**Business Analytics for Management Decision**
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**Lecture - 18**
**Inferential Analytics (Contd.)**

Hello everybody, this is Rudra Pradhan here and welcome you all to B M D course, and we are still in inferential analytics, and this is the third lecture of this particular series, and we like to continue this lectures corresponding to previous class discussions.

So, the idea behind this particular you know lecture is like this. So, we have a problem, and corresponding to a problems we have to design a particular hypothesis, which we need to be tested. So, the idea is that you know, it is a kind of you know observations or the kind of you know thought process through which something need to be tested. And the usual testing structure is like that you know, the comment about the populations that is derived from the a problem, and then with the help of you know data or you know samples. So, we have to take a decisions, and that too corresponding to the population structures.

So; that means, typically the idea is you know, to check how sample statistic is deviating from the populations parameters. So, now, there are three different ways we have to discuss this particular you know you know process. So, sampling, sampling distribution and populations, population is there. So, we have to draw the samples, and check whether you know sample statistic converts to population, and if not then some these samplings can be created as sampling distribution, and then we have to check whether sampling distribution will converse to populations. So; that means, altogether there are two different ways we can do the processing, but by the way most of the times the game will be sampled to populations. So, in between the particular structure is called as you know sampling distribution.

So, what we will do. So, we will check actually the procedure through which we, you have to draw the samples, and then we have to check the a kind of you know sample statistic corresponding to the population parameter. So, now, in the last class which you have discussed barriers, you know test statistic structure, and the empirical testing procedures. In the testing in kind of you know environment, we have altogether four

different test statistic through which you will do this particular you know investigation process.

This test statistic are Z statistic, t statistic, chi square statistics and then f distributions. And in the last lectures, we have discussed couple of problems through Z distributions. So; that means, the idea is that you know you have again comment on the populations, then on the basis of you know population parameters. So, we have a sample statistics, then you know compare you know contrast and will get some kind of you know in inference, on the basis of you know population specification or the problem kind of you know design.

So, now in the Z distributions in the particular Z test, we have the structure of you know population parameters. So, what do we will do? So, we have to just you know connect with the sample statistic with the populations; that means, typically population parameters means mu and standard deviations are given, and once you know these things are you know reported. So, the structure will be tested accordingly. And on the contrary sometimes your mu and standard deviations will not be available, then we will do the kind of you know experiment. Again similar kind of you know comment to the population parameters.

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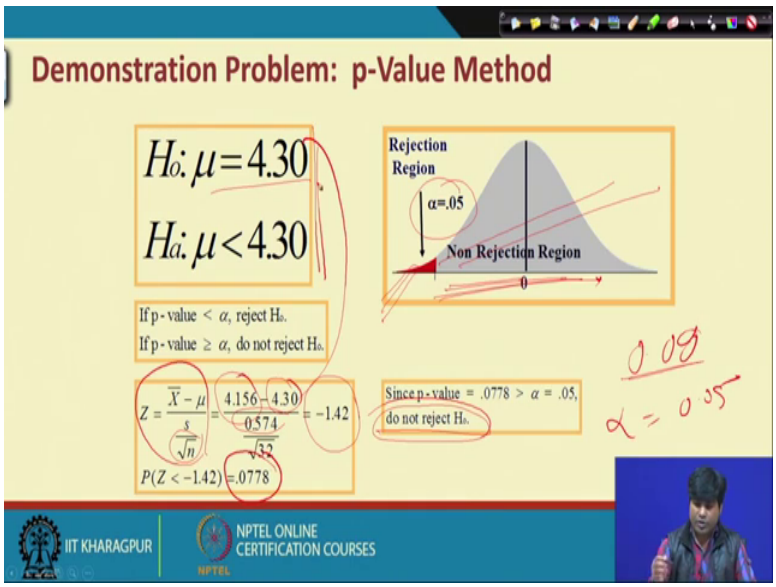


So, now in the, you know discussion process which we have already discussed in the last lecture, the procedure is like this. So, it is the, if the starting is the comment about the

population parameter. So, in this particular case mu equal to 4.30, and the alternative hypothesis will be mu less than equal to 4 4.30. so; that means, typically we are targeting here one tail test, and we can also go for you know two tailed test by putting mu not equal to 4.30, or you can go for you know right side of the you know another one tail. So, specifying mu greater than 4.30.

So; that means, there are three different ways we can do this particular you know testing. And by the way in the testing procedures we have actually two different ways to you know get the inference, and taking the kind of you know management decision in the first process. So, what will do on the basis of you know population information, and sample statistics you have to find out you know sample statistic you know test statistic value.

Then the test statistic value will be compared with the test critical value and if the test statistic value will be lower, you know lesser to lower bound and greater to higher bound upper bound; that is the upper bound. So, then you know you are rejecting the true null hypothesis. If not then it will be in the accepted zones, and in that case you are not in a position to reject the true null hypothesis.

This is the first approach. So, in the first approach it is the test statistic through which we have to compare with you know critical value, and then you have to take a decision on the other sides. So, once you find out the test statistic, corresponding to test statistic you find out what is the probability value, and then you have to compare with a probability value, which you have previously specified for you know taking the management decisions. Now if that particular probability value is be lesser than to the particular, you know well, specific value, then you are in a position to reject the true null hypothesis; otherwise you have to accept the alternative hypothesis.

So, now in the last lectures we have discussed the same problem through test statistic approach. So, where you know you have to calculate the test statistic, then compare with the critical value and take the decision, whether to accept the null hypothesis and to reject the null hypothesis. in this case here, in this case; yes we are applying the a p value approach, then we are taking this same kind of you know decisions in the same problems, but here the structure is the p value approach rather than comparing the test statistic with the critical value.

So, now having you know similar kind of you know framework problem design. So, mu equal to 4.30, and agonist mu less than 4.3. So, now,. So, your alpha fixation will be 5 percent; that is 0.05, and as a result your rejected zone will be this side, and remaining 95 percent will be accepted zone and. So, in the p value approach, if the particular you know p value corresponding to test statistic sample test statistics is less than to alpha.

So, which is nothing, but actually 50 here, then we are in a position to reject the true null hypothesis. Otherwise you have to accept the alternative hypothesis; that means, we are not in a position to reject the null hypotheses. So, now, corresponding to this you know problem. So, assuming that x bar equal to 4.1 0.56 which can be derived from the sample star sample information, and then this is the population parameter mu 4.30, which is actually specified on the basis of you know problem formulation, and then standard deviation also given to you. So, that is 0.574 and then sample size is specified here you know 32, then on the basis of you know these Z Z statistics. So, we will calculate the Z value is coming minus 1.42 right.

So, now what will you do actually. So, you go to the Z tables then you check what is the probability value corresponding to Z equal to minus 1.42. So; that means, typically you have to see the Z value, you know Z tables and that to Z value for 1.42 and then check what is the particular you know probability. So, now, if you go to the Z tables, then you will define the probability value is you know coming actually 0.00 0.0778 but our actually value fix test actually alpha equal to 0.05.

So, now here actually a you know this p is yet you know you know more than 0.05. So; that means, technically here it is coming around 0.08, but actually the alpha value which you have fixed, is equal to 0.05. So, as a result, the p is coming this side only. So, that is the accepted zone. So, as a result our declaration will be that you know we are not in a position to reject the true null hypothesis; that means,. So, the mu which you have given 4.30 is a question mark right, is a question mark. So, accordingly, the decision is that you know its the same structure. So, in the earlier case. So, we are actually comparing with the Z value; that is minus 1.42 with the critical values. So, which is nothing, but 1.96.

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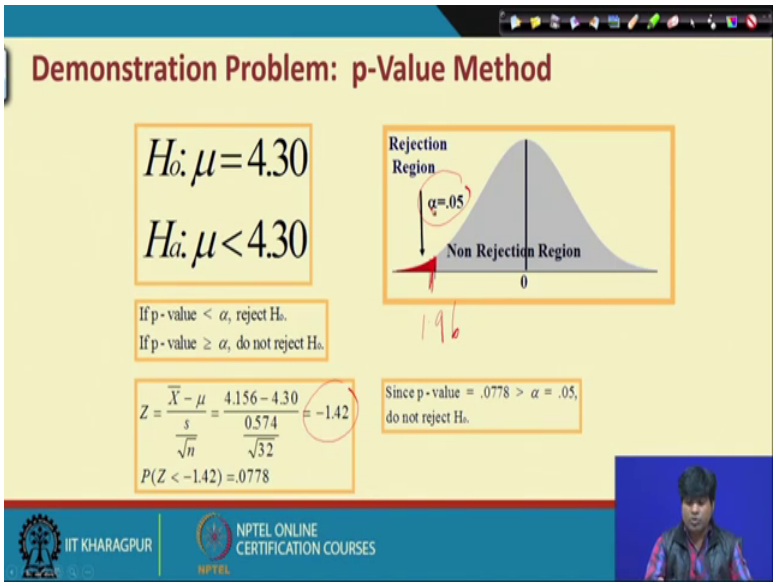


Now, here we are comparing actually p value corresponding to minus 1.42 then comparing, we comparing with the alpha value and in both the cases we are not in a position to reject the true null hypothesis. So, that is how. So, that is the process through which you have to take the decision.

