic Z test statistics calculated test statistic, will you know over take the Z critical 1.96 and if not, then you have to you cannot reject null hypothesis; that means, you have to accept the alternative hypothesis and in that case your Z calculated will be less than to Z critical that is 1.96 right.

And the corresponding to this particular you know structure. So, the decision rule will be like this so in a particular example, you know which we have already highlighted. So,

your let say sample you know this is actually sample statistic structure and this is mu and standard deviation are you know population parameter, and this is the you know Z test formula, and we have already discussed in the last lecture. So, now knowing you know having the information about you know population mean mu and population standard deviation sigma. So, then you know you just report the sample statistics that is x bar, and then you have to simplify you will be get the value called as you know Z equal to 275.

Now, on the basis of you know alpha fixation you know 0.5 that to again for 2 tailed 0.025, and then we are getting Z critical is 1.96, and since Z equal to 1.96 and here the value is coming test statistic value is coming 2.75. So, as a result 2.75 is greater than to 1.96 so that means, it is definitely it is in coming under the rejected zones. So, we are we are in a position now to reject the true null hypothesis. So, your decision corresponding to this problem and information you know you have to reject the true null hypothesis.

That means the statement which you are you know putting so, that is actually correctly specified. So, the decision will be like this, and then ok all right. So, the structure is a followed like this.

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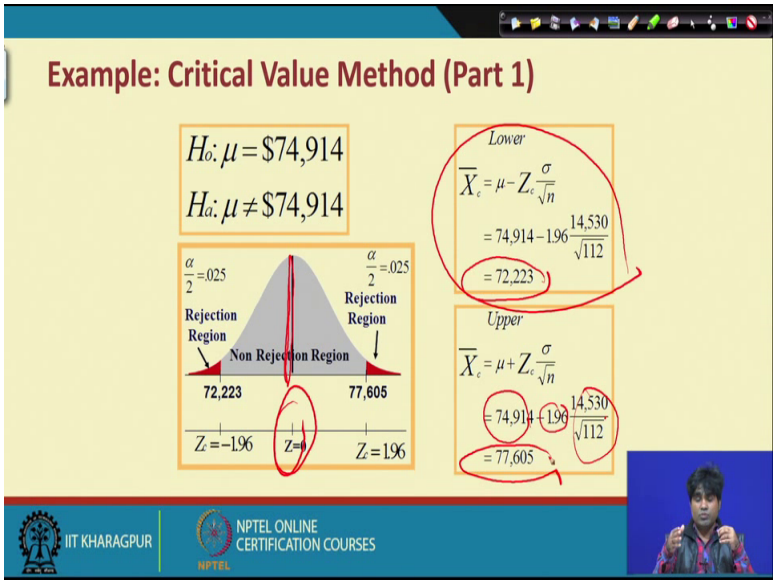

So, in the previous lectures we have discussed actually these are all actually sample statistics, and then with respect to sample value the following structure can be converted into Z structures, and when population you know you know mean equal to 74914 so that

means, if you will go by Z transformations. So, in that case Z will be exactly equal to 0 ok.

So, this is the actually the kind of you know mean, and that is how you know it looks you know symmetrical distribution, and then the confidence interval will be minus 1.96 to you know 1.96, and now on the basis of you know Z value so, the Zs calculated. So, you know it is appearing that you know it is going in the rejected zones. So, as a result so, you are you know rejecting the a true null hypothesis, but you know on the basis of this particular you know structures we will be find here 1 particular you know inference that is the kind of you know confidence interval that is the lower limit and you know upper limit.

Since we have already specify the you know critical levels in the left side and right side, and corresponding to these critical value so, you know the kind of you know structures you have to find out the a lower limit zone and under limit zones. And the lower limit zone will be so that is nothing, but actually specification about the kind of you know sample means. So, sometimes it may not be directly converge to population mean. So, as a result so, what we will do we will find actually kind of you know interval. So, the interval will be mu plus minus Z statistics followed by you know Z critical and then sigma by root n.

So, as a result so corresponding to this particular you know value. So, here the lower limit structure will be like this. So, mu is already specified that is 74914 minus Z critical which we have already calculated 1.96, and sigma is already specified there and you know on the basis of you know sigma and n is here you know assuming that you know 1 1 2, and then accordingly so, the lower limit figure will be coming actually 72223, and corresponding to the lower limit the upper limit will be mu plus you know Z critical sigma by root n.

So, as a results so this is actually the means, and then this is the Z criticals and corresponding the standard deviation by root n s, and then it will be coming 77605. So, so the mean is 74914, and then the confidence interval will be created actually a up to you know left side 72223, that is the lower limit and the right side it will be coming 77605 so; that means so the confidence interval for this mean mu equal to 74914 is nothing, but you know 72223 and 77605.

