Evaluation of Textile Materials
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Lecture – 08
Sampling Methods and Sample Size: Practical Statistics (Contd..)

Hello everyone, now we will continue with the significance testing and last segment what we have discussed in the significance testing of mean ok difference in mean. And now we will discuss the significance testing of dispersion. If the mean is different ok, from the nominal mean or mean of two data are different in last segment we have seen in the last segment we have seen you can take proper action. We can either reject or we can accept depending on the significance testing ok. If the variation difference is significant then we can take action.

But there may be another situation where the mean are not that different maybe same almost same suppose we can say 20 count yarns, 2 yarns we have taken both the yarns the mean value is giving say 20. But in one yarn the standard deviation is much higher than other. Now the problem is that which one has to be accepted. Same problem that the higher one the higher variation should right away reject it is not that before that we have to do the significance testing.

Here the problem is that significant test of dispersion or variability. So, the variability is expressed mainly in terms of either standard deviation or the coefficient of variation.

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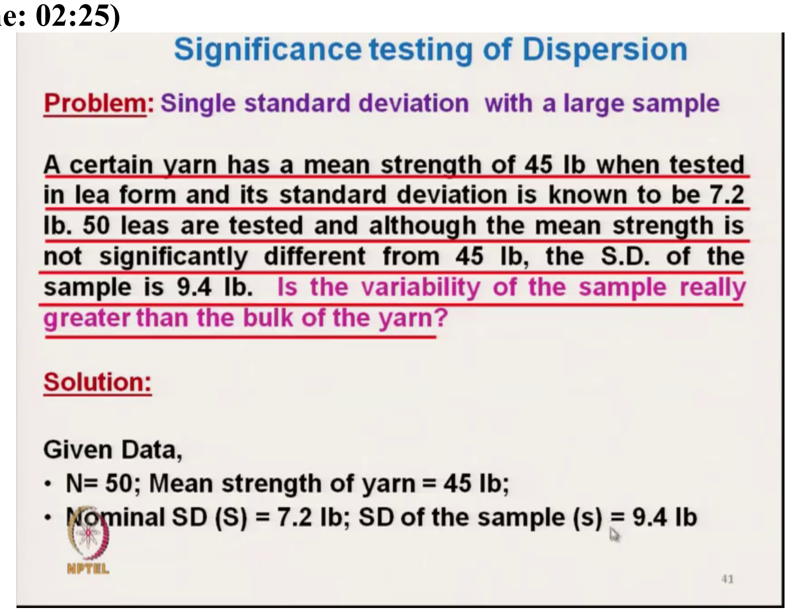

Now in this problem the single standard deviation with large sample what does it mean standard deviation? Here single standard deviation means the nominal standard deviation and this sample has got its standard deviation. So, certain yarn as a mean strength of 45 pound and when tested in the leas form 45 pound is the mean strength ok. Its standard deviation is known to be 7.2 lbs means it is nominal standard deviation so 45 pound is the mean strength and the standard deviation is 7.2 that is the variability 50 leas are tested from there it is the known value 45 pounds and 7.2.

Now the sample is taken 52, 50 leas are tested and although the mean strength is not the significant different from 45 so we are not bothered about mean strength. So, then suppose the yarn is giving 45 strength but the standard deviation of sample is 9.4 our target at nominal standard deviation is 7.2 that is acceptable But it is giving 9.4, now our problem is that to know if the variability of the sample is really greater than the bulk samples.

Bulk samples are the 7.2 standard deviation now it is the 9.4, the treatment here is exactly same as we have discussed earlier. But the formula will be little bit different. Here the standard deviation we are measuring this is the problem here the given data N = 50 mean strength is 45 and nominal standard deviation is capital S is 7.2 and the standard deviation of sample small s is 9.4 ok.

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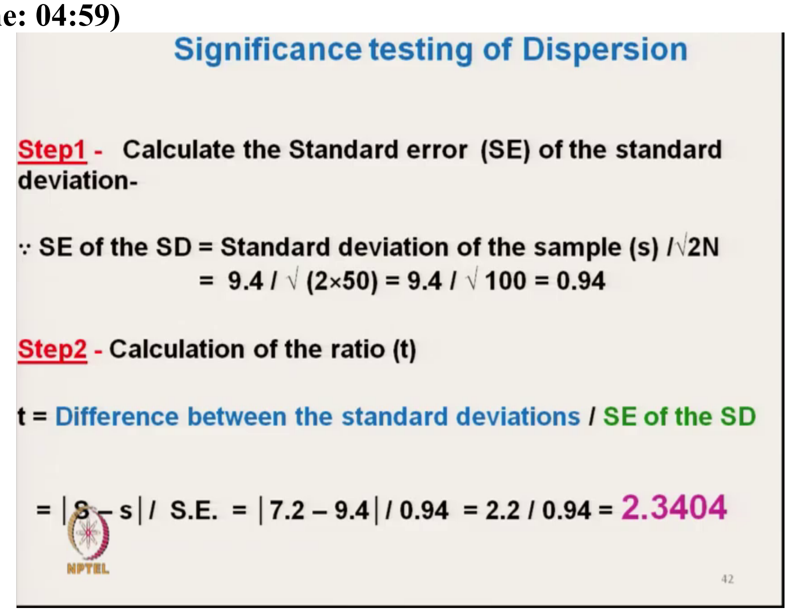