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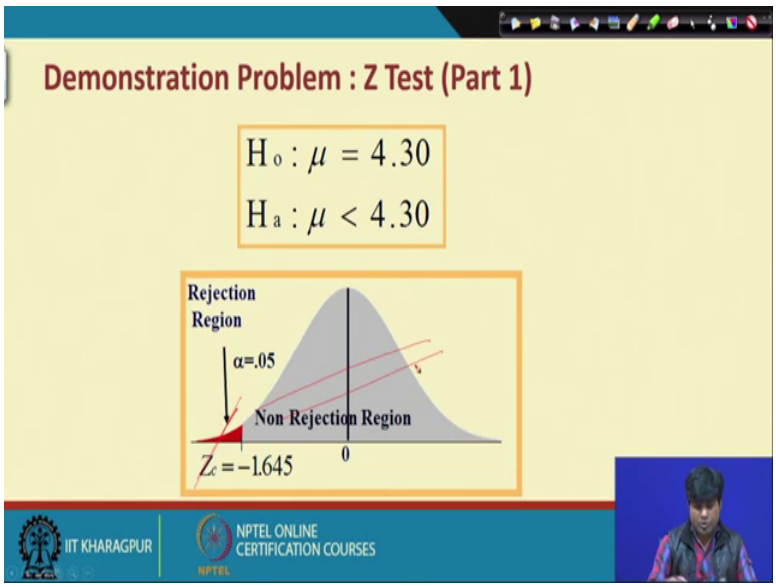


And then and you have to come to the, you know kind of you know inference and the kind of you know solutions, the same things here. So, it is the actually here alpha alpha 5 percent, and then corresponding to the a problems. So, Z critical is coming minus 1.645

and as a result here. So, this is actually declared as a, this is declared as a except you know just a minute.

So, this is declared as a you know rejected zones and by default this is a declared as you know accepted zones, and then corresponding to the previous discussions. So, the same structure you have to follow and then you have to take the decisions ok.

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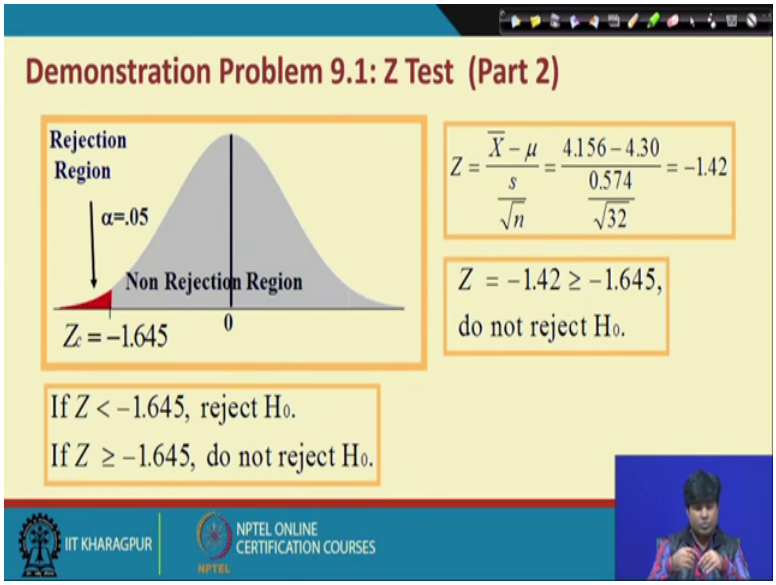


So, the decision will be like this. So, now, you have to calculate the Z value against it is coming minus 1.42, and since minus 1.42 is coming you know greater than equal to minus 1.645. So, you are not in a position to reject the true null hypothesis.

So; that means,. So, in the p value approach. So, the conclusion is in you know the, you know acceptance or of you know null hypothesis; that means, you are not in a position to reject the null hypothesis. So, here also in the case of you know test statistics. So, that is actually. So, the Z value is coming like this, and the critical value is coming you know like this.

So, as a result. So, the Z calculated is above than the Z criticals. So; that means, minus 1.645 is actually coming other side. So, as a results you are not in a position to reject the null hypothesis.

So; that means, the idea behind these two approaches you know are same, and whatever conclusion you are getting in the first sides, the same conclusion you are getting also in

the second approach; that means, whether you apply the p p a p value approach or you know kind of, you know test statistic approach. So, the conclusion remains same so, but we have a two different alternatives through which you have to, we have to actually investigate the problem, get the inference and then take the management decision as per the problem requirement.

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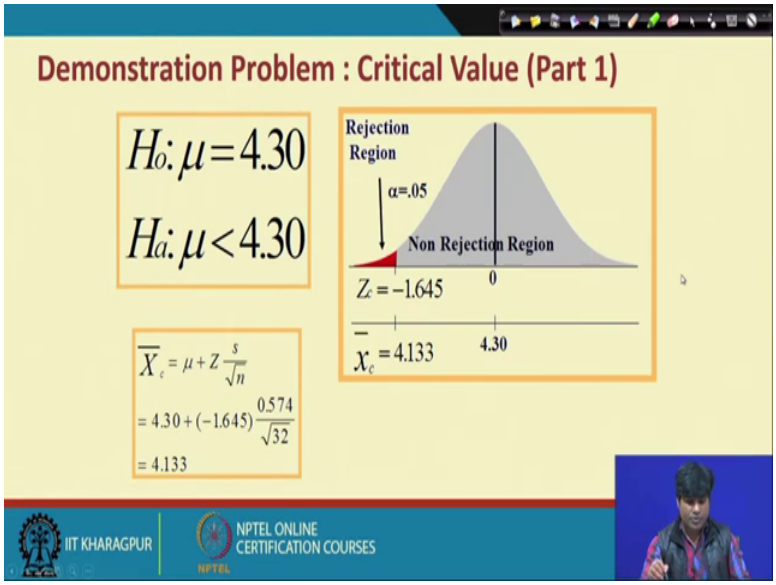


So, this is how the kind of you know structure and similarly. So, you know what we have already discussed that you know. Once you have a specify the concept you know a population parameter, then corresponding to the kind of you know alpha structures and the kind of you know choice of the test statistics. You can also find out the, a kind of you know all, or you know lower bound and upper bound through which actually your sample statistic can be you know represented.

So, in this case, the upper bound will be mu plus Z s by root n. So, that is actually 4.133, but actually the mean value is coming, the mean value is coming 4.30. And here actually one particular you know critical value will be 4.133.

Similarly you can go for actually a other sides. So, the other side will be a the kind of you know different structures, you know; that means, it is actually two different sides its mu plus minus. So, the plus side will go to the right side; that is the upper bound and the minus mu minus Z sigma, you know by root ends will be coming in the left side.

So, by as a results you will find a kind of you know confidence interval, we have a more discussion on confidence interval you know after this lecture, but in the mean times. So, here also we can say, we can actually report the same things and then ok.

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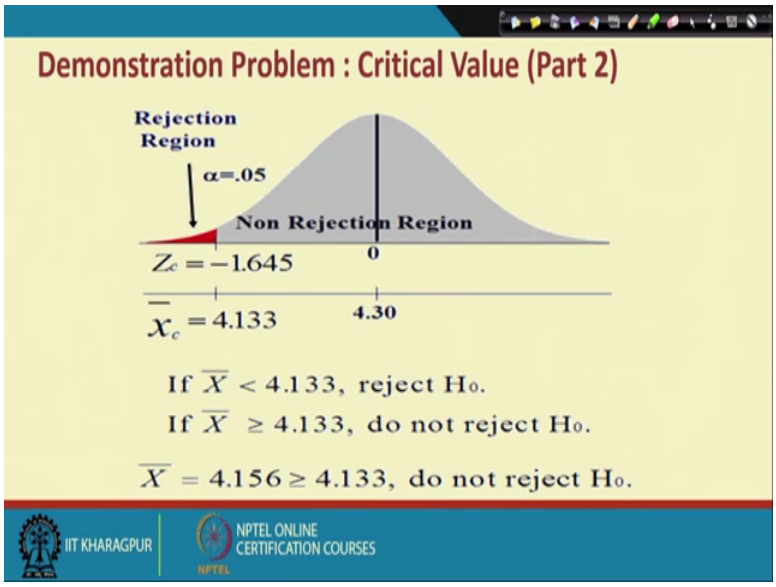


So, this is how a clear cut you know decision making process now, and since x bar you know is coming actually 4.133 and that to a, you know, is actually comparing with you know 4.30. So, as a results you are not in a position to you know, I mean say in not in a position to take a decision and. So, in this case typically x bar is coming 4.13 c 33.

So; that means, actually it is, actually a lesser to this critical value. So, as a result you have to reject the null hypothesis and in the counterpart, if x bar is coming greater than 2 4.133, you are not in a position to reject the eminence in null hypothesis. So, in this typical case x bar is coming 4.156 and which is greater than to 4.133. So, as a results you are not in a position to reject the null hypothesis.

So; that means, you know its actually kind of you know decision making process and the process is very simple. Actually corresponding to kind of you know population parameter and choice of the test statistic, and the kind of you know alpha you know fixations. So, you will get the critical value. And once you get the critical value, then the sample statistics positions will specify whether to except the null hypothesis and alternative hypothesis.

Then accordingly you get the inference. And on the basis of this inference we have to take the management decisions right. So, then you know same structure here, and this is another way to actually specify the kind of you know structure.

