Elementary Stereology For Quantitative Microscopy

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Lecture – 07
Volume Fraction and Particles Size Part - 3

Ok so, we will look at this data set what we have been calculating since morning, I want to bring one point to your attention. Now you see that I have populated the column with what I have done here is it is an individual P p, what I showed in the morning is total average P p.

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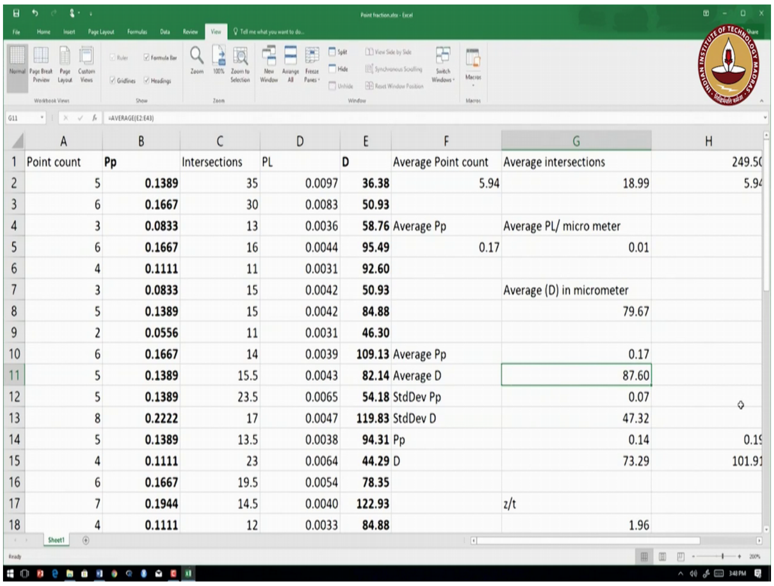

	A	B	C	D	E	F	G	H
1	Point count	Pp	Intersections	PL	D	Average Point count	Average intersections	249.5
2	5	0.1389	35	0.0097	36.38	5.94	18.99	5.94
3	6	0.1667	30	0.0083	50.93			
4	3	0.0833	13	0.0036	58.76	Average Pp	Average PL/ micro meter	
5	6	0.1667	16	0.0044	95.49	0.17	0.01	
6	4	0.1111	11	0.0031	92.60			
7	3	0.0833	15	0.0042	50.93		Average (D) in micrometer	
8	5	0.1389	15	0.0042	84.88		79.67	
9	2	0.0556	11	0.0031	46.30			
10	6	0.1667	14	0.0039	109.13	Average Pp	0.17	
11	5	0.1389	15.5	0.0043	82.14	Average D	87.60	
12	5	0.1389	23.5	0.0065	54.18	StdDev Pp	0.07	
13	8	0.2222	17	0.0047	119.83	StdDev D	47.32	
14	5	0.1389	13.5	0.0038	94.31	Pp	0.14	0.1
15	4	0.1111	23	0.0064	44.29	D	73.29	101.91
16	6	0.1667	19.5	0.0054	78.35			
17	7	0.1944	14.5	0.0040	122.93		z/t	
18	4	0.1111	12	0.0033	84.88		1.96	

There is a small catch here I will I am just going to come there. So, what I have done again is an individual P L this is individual P p and then I have taken the average of that. So, this is what I am getting this average P p and you see that this is an average D in micrometer which I told in the morning right.

So, now when we do this individual P L and individual P p the D I am getting is 87.6 slightly higher than that. So, one of the reason is P p is a random variable, P L is again random variable each one will follow a distribution. This again this ratio P p by P L will be it will be produce another random variable that will follow a different distribution that is why this difference comes.

I just want to bring into attention we will leave it there, but then to come to this putting our data into this format for example, what we have Professor Sankaran said like we have t distribution as well as we have.

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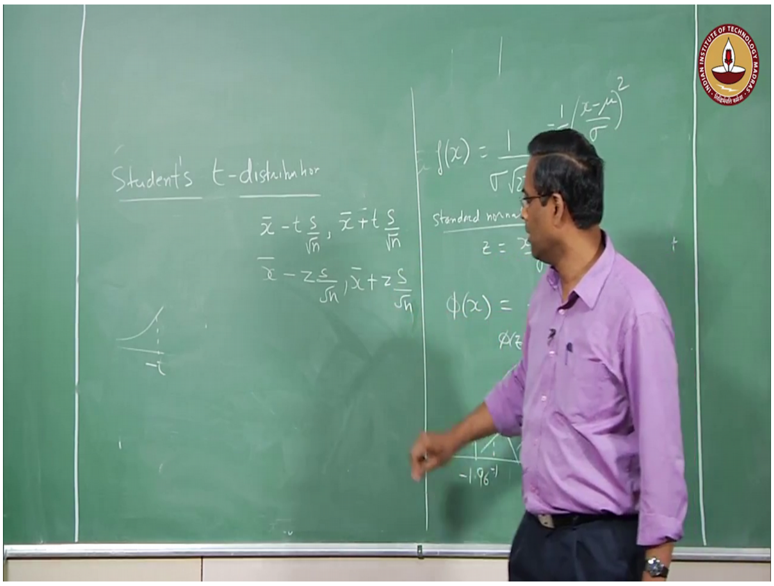