Now there step one is that calculate the standard error of standard deviation. Now earlier what we have done calculated the standard error of mean. Here now we are trying to calculate the standard error of standard deviation. The formula is just here it is instead of N it is 2N ok.

Standard error of standard deviation is standard deviation of sample divided by under root 2N. Here one thing we should remember, here we are not talking about the standard deviation of population.

We have two values one is population value and other is sample value where we will be taking standard deviation of sample by under root 2N ok. Standard deviation of sample is 9.4 and 2N and then it is coming out to be 9.4. This is standard error of standard deviation ok. And then the process will be exactly same so we calculate the t value. T value will be different between the standard deviation because we are now trying to calculate the difference between the standard deviation it is not the mean ok.

Difference between the standard deviation by standard error of standard deviation, so the difference is capital S - s by standard deviation error, show the t value as comes out to be 2.3404 ok, this is the t value. Now this t value we have to compare.

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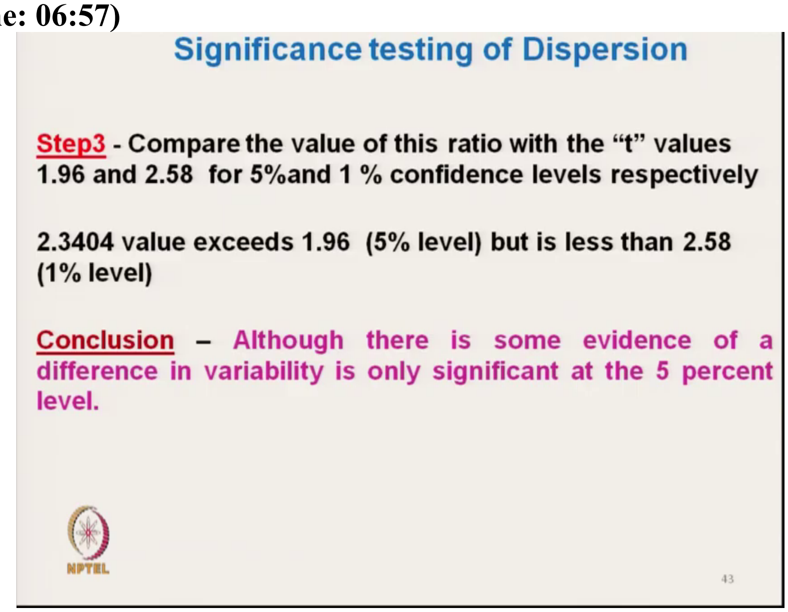

Now compare these, t value with the 1.96 and 2.58 which we have seen earlier for 5% and 1% confidence level for large sample That we have seen 1.96. And this once you compare 2.34 when compared it is higher than the 1.96 but less than 2.58 ok. So, the conclusion is that although there is some evidence difference in variability it is only significant at 5% level ok. So it is it is not significant at 1% level, so what should we should take as action. We should; we may or may not except ok. But in normal case we may allow it ok if there is no extreme problem ok.

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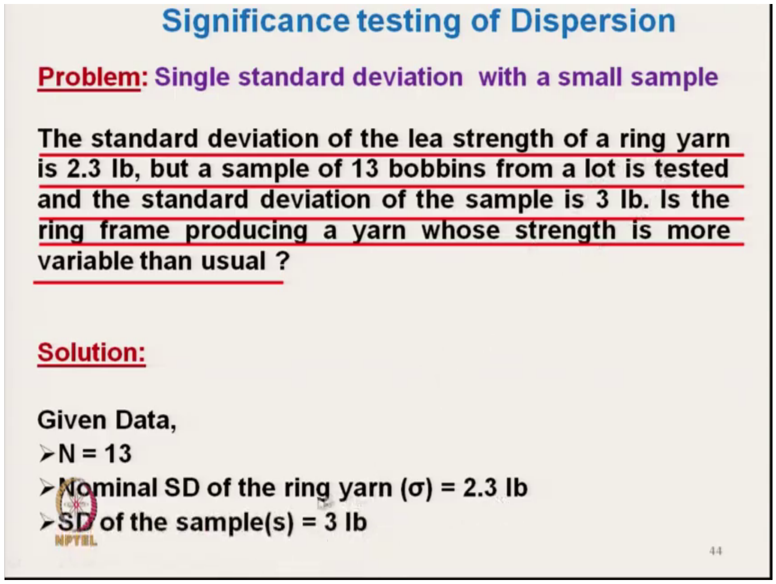

Next is that the earlier one was watch the single standard deviation with large sample this was with the large sample large sample next one is single standard deviation with small sample. Now the problem is the standard deviation of the leas strength of the yarn is 2.3 parts. But the sample of 13 bobbins samples 13 bobbins from the lot is tested and the standard deviation of the sample is 3. So, it is the 2.3 is the nominal and 3 is the actually I got ok. Now we have to do; is the ring frame produce a yarn whose strength is more variable than usual ok this is the problem.