So that means, in a particular point of times you are in a position to report the significance of this particular you know structure to whether to accept the null hypothesis, and alternative hypothesis and corresponding to the you know population mean we can actually report the kind of you know confidence interval so; that means, the mean which you have a so, what should be the actually lower limit range and you know what should be the upper limit range sometime, it is very difficult to find a situation that you know your sample statistic will be exactly converge to populations a statistics.

If not then we have to create a confidence interval and that confidence interval will give you some kind of you know inference as per the kind of you know problems, and then accordingly you will be take some kind of you know management decision. So, now, corresponding to this particular you know structure. So, I will give you another you know example here and see here is.

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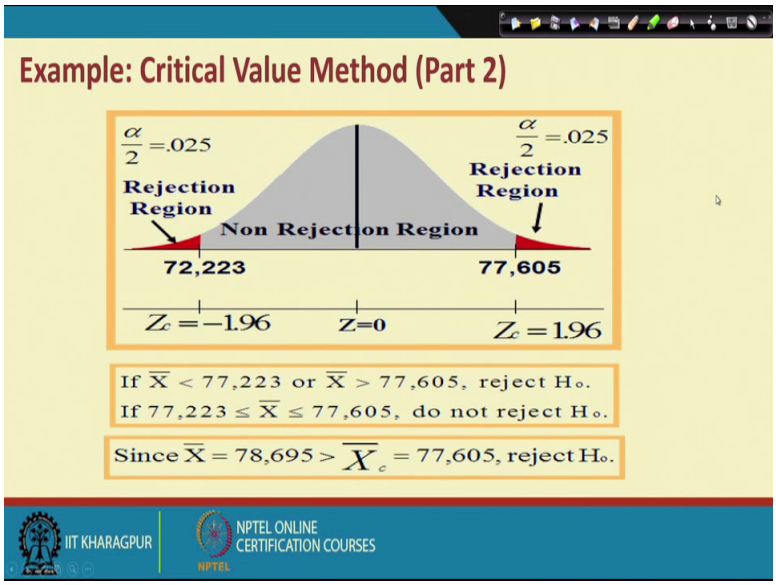

So, now here x bar is the lower limit you know x bars you know 77,223 where you know x greater than 77,605.

So that means so, the lower limit range is a 77,223. So, now, if the test statistic actually having less than that then that will be actually rejected, and then in this case you know upper limit is a 77,605 so, if the test statistic coming you know greater than to that so, then it will be coming under the rejected zones. So, now, in this particular case since X

bar is coming 78,695 and which is greater than to 77,605 then by default you are actually now rejecting the true null hypothesis.

So that means, actually the whole idea is that you know on the basis of you know here, you know population parameters and the sample statistic you have to find out you know confidence interval typically in the case of you know 2 tailed test. So, now, the confidence interval will be actually lower you will give you the idea about the lower limit, and you know upper limit. So, now, if you are test statistic is you know falling lesser to the lower limit, and then higher to this you know upper limit, then you are actually in a position to reject the true null hypothesis, and that is the decision which you have actually taken into considerations here is, and that to you know as per you are you know problem requirement.

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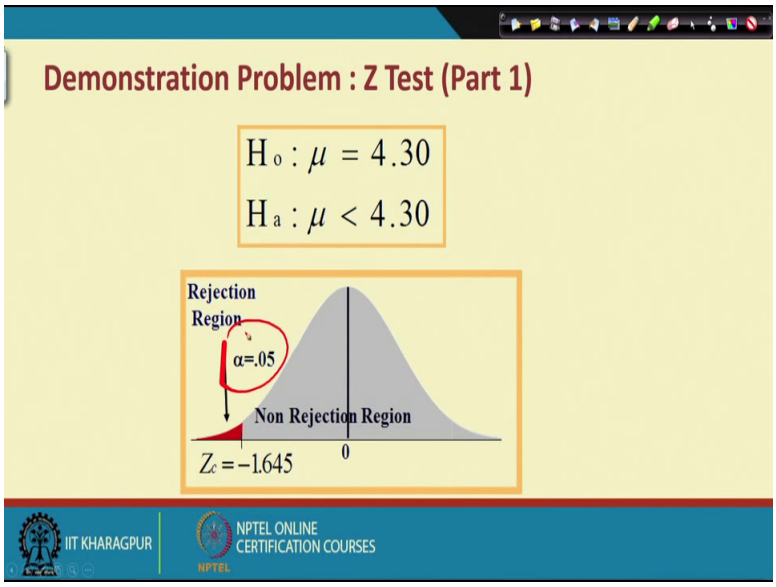

So, now corresponding to this so, another examples which I can sit here. So, now let us say mu equal to 4.30, and then the counterpart will be mu less than to 4.30. So, now again you know we will go by 1 tailed test here, because you know the alternative hypothesis fixed at actually mu less than 4.30. So, as a result you know if you are putting actually alpha equal to 0.05 alpha equal to 0.05 so, then you know the Z critical will be minus 1.645.