So, x bar z x bar plus z this. So, like he mentioned we can choose to represent the confidence level in between either t distribution or the z distribution. So, based on that what we have shown here is you can see that the standard deviation is 0.07 for the data of we have collected that is n is equal to 42, what we have calculated.

And then the standard deviation for P p is 0.07 then standard deviation for D is 47.32. And if you look at this confidence level we have arrived at these 2 numbers based on this based on this.

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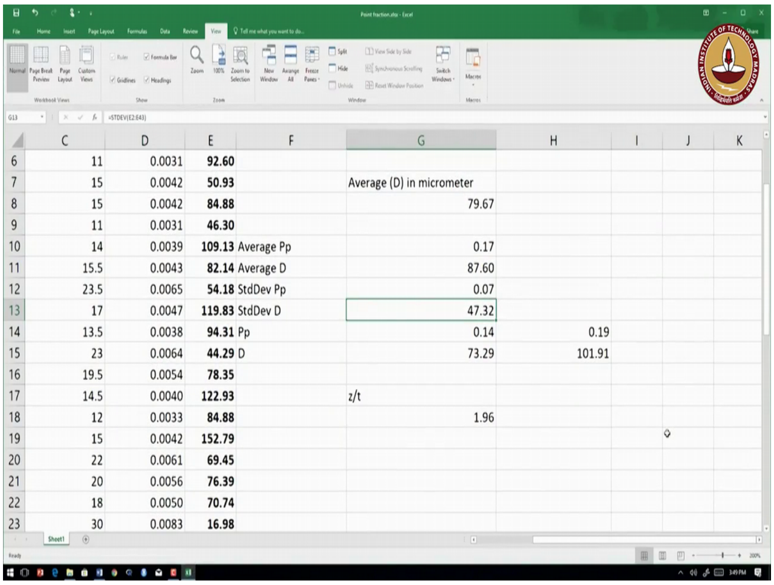

So, here we have chosen 95 percent of confident interval. So, if you look at that table just we talked about.

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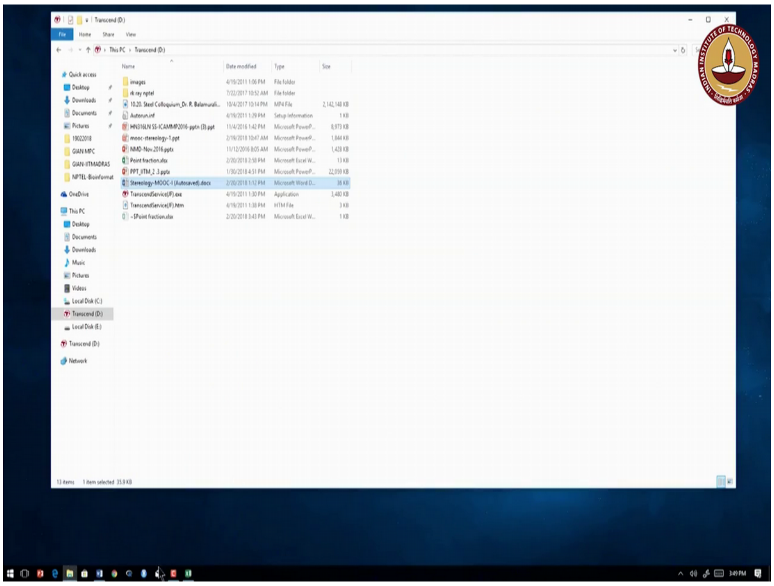