Now here the thing is that in this case as it is a smaller sample we can definitely go for the standard error principle as we have done earlier we can take we can solve this numerical based on exactly same earlier value only thing is that hear the; earlier case it was the large sample that t value is taken based on degree of freedom of infinity. Here we have to take the t value based on degree of freedom 13-1 that is 2N. On that basis we can we can test and do the analysis. But as is the smaller sample, we can take we can use another technique.

This technique which is simpler 1 much simpler one we do not we actually cluster one it needs very small calculation that is the If test we can carry. So the data which is given here N is 13, nominal standard deviation of the ring yarn 2.3 is the nominal standard deviation which is targeted and the standard deviation of the sample is 3, three is the standard deviation of sample.

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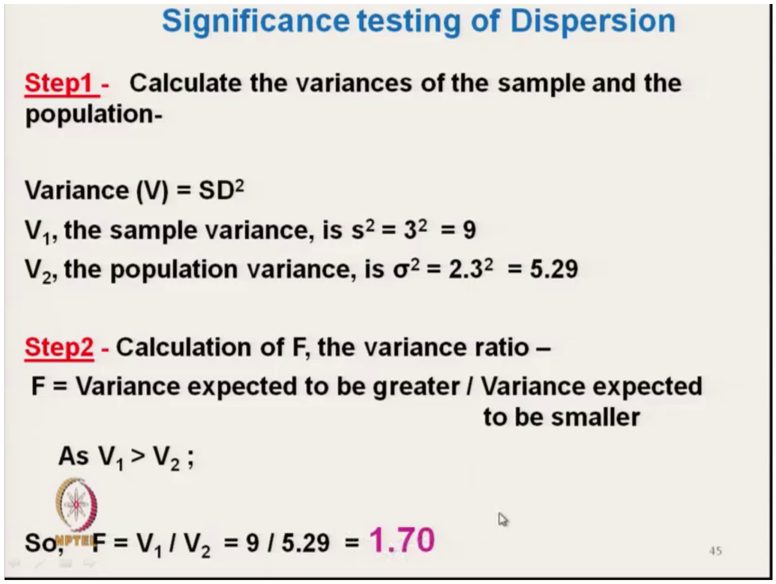

Now for F test calculate the variance F is as we have seen, F is nothing but the variance ratio ok. Then we calculate the variance what is variance? Variance is the square of deviation. And now the V1 we do not know whether it will be V1 or V2, V1 will be always higher, here we have seen 3 was higher. 3 is the sample standard deviation that is why V1 we are taking as, 3 square 9 ok. And V2 is lower, is 5.29 it is 2.3 square, which is the nominal standard deviation. Now what we have to do we have to simply take the ratio so calculate F, F is the ratio variance of greater V1.

And it is a smaller one so this is the ratio of; now this F value we have calculated we have to compare with the table F value.

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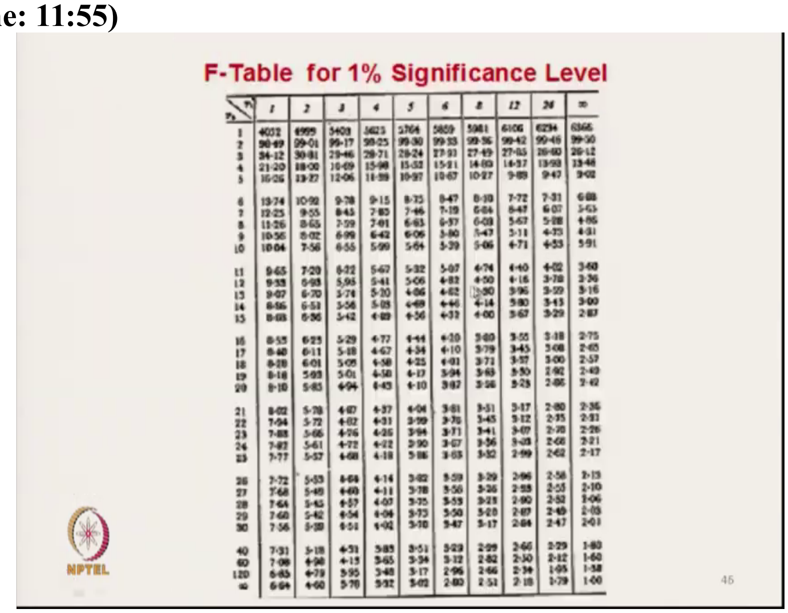