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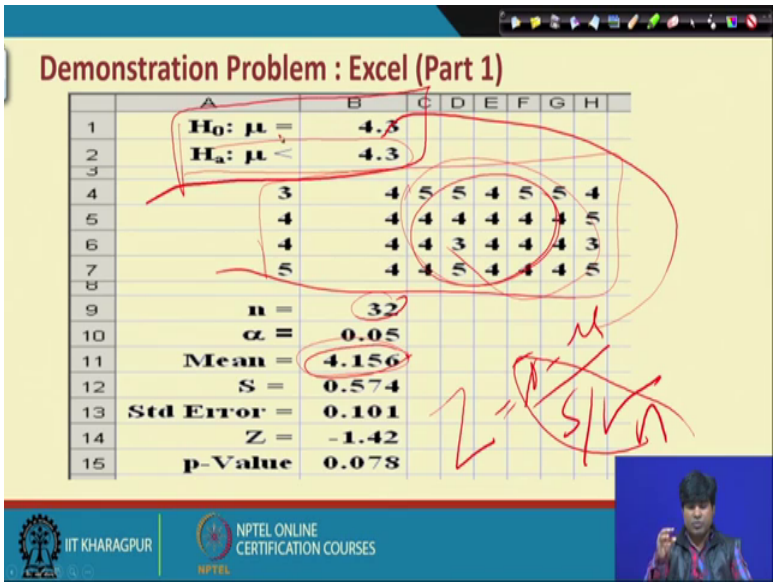


And in the you know the same things we can test through you know spreadsheet, excel spreadsheet and in the excel spreadsheet. So, what we will have here. This is actually the kind of you know test structure which you like to test, and here mu is actually 4.3 and corresponding to mu equal to 4 3, alternative hypothesis will be mu less than to 4.3 and these are all actually sample information.

So, we have altogether 32 samples n equal to 32, starting with you know 3 and ending with the 5. So, alpha, we are fixing here 0.05; that means, 5 percent you can actually change the alpha value you can go to 1 percent, you can go to 10 percent. So, accordingly you will find different kind of you know critical value and if your alpha will change, then critical value will change, and the decision will be also accordingly change.

But if your sample size will be very high then you know the change of alpha may not drastically affect your you know decision making process. So, in with the basis of these samples, we have to calculate the means which is our requirement. So; that means, technically the formula is a Z equal to x bar minus mu by s by root n. So; that means, technically. So, here mu is given; that is actually 4.3 and then rest of the things you have

to calculate, calculated from this particular you know sample observations right and. So, there are you know 32 observations

So, the sample mean will be a sum of all these observation divided by 32. So, which will be coming actually 4.1 .4 .156, and here the population mean is given actually 4.3. So; that means, in this particular problems we are assuming that you know the average, average you know of structure will be 4.3, and that is how the comment about the populations, and our investigation process will be that you know whether the particular you know some, you know mean is correctly specified or there is in need of you know some kind of you know change.

On the basis of that, investigation is you know done, and on the basis of these samples we have got the sample statistics, and then we will come you know with it, with the help of test statistic. We have to compare with the population structure and then come to the conclusion or inference, and accordingly we will take some kind of you know management decisions.

So, now the standard requirement is to find out the means. So, from this sample observation you can easily get the mean value. So, this is simply sum of the all observations divided by the sum you know sample points. So, that is 32, and it is coming 4.156, and the sample variance will be coming actually. So, that is actually. So, the x bar is nothing, but x bar is nothing, but summation x I by ns and that is nothing, but summation x I by a 32 right.

And in the case of you know this one in the case of you know standard deviation. So, it is nothing, but actually a summation x I minus x bar whole square divided by n and then you know once you get this you know variance. So, you have to find out the standard error that is actually nothing, but actually s by root n. And once you get the you know standard error. So, then you are you know difference between you know sample mean minus population mean divided by standard error will give you the Z value.

So, it will give you this Z value. So, now, once you get the Z value and corresponding to the Z value, you have to find out the p value and 1, since your alpha is already fixed you know 0.05. so; that means, technically. So, here the approach is like this.

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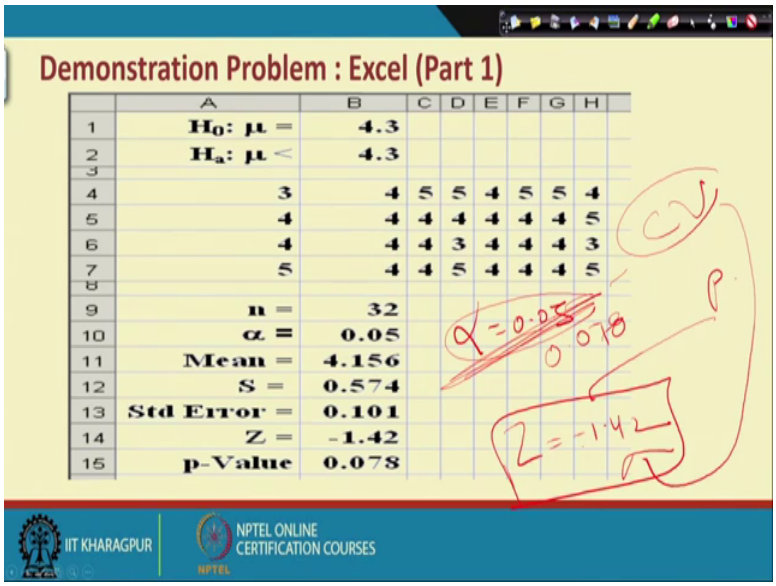


So, you have alpha equal to 0.05. Now you have to find the sample statistic is showing you know Z equal to minus 1.42.

So, corresponding to Z equal to minus 1.42, you have to see actually what is the probability value here. So, the probability value is coming corresponding to z, this much is coming actually 0.078 which is actually overtaking this particular you know value. So, this particular; that means, you know your sample statistic is actually in the accepted region, and in the same things you can actually conclude in other way.

So, where you know 0.05 you find out corresponding to alpha 0.05. You have to find out the critical value and this critical value can be compared with the Z equal Z you know calculated; that is minus 1.42. So, then you have to see the position whether it is in accepted zone or you know it is a kind of you know rejected zone, then on the basis of that you have to take the equals. So, you know whether to reject the null hypothesis or to accept the null and null hypothesis ok.

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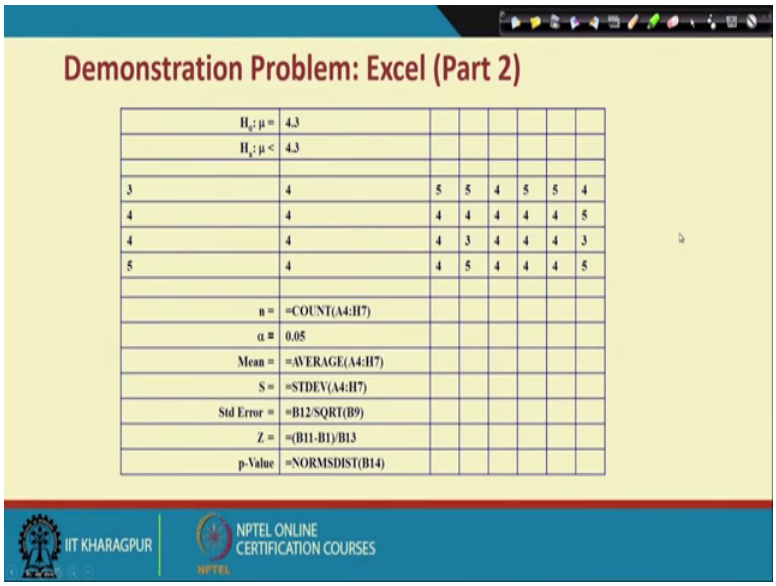


So, now accordingly. So, you have to move to this you know structure and see here, this is actually excel spreadsheet and either you calculate separately and a report, or else I just enter the data, and then you know you go to this you know structure. So, here actually you know you just put you know excel server command.

So, it will give you actually how much; obviously, the answer will be 32 here, and alpha is the fixed here, mean if you know specify from this end to this end and that is a 4 to H 7, and similarly standard deviations a 4 to H 7 and standard errors is nothing, but standard deviation by you know root ns. So, it is coming actually a whatever you know on the basis of sample, you will get this ones, and then again you have to find out the Z value and compare with the Z value with you know p value; that is on the basis of you know normal distribution, and then compares and the basis of these comparisons will come to the conclusions that you know that we accept the null hypothesis or you know reject the null hypothesis.

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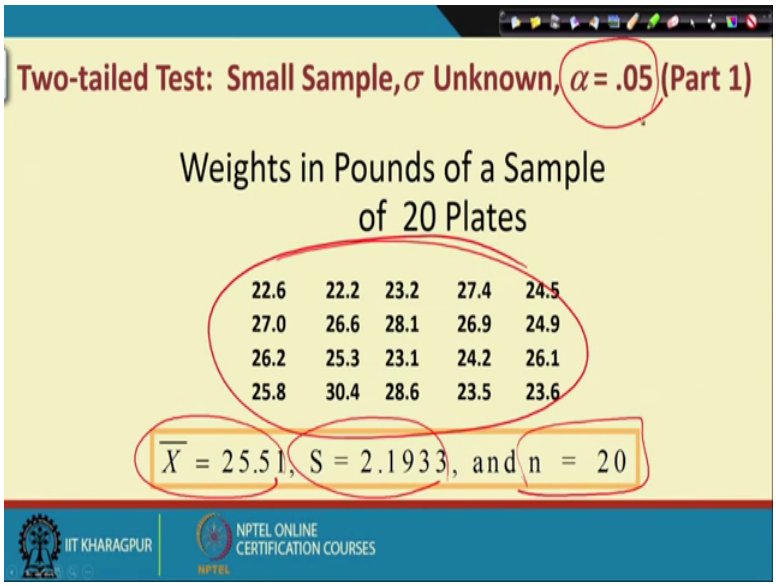


This is another kind of you know problems and in this problem need to be actually tested through two tailed test, and here it is a small sample case and that is on the basis of you know n equal to 20, because you know whether it in a small sample and large samples. So, we have to see actually whether you know n is coming less than 230 or greater than 230. So, since n is coming 20.