So that means, against you go to this you know probability structure, and then corresponding to that you know 0.05. So, we will be find z critical will be minus 1.645

then again you will be calculate the test statistics, and then you will be see the position of you know test statistic whether it is coming under the rejected zones or it is coming under the accepted zones.

So, now once we will be actually in a position to calculate then you will take a decision accordingly so, here so this is what the particular structure.

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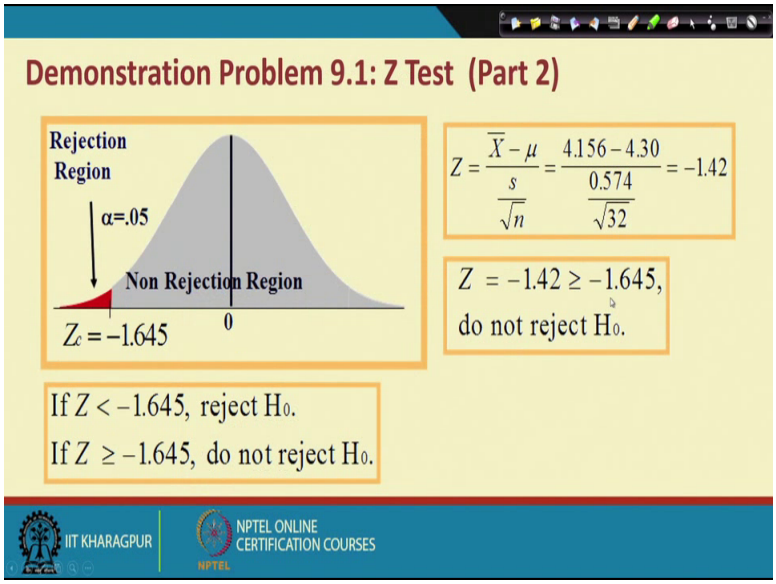

Now, So the Z critical will be minus 1.645, and in this case on the basis of you know information your x bar is coming that is called as you know sample statistics. So, it is coming 4.156 and the population statistic is given that is 4.3, and that is nothing, but actually mu specifications and s is a here givens 0. 574 and n is given 32.

So, as a result your Z calculated will be minus 1.42, and if you compare here is this minus 1.42 is actually this is actually critical zones minus 1.645, and then your minus 1.42 is actually coming this sides, minus 1.42 means it is you know coming under this side. So as a result so, you are not in a position to a reject the hypothesis so that means, so in this case we have to accept the alternative hypothesis. So that means, it is very much clear that you know so, on the basis of your you know population you know informations are you know the specification of you know population parameter.

So, you have to calculate the sample statistic and then check, whether the sample statistic is coming you know within the confidence interval or going beyond the confidence

interval; that means, whether it is actually coming a lower to you know lesser to the lower bound and higher to the upper bound, then you are in a position to reject the true null hypothesis if not then it will be coming in a kind of you know confidence interval that is what it is called as a accepted zones, and if your test statistic value will be lying on that particular zones then you are not in a position to reject the true null hypothesis.

In that case you have to accept the alternative hypothesis. So, now, the decision is very much clear here is. So, the typical structure is that you know you are going to you know investigating a problems. So, you know ones you go through this problem. So, you have to specify the particular you know comment what we need to actually test, and the comment which need to specify corresponding to that problems is nothing, but if the formulation of you know null hypothesis. And then so your observation is a or you know testing structure or inferential structure is a so, whether to accept this particular you know statement or whether to reject the particular statement, then in that case you have to collect the information choose the test statistic, choose the kind of you know probability level of significance, then there is a kind of you know structure through which you have to take a decision.

So, this structure is like that you know here, you know the sample test statistic should be compared with you know test statistic critical value depending upon this sample size, and the fixation of you know alpha that is the type 1 error, and the if you are you know test statistic value is coming under the accepted zone, then you are not in a position to reject the true null hypothesis and if not then it will be coming under the rejected zones. So, in that case you have to reject the true null hypothesis. Then accordingly depending upon your fixation of null hypothesis you have to take a decisions, and then the inference will give you some kind of you know management decisions as per here problem requirement.

With this, we will stop here is and we will continue from this in the next lectures.

Thank you very much. Have a nice day.