v_2 \ v_1	1	2	3	4	5	6	8	12	24	∞
1	4052	4999	5403	5625	5764	5859	5981	6106	6234	6366
2	98.49	99.01	99.17	99.25	99.30	99.33	99.36	99.42	99.46	99.50
3	34.12	30.81	29.46	28.71	28.24	27.91	27.49	27.05	26.60	26.12
4	21.20	18.00	16.69	15.98	15.52	15.21	14.80	14.37	13.93	13.46
5	16.26	13.27	12.06	11.39	10.97	10.67	10.27	9.89	9.47	9.02
6	13.74	10.92	9.78	9.15	8.75	8.47	8.10	7.72	7.31	6.88
7	12.25	9.55	8.45	7.85	7.46	7.19	6.84	6.47	6.07	5.65
8	11.26	8.65	7.59	7.01	6.63	6.37	6.03	5.67	5.28	4.86
9	10.56	8.02	6.99	6.42	6.06	5.80	5.47	5.11	4.73	4.31
10	10.04	7.56	6.55	5.99	5.64	5.39	5.06	4.71	4.33	3.91
11	9.65	7.20	6.22	5.67	5.32	5.07	4.74	4.40	4.02	3.60
12	9.33	6.93	5.95	5.41	5.06	4.82	4.50	4.16	3.78	3.36
13	9.07	6.70	5.74	5.20	4.86	4.62	4.30	3.96	3.59	3.16
14	8.86	6.51	5.56	5.03	4.69	4.46	4.14	3.80	3.43	3.00
15	8.68	6.36	5.42	4.89	4.56	4.32	4.00	3.67	3.29	2.87
16	8.53	6.23	5.29	4.77	4.44	4.20	3.89	3.55	3.18	2.75
17	8.40	6.11	5.18	4.67	4.34	4.10	3.79	3.45	3.08	2.65
18	8.28	6.01	5.09	4.58	4.25	4.01	3.71	3.37	3.00	2.57
19	8.18	5.93	5.01	4.50	4.17	3.94	3.63	3.30	2.92	2.49
20	8.10	5.85	4.94	4.43	4.10	3.87	3.56	3.23	2.86	2.42
21	8.02	5.78	4.87	4.37	4.04	3.81	3.51	3.17	2.80	2.36
22	7.94	5.72	4.82	4.31	3.99	3.76	3.45	3.12	2.75	2.31
23	7.88	5.66	4.76	4.26	3.94	3.71	3.41	3.07	2.70	2.26
24	7.82	5.61	4.72	4.22	3.90	3.67	3.36	3.03	2.66	2.21
25	7.77	5.57	4.68	4.18	3.86	3.63	3.32	2.99	2.62	2.17
26	7.72	5.53	4.64	4.14	3.82	3.59	3.29	2.96	2.58	2.13
27	7.68	5.49	4.60	4.11	3.78	3.56	3.26	2.93	2.55	2.10
28	7.64	5.45	4.57	4.07	3.75	3.53	3.23	2.90	2.52	2.06
29	7.60	5.42	4.54	4.04	3.73	3.50	3.20	2.87	2.49	2.03
30	7.56	5.39	4.51	4.02	3.70	3.47	3.17	2.84	2.47	2.01
40	7.31	5.18	4.31	3.83	3.51	3.29	2.99	2.66	2.29	1.80
60	7.08	4.98	4.13	3.65	3.34	3.12	2.82	2.50	2.12	1.60
120	6.85	4.79	3.95	3.48	3.17	2.96	2.66	2.34	1.95	1.38
∞	6.64	4.60	3.78	3.32	3.02	2.80	2.51	2.18	1.79	1.00

This is the table of F values at 1% level what is the degree of freedom. The degree of freedom is the scale for V1 that is for sample 1 and infinitive for this one this value. That means this is coming out 2.18 it is not clear but it is 2.18 value at 1% significance level. Similarly for 5% significance level it is 1.75.