So, we will consider that this problem is a small sample case and these are the sample points. So, these are the sample points and on the basis of these sample points. So, you will find out you know sample means and sample standard, you know variance. And then n is n count is 20, and then a alpha is fixed here you know 0.05 that is 5 percent. You can change the alpha value 1 percent 10 percent 7 percent, whatever you know where you can change.

So, then you know here, you know the comparison will be also or your decision will be also changed accordingly, and against. One second I say continuously repeating that you know when your sample size will be increased it towards you know infinite, then you know there is a high chance that you know you are in a position to reject the to null hypothesis. If your problem is very consistent you know very accurately your you know exactly specified, and then corresponding to these problems. So, what will you do. So, these are the reporting.

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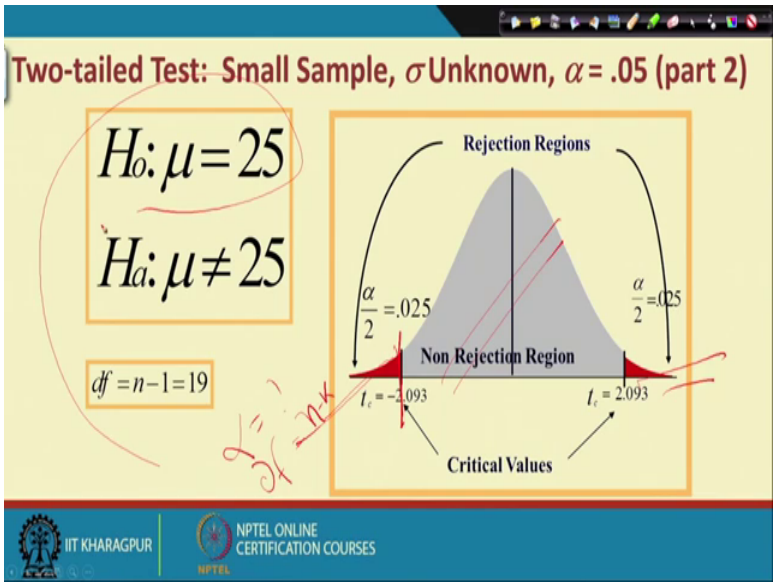


And then what will you do. So, let us say mu equal to actually 25 and corresponding to this, you know mu equal to 25. So, here you know calculated you know ok.

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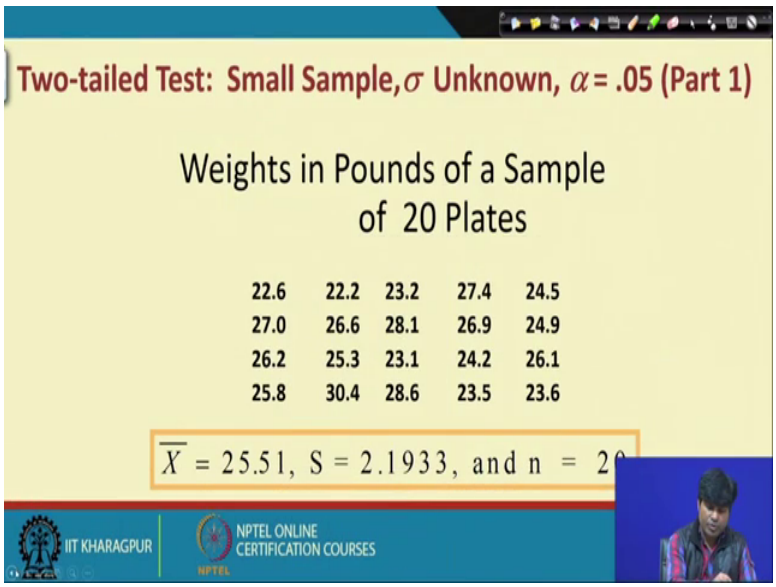


So, what will we do? You know on the basis of this one. See here if you know population parameters are not known then what will we do. You use these sample informations and represented as you know population parameter, and on the basis of that against you have to actually a you know compare, and then you have to take the management decision, and in this case, since it is a small sample case and sigma is a unknowns. So, the test

statistic, which you like to choose to you know take the management decision is nothing, but called as you know t statistics. So, generally Z is a use actually when you know sigma is n known to you, and the sample sizes is substantially very high.

And if not then you know best statistic which you can apply to get the inference is nothing, but t statistic. And in this case we are you know going to use the t statistics, and it is more or less you know same like you know z, but everything will be collected from the sample informations and as a result we are you know specifying here, first you know population parameters; that is mu equal to 25 and we are going for two tailed test as a result alternative hypothesis will be mu not equal to 25. So, then you go to the t tables. So, like Z table we have a t tables corresponding to the degree of freedom and here you know alpha value.

So, you will find a critical value and that critical value will be fixed at fixed here again same like you know Z test. So, here actually you know this critical value you need two things alpha alpha indication and the degree of freedom which is nothing, but actually n minus you know k k is the number of variables involved in this process, and n is the sample size and corresponding to this you will find critical value, and if it is two tailed, then it will go to the both the sides by you know alpha by 2 alpha by 2; that is 0.025 and 0.025 as per your ((Refer Time:25:47)) discussion. So, this should be the rejected zone this should be the rejected zone, and this one will be the accepted zones.

So, now our idea is actually to using this sample you know test statistics. You have to see whether you know test statistic value will be in the accepted zone or rejected zones accordingly, we will put you know comment to the you know population parameter and then we will take some kind of you know management decision ok.

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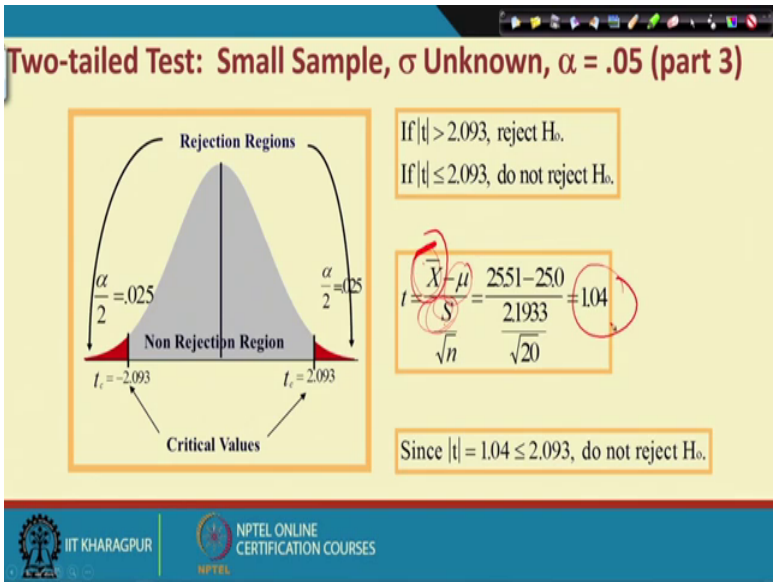


So, corresponding to this and we will move like this and then you know. So, in this case with the help of you know samples we are getting, you know a sample mean is coming actually 2.5. So, let us let me one second highlight here. So, 25.51. So, that is actually the kind of you know sample information and population figure is already give hints, and this is actually sample variance and. So, this an x bar and s need to be calculated n is the count, that is the sample size. So; that means, everything is there in the particular you know spreadsheet so on.

The basis of you know spreadsheet data you have to first calculate you know sample mean and sample standard deviations, and then you have to find out the t statistics, and t statistic actually more or less same with the Z statistics, only difference is you know in the case of Z mu will be a givens a or you know population parameters will be given and then Z can be applied, when the sample size will be large, and if not then you will be apply the t statistic, but the structure is more or less same. So, far as you know calculation is concerned or the testing is concerned. So, as a result, the t calculated will be 1.0 for like you know Z calculation.

So, then you have to see whether you know this t t calculated will be in the accepted zones or you know rejected zones. Then on the basis of you know t tables where alpha equal to actually 5 percent and that to under the two tailed umbrella and corresponding to

the degree of freedom 19. So, your critical value is coming 2.093, and since it is actually coming 1.04.

So, by default you have to come to the this side and 1.04. Means it is actually coming under the accepted zones, it is coming under accepted zones. So, by default your you know conclusion or the inference is you are not in a position to reject the true null hypothesis; that means, this judgment which you are you know targeting is correctly specified ok.

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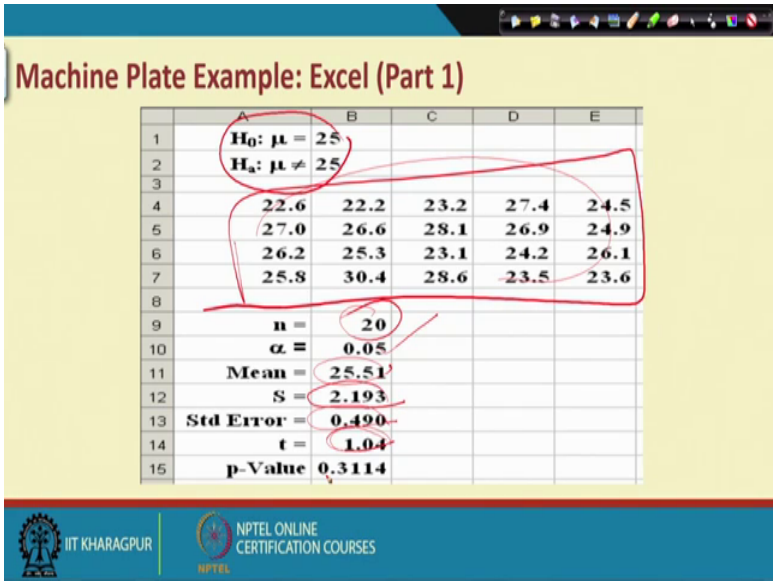


So, now corresponding to this problem. So, then you move again, and against this can be actually very easily, can be done through you know excel spreadsheet, and in the excel spreadsheet you just you know specify this particular indication, and these are all you know sample observations and a total sample observation is coming 20, and we are specifying alpha equal to 5 percent, and using these samples you have to find out you know mean. And then you have to find out the variance, and then you have to calculate the standard area, and on the basis of standard errors and you know the other you know requirements, you have to calculate the t statistic which is nothing, but actually x bar minus mu by s by root n, and then on the basis of actual t value you can check the probability value right.