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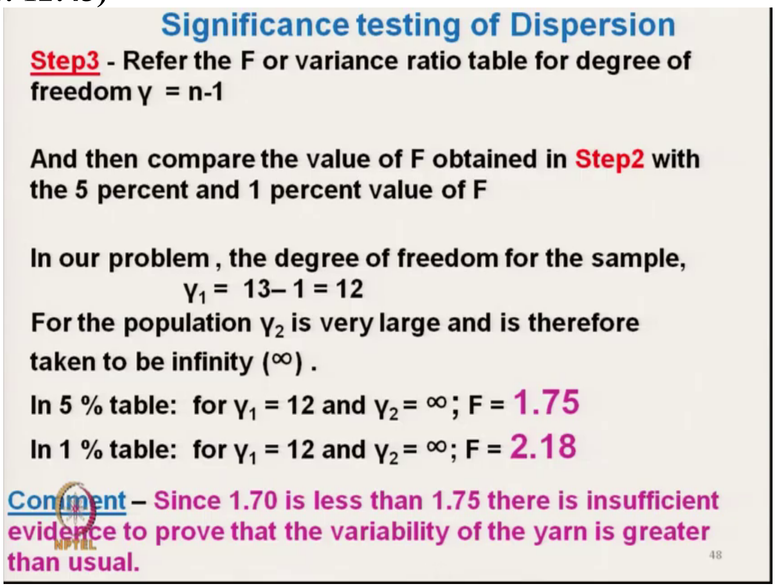

Now we can compare with the value which we have got degree of freedom that is the degree of freedom n-1. Here the degree of freedom will be 12, so against 12 we have seen the larger population is degree of value is 2, second there is the infinity. And here it has come F is 1.75 as we have seen from the table And 2.18 for the 1% level and our calculated value is 1.7 which is less than 1.75 ok, that means iinsufficient evidence is to provide that the variability is not there that is the case.

Now the tricky thing is that here we have two options one is standard deviation option by standard error method we can calculate we can have T test and F test. And obviously as I have told the F test is the simplest one it needs least calculation. So that means always we should prefer if F test at least for the variability test for variability difference significance difference variability. But F test has got one limitation in this problem in this numerical I will just come back once again.

In this numerical once again it is the small sample, one small sample we are comparing with the population which is larger one. The F test only can be done can actually be performed if the sample size is small. For large both large size suppose our sample size is large then we cannot perform F test. Now the question is why? You just see it is very tricky because it is always people see like to test without calculation. Now here if you see the F value here for both sample and both the samples are the sample size is high.

Sample size is very high if it is infinity, you see the Infinity value for sample 1 and for sample 2 it is a large sample it is a infinity. And what will be the F value or if you see the F value here F value becomes 1. This is true for 5% level, at 5% level for both infinity degree of freedom for 1and degree of freedom 2 it has become one which is actually against our assumption. What was our assumption are F should be more than one always it will be more than one.

Because F value 1 exist only in one case only when the standard deviation of sample 1 and standard deviation of sample 2 are exactly same.

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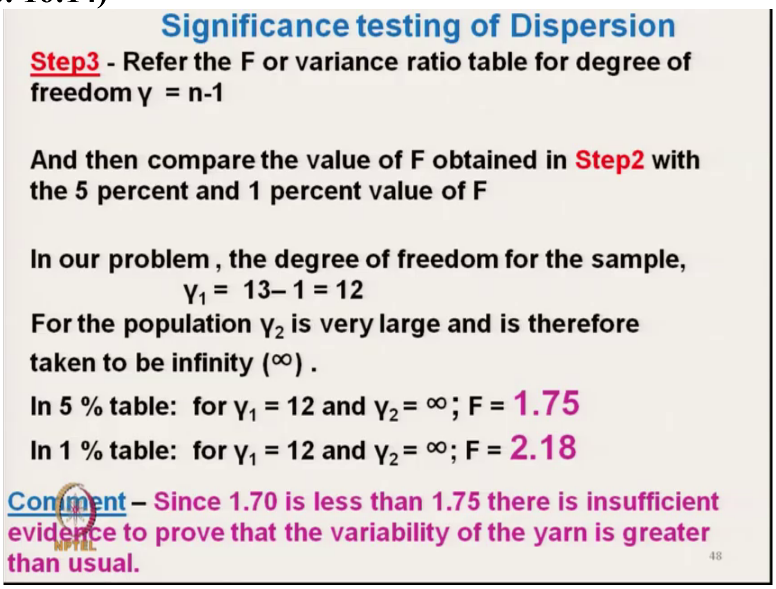

In that case only the F value will be one, but if the standard deviation are same then we not need the calculate significance test so that is why F test is only carried out in case of when the data the number of data or smaller in size ok.

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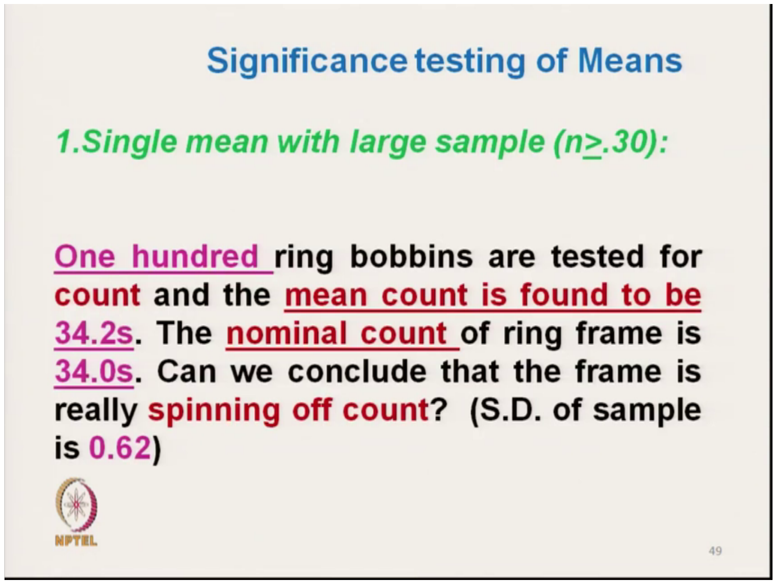