So, either way. So, this here also you can compare you know test statistic to you know critical value or you can on the basis of you know test statistic, you find out the p value,

and then compare the p value with the alpha fixations, whether it is a 5 percent or you know 1 percent or 10 percent, then you take a decision whether to reject the true null hypothesis or you know accept the true null hypothesis. So, now, corresponding to this, you know you will go to the actually excel spreadsheet and check you know this is how the kind of you know structure.

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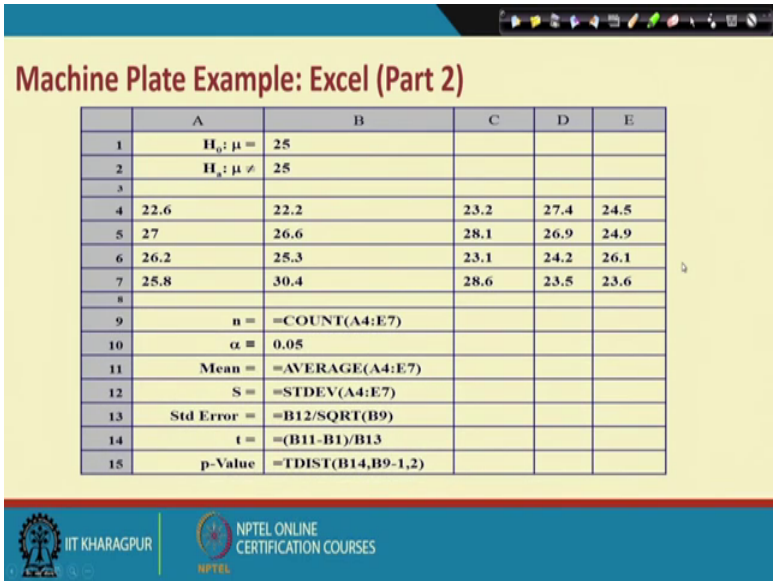


| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | $H_0: \mu =$ | 25 | | | |
| 2 | $H_a: \mu \neq$ | 25 | | | |
| 3 | | | | | |
| 4 | 22.6 | 22.2 | 23.2 | 27.4 | 24.5 |
| 5 | 27 | 26.6 | 28.1 | 26.9 | 24.9 |
| 6 | 26.2 | 25.3 | 23.1 | 24.2 | 26.1 |
| 7 | 25.8 | 30.4 | 28.6 | 23.5 | 23.6 |
| 8 | | | | | |
| 9 | n = | =COUNT(A4:E7) | | | |
| 10 | $\alpha$ = | 0.05 | | | |
| 11 | Mean = | =AVERAGE(A4:E7) | | | |
| 12 | S = | =STDEV(A4:E7) | | | |
| 13 | Std Error = | =B12/SQRT(B9) | | | |
| 14 | t = | =(B11-B1)/B13 | | | |
| 15 | p-Value | =TDIST(B14,B9-1,2) | | | |

And these are the command which you have already discussed. And once you enter the data and then a systematically you calculate all these you know items, and finally, you have to check actually whether to accept the kind of you know things, or you have to you know rigid kind of you know things.

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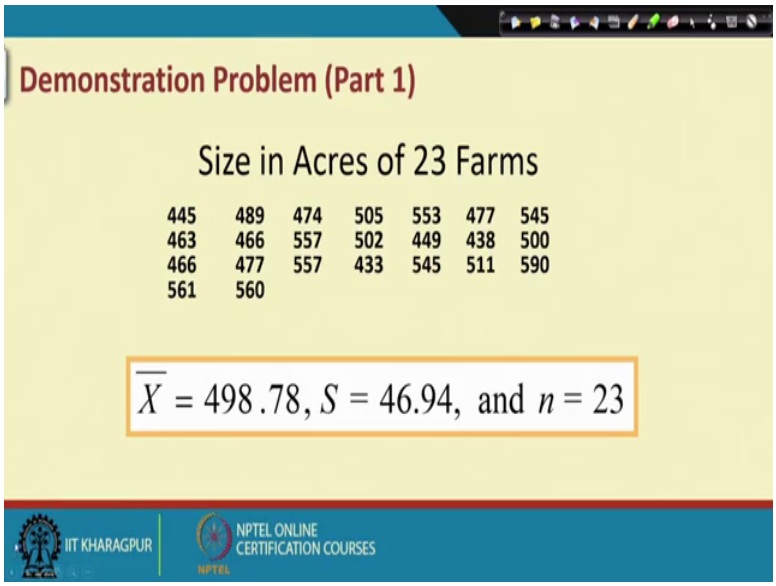


So, now the comparison can be you know done accordingly.

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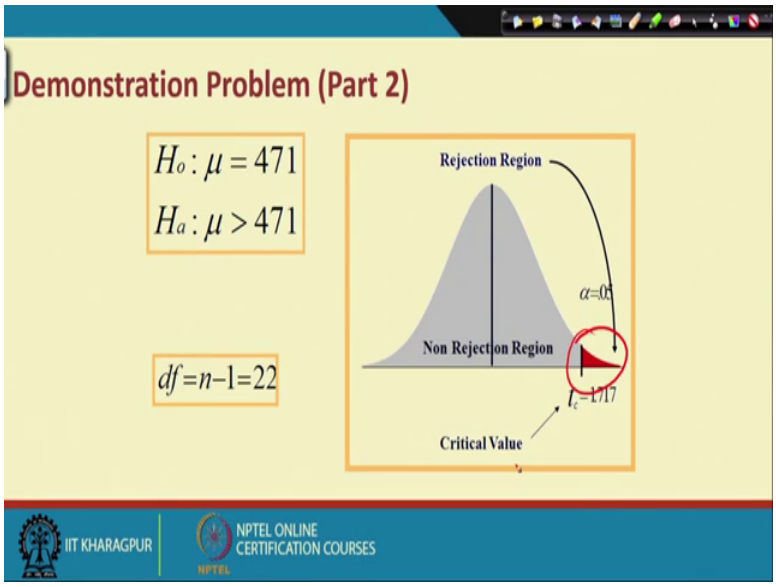


And this is what actually the kind of you know, this is what we have already discussed. And then the second problem will be like this again similar kind of you know problems. So, here sample size is a 23, and then with the help of you know the sample informations. So, you can actually calculate the a kind of you know mean and variance, and then again you apply test statistics to you know validate whether to you know accept the null hypothesis or you know a rigid the null hypothesis.

So, accordingly you can actually take the call to you know or you know take the management decisions, now corresponding to this you know data. So, we are fixing you know population parameter 471 that is mu equal to 470 471, for you know H zero, and the counterpart will be mu greater than 471 for you know alternative hypothesis that as a result, your you know critical value structure will be like this.

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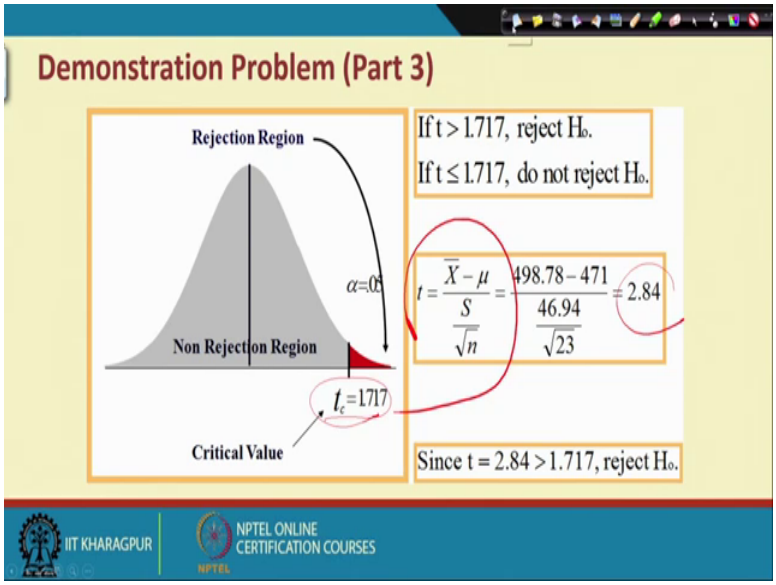


Since it is actually mu greater than and as a result here you know typical you know critical value zone will be this side only. So, this is what actually critical value zones.

So, it is coming actually minus 1.717, and this is actually obtained in the t tables corresponding to alpha 5 percent and the degree of freedom 22. So, now. So, you know you check actually what is actually t calculators, then you will check whether you know the calculate d calculator is coming under the accepted zone or you know rejected zone on, and on the basis of that you have to take the management decisions right.