Now we have done all this numerical solved, now this is for your homework, you can simply note down the numerical and test try using the form theory are the using the all this problems we have solved. Just I will read all this thing, 100 ring bobbins are tested for account and the mean count is found to be 34.2. Then the nominal account of the Ring frame is 34.0 ok. Can we conclude that the frame is really spinning off count that we can the standard deviation of sample is given is .62.

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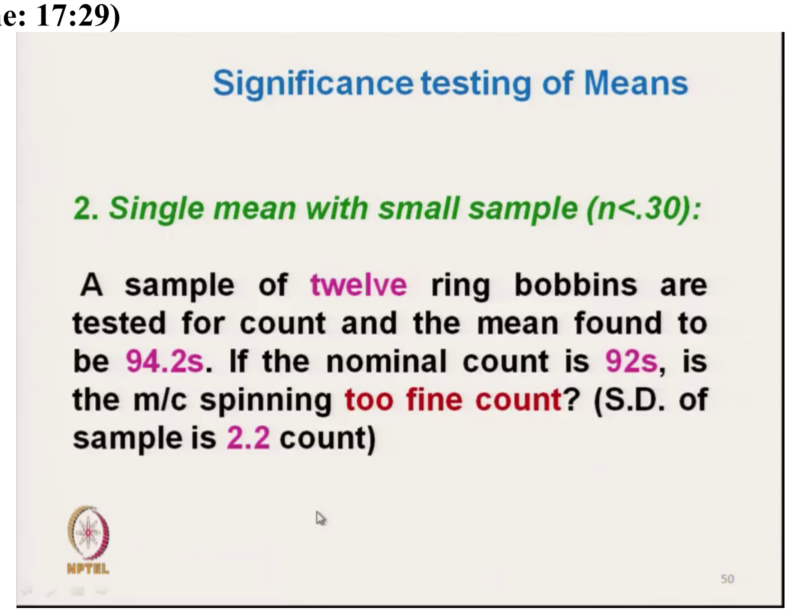

Next is of sample of 12 ring bobbins are tested this is small sample ok, example tested for account under mean found to be 94.2. If the nominal account is 92 is the mission spinning too fine count, this type of numerical that we have already discussed standard deviation of sample is given.

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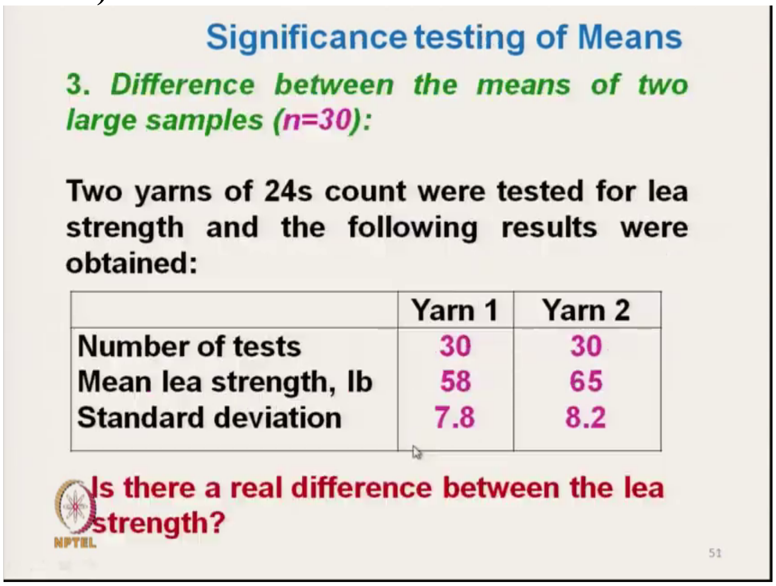

And this is also we have discussed so the difference between the means of two yarns samples 2 yarns, yarn1, yarn2 details are given ok is there your real difference between the lea strength. Similarly we have given 60 or 70 we have seen problem. Same way we can solve this problem.

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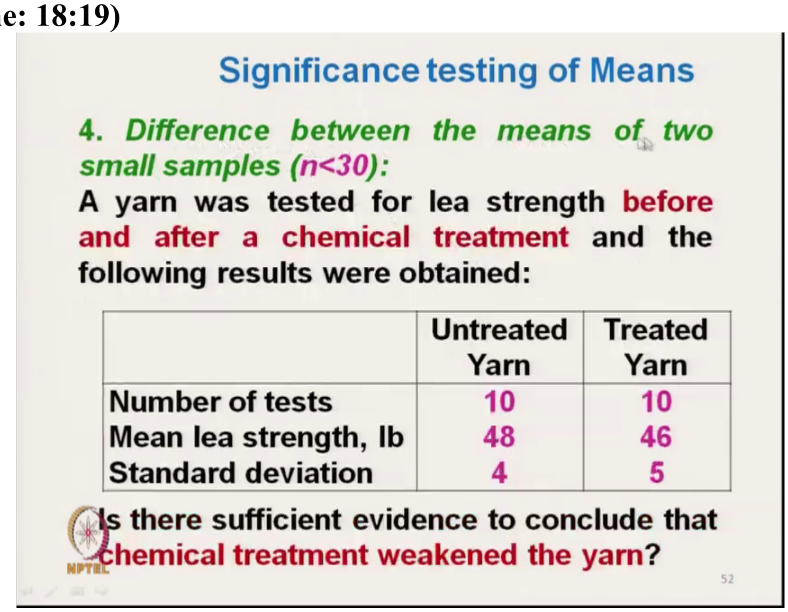

Another problem is mean of two small samples hear the samples or smaller. In this case only one difference is that we have to calculate the degree of freedom. Earlier case we have use the, we have use the larger sample degree of freedom as infinity. For small sample what we have to do, in one class N2- 2, that is the degree of freedom. In this case degree of freedom we have to see T test we have to refer the T-test for degree of freedom for 80 ok for that we can test rest other system are exactly same.

Here it is the untreated yarn of sample which is given of 48 strength and after treatment it has become 46. Now we would like to know whether the treatment As given, the treatment as weakened yarn are not, that means if it is the question that the chemical treatment weakened the yarn that means weather this strength as the difference in strength is actually significant or not that we have to test ok.

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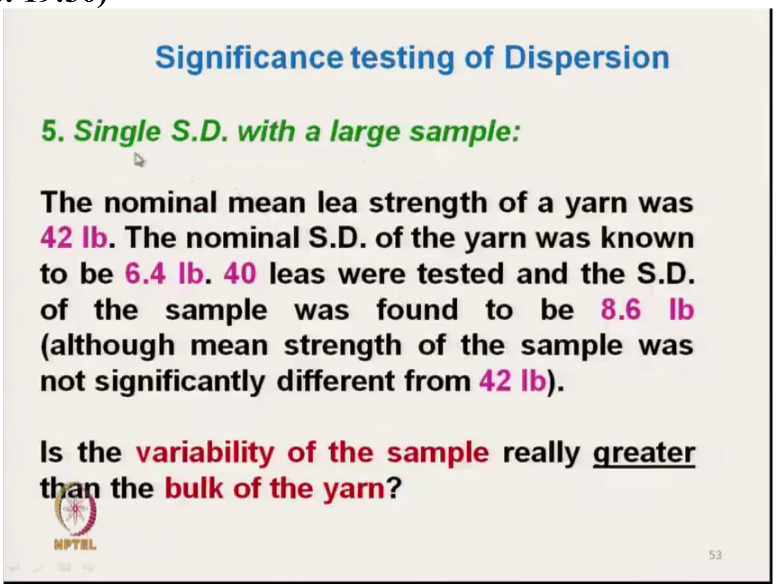

Next is sample deviation with large sample ok the nominal count this type this type of problem we have already discussed the mean leas strength of yarn was 42 pound. The nominal standard deviation is known to be 64 count 40 leas are tested standard deviation The of the sample was found to be 8.6 lbs although the mean strength are same is the variability of the sample is really greater than the bulk of the same similar yarn.

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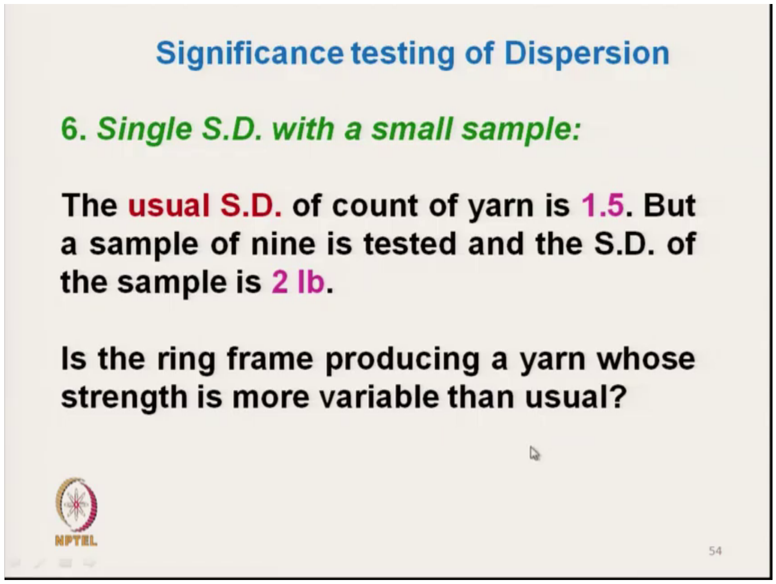