So, then here is the kind of you know call and t is coming actually 1.717, and then on the basis of you know sample statistics what we have actually here t equal to t equal to coming to 2.84 and 2.84. Means it is actually over taking this, you know critical value 1.717. So, as a result straightforward answer is 2 rigid true null hypothesis.

Straightforward answer is the rejection of you know true null hypothesis. So; that means, its actually standard kind of you know format and every times. So, you take the

samples and then use the sample test statistics, and calculate the kind of you know test statistic value, and then with the help of you know alpha, you know indications and the kind of you know degree of freedom find out the critical value and check the position of the test statistic, whether in the accepted zone or you know rejected zone. And on the basis of that you have to take the management decision whether to reject the true null hypothesis or you know accept the true null.

So; that means, it is actually kind of you know interesting kind of you know structure, and most of the management problems you know used to check you know randomly a corresponding to the kind of you know change, they have to take a you know kind of know future, you know with respect to you know time for instance, you know let us say you know average profit for a particular you know company is a coming sum is something like you know, let us say for you know 4000 US dollars, but you know you have to check actually whether it you know over the time, or you know over the kind of you know cross sectional unit this particular you know structure is a still valid or not valid.

So, you know with the help of this you know sampling and you know sample statistic you may be in a position to you know take the call and take the decisions. So, like you know many different instances, you can actually you know try to apply this particular you know structure, and then you know you have to take the management decisions every time, you know I mean a this particular you know structure particularly, this you know hypothesis testing and you know.

So, far as a inferential analytics is concerned it is every time actually to check or you know what is the population structure, and whether the population structure is still valid, and you know some you know it cannot be actually you know valid for the long time. So, you know over the time the population parameter may change, and the change which can be actually you know specified against on the basis of you know testing only.

If the sample statistic actually not converging, then you know there is a difference and if the difference is statistically significant in over the time, and over the a different kind of you know cross sectional process, then by default the population parameter may be changed you know. So, accordingly the management decision need to be taken. So, every

times it is a kind of you know continuous affairs and then management decision has to be taken as per the kind of you know the cross check process only ok.

So, this is what the particular you know structure.

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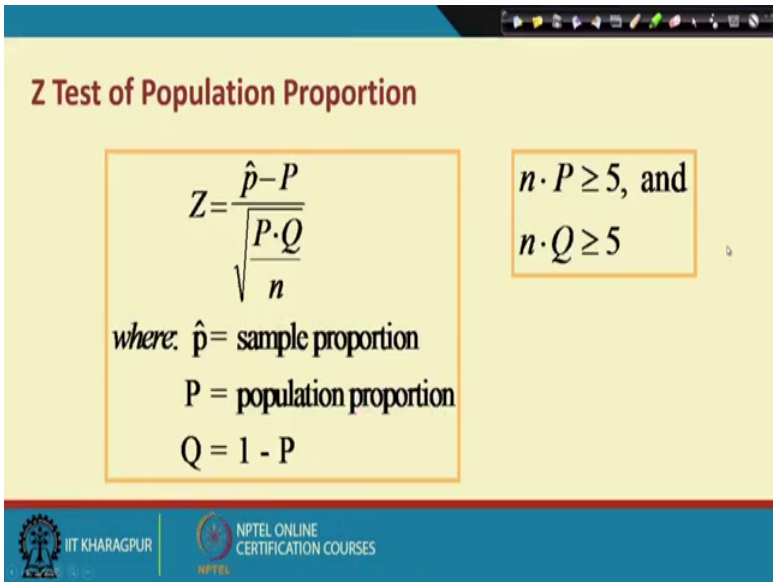


And there is another kind of you know structure through which, actually you can test the you know investigation; that is called as you know population proportion and this can be also applied through Z statistics. And here in this case, it is actually similar kind of you know process. So, this is actually some sample proportion, and this is what actually population proportions and this is nothing, but actually probability concept. And since total probability exactly equal to 1, then the this is the.

If the p is the probability of success and by default q is the probability of failure, which you have already discussed in the kind of you know distribution and probability distributions, and here Z statistics is the difference between you know sample proportions minus you know population proportions, like you know x bar minus mu here actually p s d methods minus p, and then it will be adjusted with you know square root of you know probability of success with the probability of failure and the sample of generations right

So, then accordingly is the same process will be followed, and then management decision can be taken into considerations.

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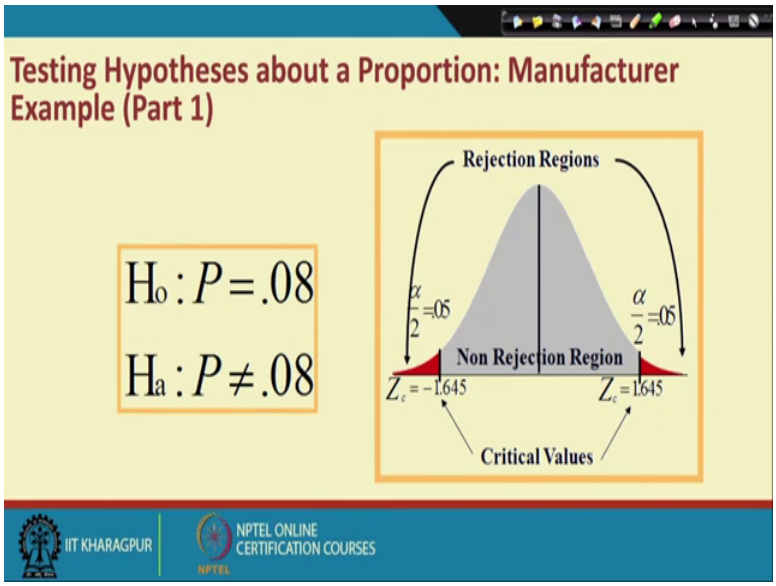


So, now the process will be more or less same against. So, you have to put the population indications, and then you have to calculate the sample statistics and then compare with you know the critical value. So, the decision against same, whether to accept the true null hypothesis or you know reject the true null hypothesis right.

So, in this case it is coming minus 1.6645 is the kind of critical value.

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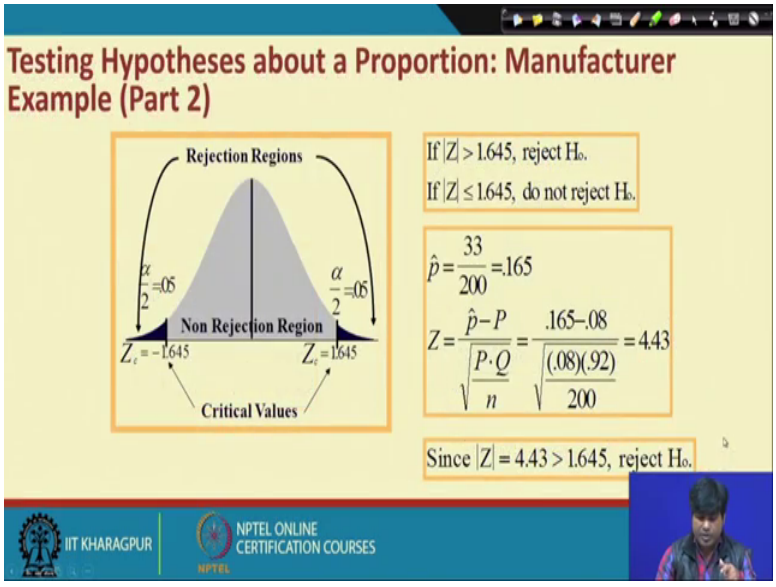


And then here on the basis of you knows information, sample information your Z a calculator is coming 4.43 and as a result.

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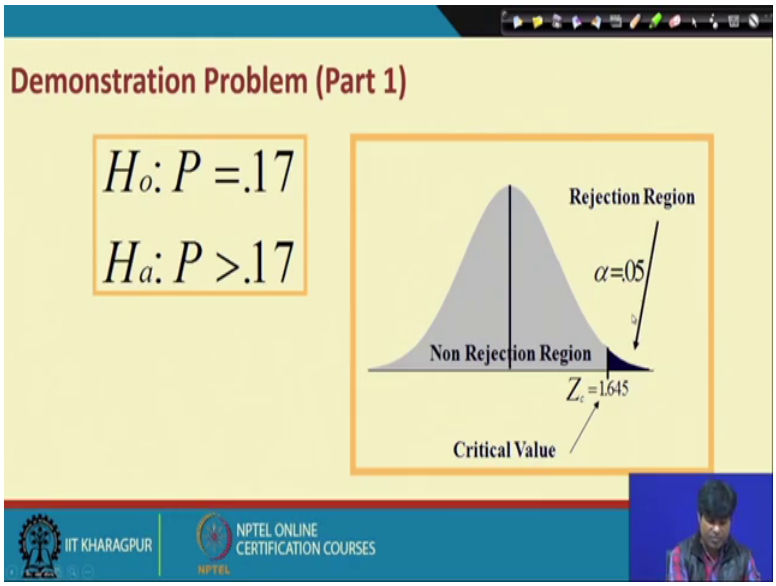


So, it is actually overtaking the critical value and the straight forward decision is a to reject the true null hypothesis.

Because you know 4.43 is you know greater than to 1.645. So, this is actually similar kind of you know example. So, another examples here the same population proportion, we are fixing actually population structure 0.17 agonist you know p greater than 0.17. So; that means, straightforward you know a right tailed test, and then we are here to specify, actually whether you know calculate test statistic will overtake to Z criticals.

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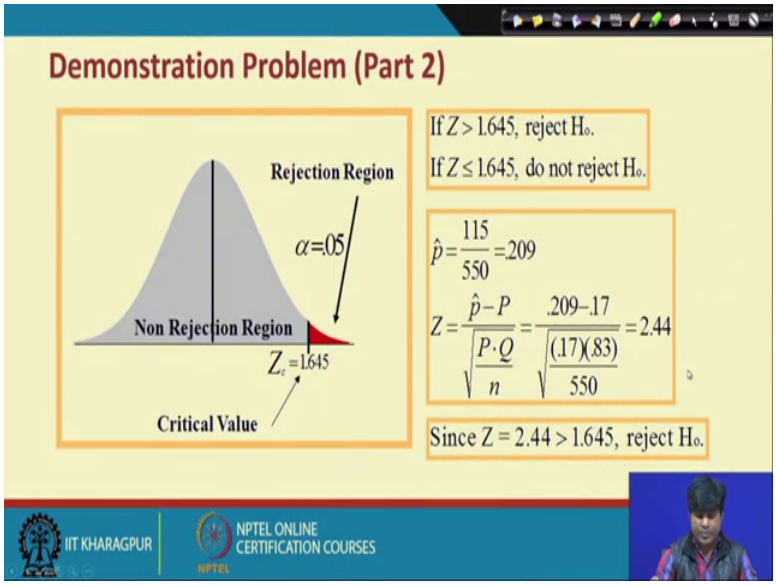

And accordingly and then here it is coming 2.44 and against you are in a position to reject true null hypothesis.

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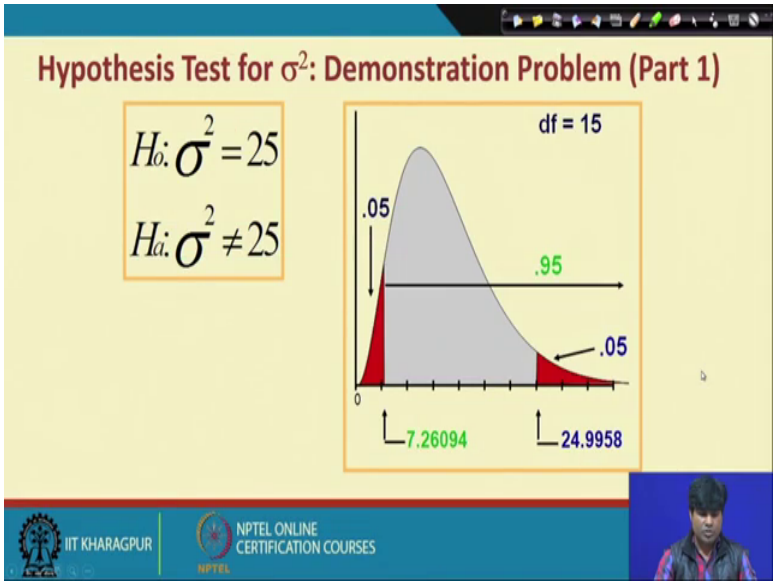


So, likewise and there is another kind of you know structure called as you know hypothesis testing for you know sigma squares.

So; that means, actually we have discussed the kind of you know inferential analytics with the help of you know Z statistics, then t statistic and the kind of you know sample proportion, and then you know population proportions, and here there is another kind of you know structure through which you have to analyze the problem with chi square distributions. And in fact, we have discussed you know two different test I means 4 different test statistics a Z z Z distribution t distribution chi square distribution f and f distributions.

Out of all these four distributions, and usually a chi square and f are you know positively skewed distributions, and Z and t can be positive, can be negative, but you know the test procedure is almost all you know same. Every times you have to specify the null hypothesis and the alternative hypothesis, and then you specify the type 1 error, and then on the basis of you know degree of freedom, and you know alpha value that is the type 1 fixation. So, you will be find out the critical value and then on the basis of you know sample information, you have to calculate the sample statistic, and then check whether

your sample statistic will be within the critical you know intervals or you know going again you know beyond the critical interval.

So, then accordingly you have to take the decisions. The usual standard structure is you know, if you are you know the sample statistic is overtaking the a critical value in the lower side and upper sides, then you are in a position to reject the true null hypothesis. Otherwise you have to accept the true null hypothesis then the management decision has to be taken into consideration accordingly.

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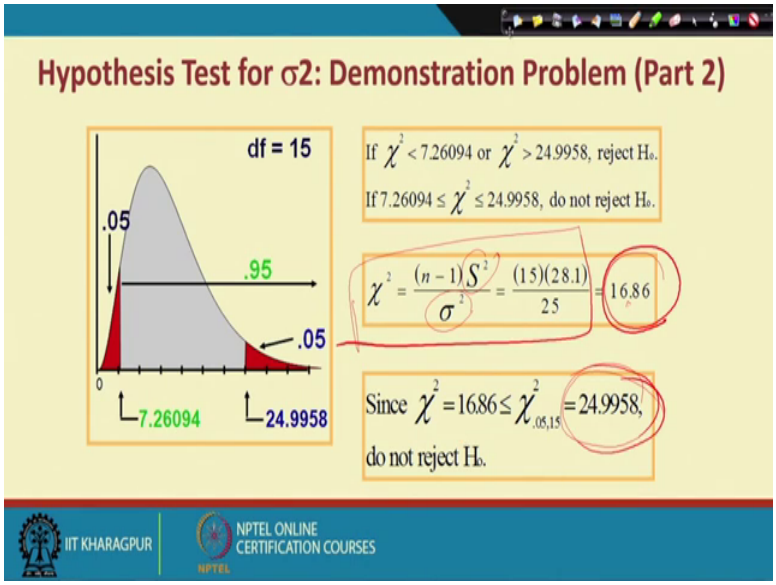


So, this is actually standard procedure, and this case you know in the chi square. It is actually more or less same. And here only thing is the calculation procedure is a little bit different for instance. So, here the chi square, chi square statistic need to be calculated and again it is a same actually. So, you have to just find out the sample you know sample variance.

And this is actually population variance and then on the basis of that you know you have to calculate the chi square, and that is what actually it is called as you know calculated chi square, and then corresponding to the chi square you know an alpha value and degree of freedom, you will be find the critical value which coming actually 24.9958. And since its actually the calculated test statistic calculated chi square is coming actually less than 2 chi square you know critical. So, as a results you are not in a position to reject the true null hypothesis.

So, this is actually more or less same, like you know Z distribution and t distribution, but still you know, still you have to see how is the problem.

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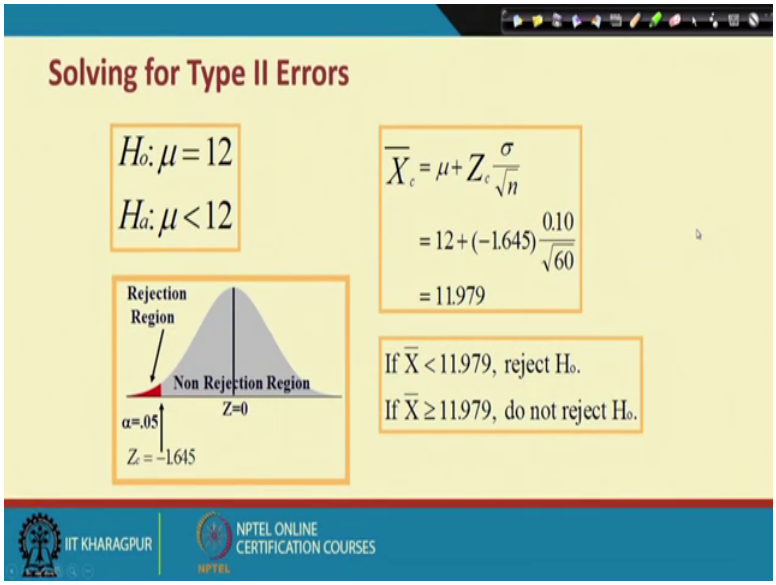


And then accordingly you can take the decisions and there is another kind of you know structure which is called as you know type 2 errors in the first case we whatever problems we have discussed till now that is with the help of you know alpha fixations that is the type comment about the type 1 error and against the same problems can be discussed with you know type 2 errors.

So, now, this is what actually the structure of you know type 2 error means. So, you are you know you know you are going against the kind of you know type 1 error decisions. So, we have already gone through this particular you know process you know here we are actually in not rejecting the true null hypothesis you are accepting the false null hypothesis.

That is how the particular structure is about. So, this is the standard structure as usual you know discussion and here is the kind of you know comparisons see here.

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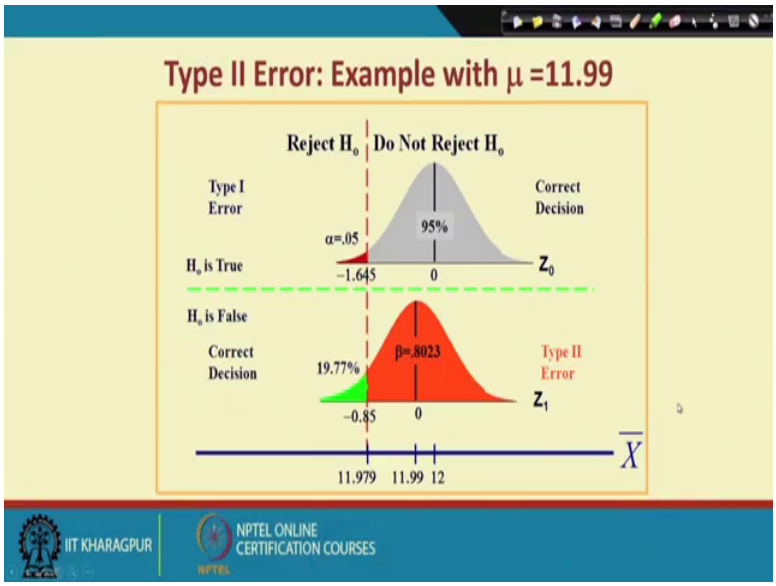


In this case. So, we are targeting here only. So, the particular structure is here this is actually the kind of you know type 2 error concept, and this is actually type 1 error concept. So, here is the rejected zone, here is the accepted zone and this is the correct decisions and in the case of type 2 type 2 error. So, this is the correct decision and this is the type 2 errors. Actually we have already discussed the table earlier and on the basis of that actually whether you can target type 1 error and conclude the kind of you know things or you can target the type 2 error, you can conclude the particular things and management decisions need to be taken accordingly ok.