Sixth one is the usual standard deviation that is the nominal standard deviation of count of yarn is 1.5. But the sample of 9 is tested and the standard deviation is found to be 22 ok. If the ring frame producing a yarn with strength is more variable are not. Here we it is a small sample we can use other standard deviation or standard error or T test or we can use F test ok.

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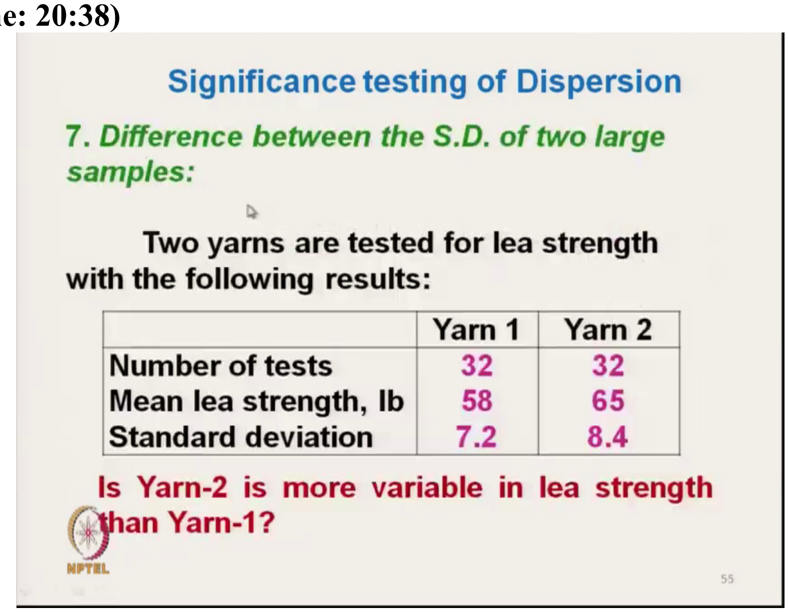

Here in this sample here we have to do as it is large sample we can do the T test as we have discussed earlier also ok.

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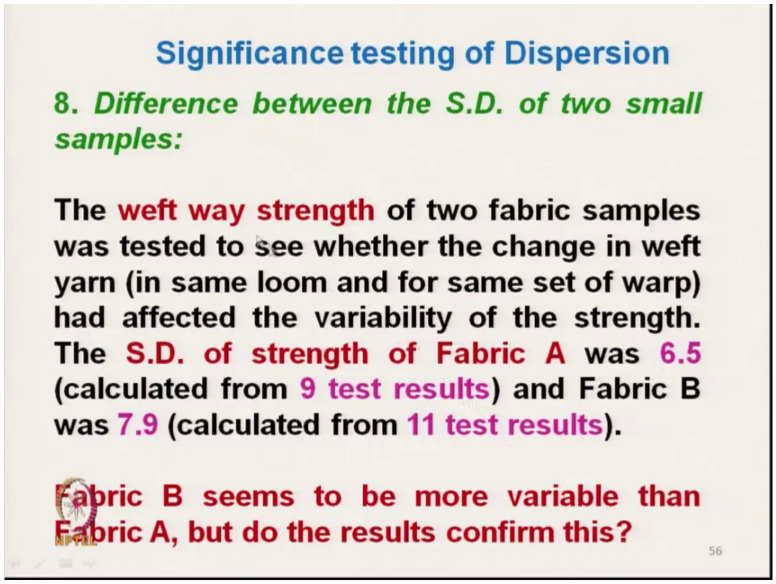

Standard division two small sample two small sample we can we can test F test also. F test strength of two fabric samples was tested to see whether the change in weft yarn the yarn has been changed in the same loom and for the same set of work and affected the variability of the strength ok so that is the strength of; standard deviation of strength of fabric A was 6.5 and calculated from the 9 tested results N1 = 9 and if the fabric B was 7.5 N2 = 11 so we have to test so that is the variability.

Here you can see the standard deviation of the B was higher this we can assume that square of B is B1 that is the variance one and the variance 2 will be this one 6.5 square , so a value will be 7.9 square by 6.5 square, we will see against that the horizontal line see the degree of freedom 10 against 8, 10 against 8 the whatever value we are getting that is F value that is we have to compare.

So, in that way we can do this we can solve this numerical and we can try similar numerical of also. And with this finish this segment of significant test thank you.