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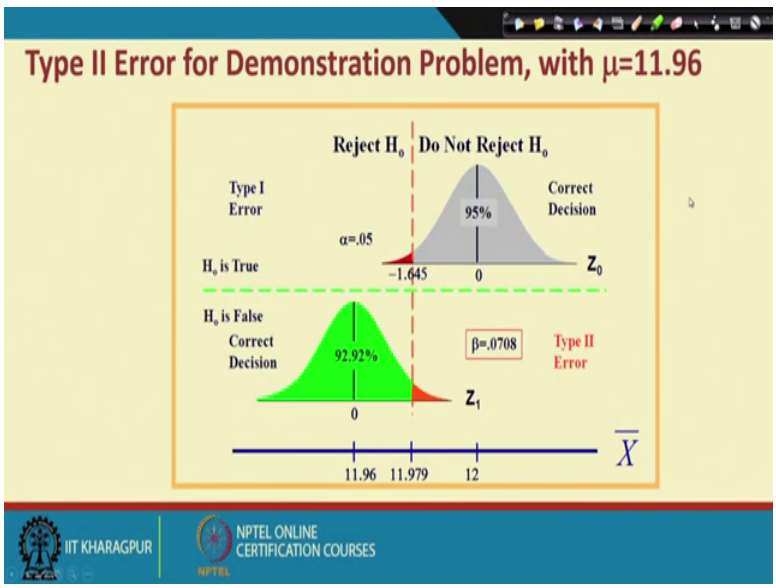

So, this is how the particular process and then this is another kind of you know look regarding the type 2 error, for you know you see just you know just comparing actually how is the kind of you know visualization the type 1 error versus you know type 2 errors, but the real comparisons you can find it here.

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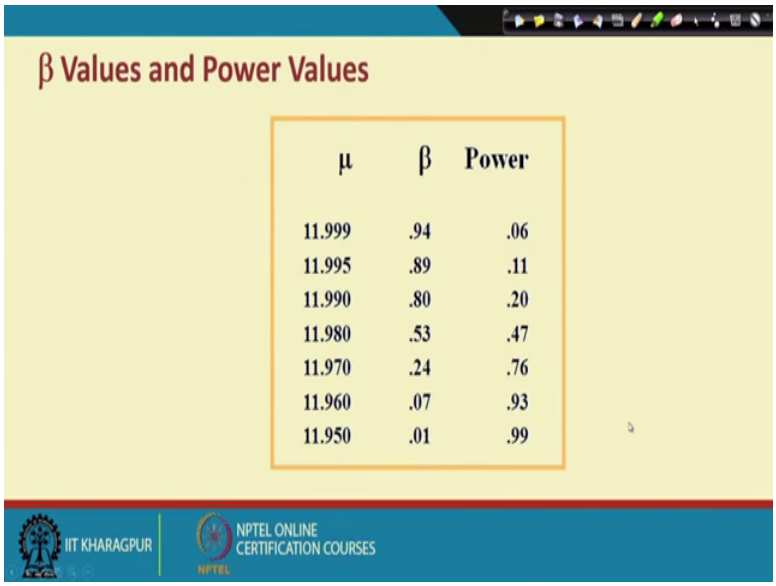


Now,. So, this is actually means type 1 error is actually indicated by alpha and in the case of type 2 error. So, it is indicated by beta. So, now, when actually mu value that is actually population parameter is you know changing from one point to another, then the power of the test will be actually changing accordingly.

So, this is how the beauty of this particular you know inferential analytics. So, you have lots of you know options, how to take the decisions and how to comment about the population parameter with the help of you know sample statistics.

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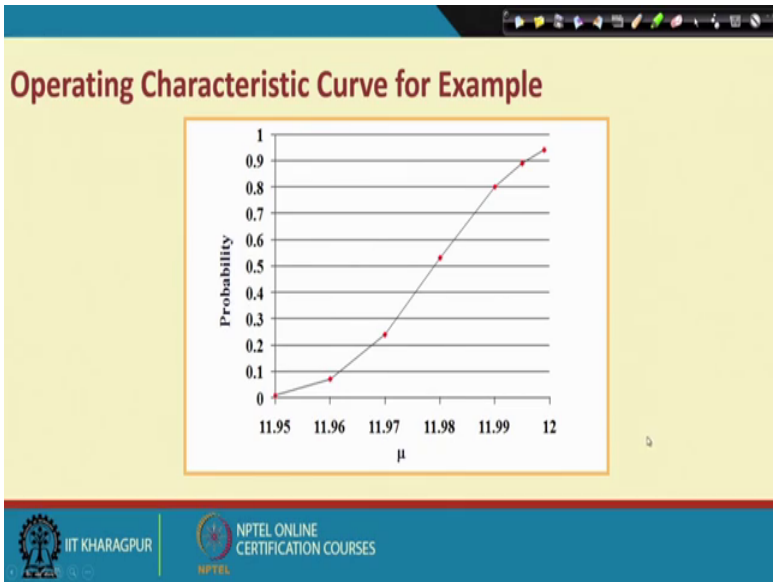


And this is actually how the movement about the change of the population parameter with actually probability value. So, with respect to the kind of you know beta component and the power of the test ok.

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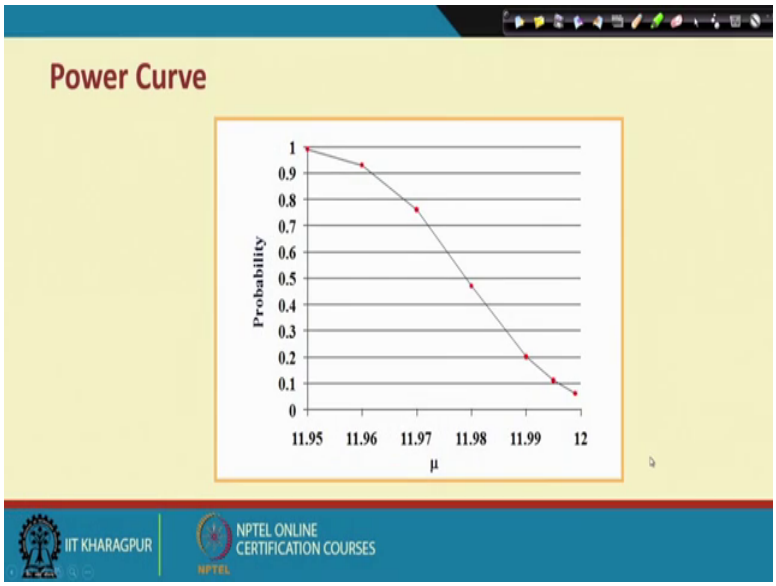


So, with this actually you know we like to conclude here, and in the mean times.

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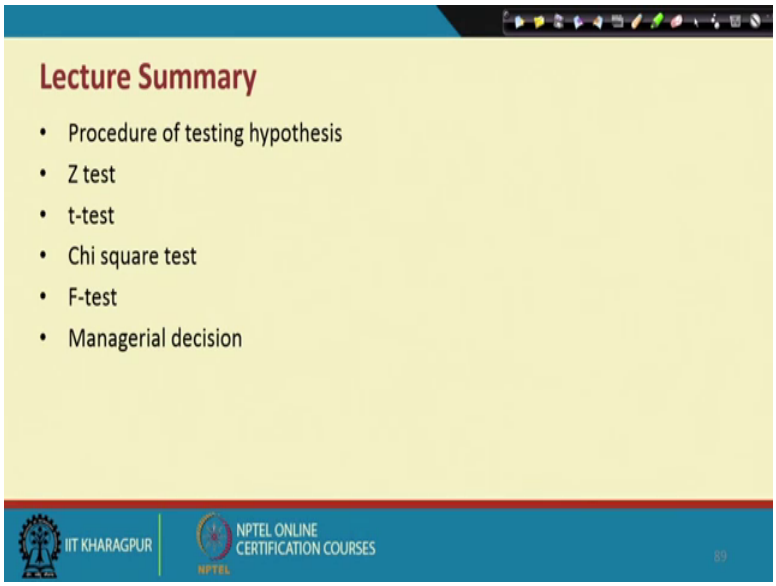


We have already discussed the kind of you know testing and that too with the help of Z Z distribution t distribution and you know chi square distribution.

So; that means, a with respect to any kind of you know problems. So, how Z test, t test and chi square test can be applied and to get some kind of you know managerial decisions with the kind of you know given situations. So; that means, we have actually plenty of you know options to investigate the problem, and then come to get you know get some kind of you know inference, and on the basis of the particular you know information you can take some kind of you know management decisions. And we will stop here, and in the next lecture we will discuss details about the confidence interval and more about the other test statistics.

Thank you very much, Have a nice time.