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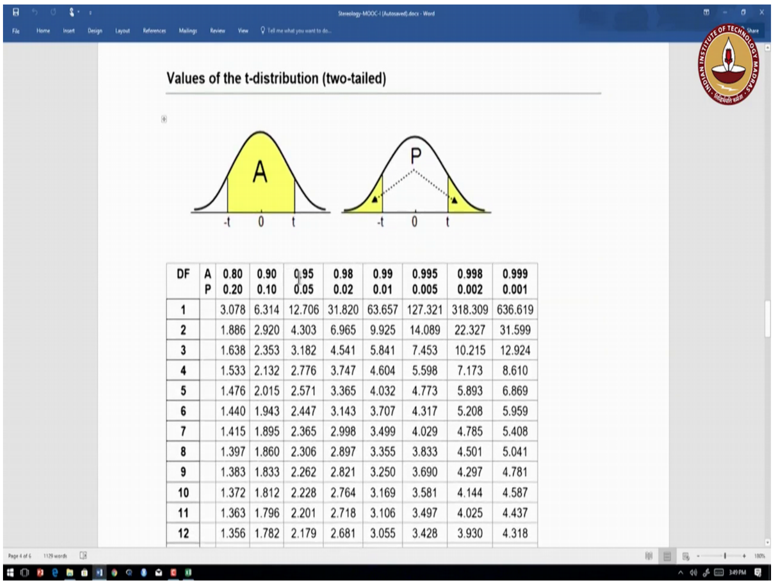

Values of the t-distribution (two-tailed)

DF	A	0.80	0.90	0.95	0.98	0.99	0.995	0.998	0.999
	P	0.20	0.10	0.05	0.02	0.01	0.005	0.002	0.001
1		3.078	6.314	12.706	31.820	63.657	127.321	318.309	636.619
2		1.886	2.920	4.303	6.965	9.925	14.089	22.327	31.599
3		1.638	2.353	3.182	4.541	5.841	7.453	10.215	12.924
4		1.533	2.132	2.776	3.747	4.604	5.598	7.173	8.610
5		1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.869
6		1.440	1.943	2.447	3.143	3.707	4.317	5.208	5.959
7		1.415	1.895	2.365	2.998	3.499	4.029	4.785	5.408
8		1.397	1.860	2.306	2.897	3.355	3.833	4.501	5.041
9		1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781
10		1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587
11		1.363	1.796	2.201	2.718	3.106	3.497	4.025	4.437
12		1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318

See 95 percent of confidence level you look at this 0.95 and our n is 42 right.

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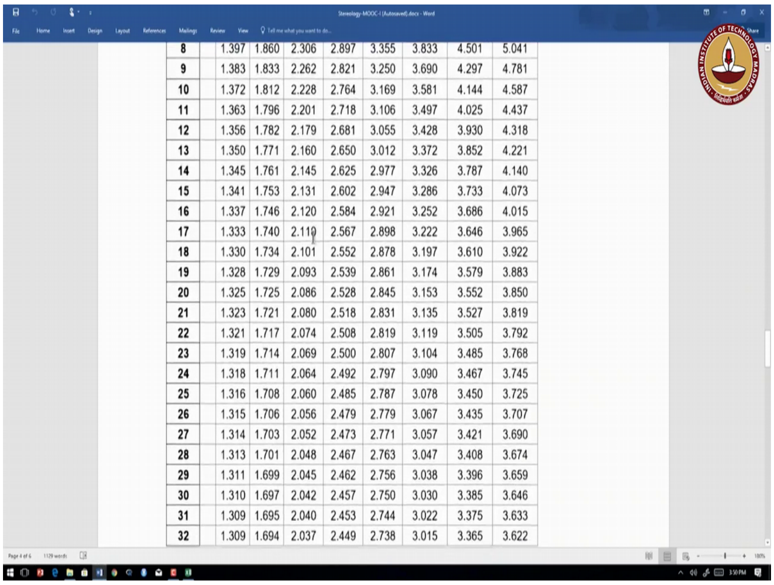

8		1.397	1.860	2.306	2.897	3.355	3.833	4.501	5.041
9		1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781
10		1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587
11		1.363	1.796	2.201	2.718	3.106	3.497	4.025	4.437
12		1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318
13		1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.221
14		1.345	1.761	2.145	2.625	2.977	3.326	3.787	4.140
15		1.341	1.753	2.131	2.602	2.947	3.286	3.733	4.073
16		1.337	1.746	2.120	2.584	2.921	3.252	3.686	4.015
17		1.333	1.740	2.110	2.567	2.898	3.222	3.646	3.965
18		1.330	1.734	2.101	2.552	2.878	3.197	3.610	3.922
19		1.328	1.729	2.093	2.539	2.861	3.174	3.579	3.883
20		1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.850
21		1.323	1.721	2.080	2.518	2.831	3.135	3.527	3.819
22		1.321	1.717	2.074	2.508	2.819	3.119	3.505	3.792
23		1.319	1.714	2.069	2.500	2.807	3.104	3.485	3.768
24		1.318	1.711	2.064	2.492	2.797	3.090	3.467	3.745
25		1.316	1.708	2.060	2.485	2.787	3.078	3.450	3.725
26		1.315	1.706	2.056	2.479	2.779	3.067	3.435	3.707
27		1.314	1.703	2.052	2.473	2.771	3.057	3.421	3.690
28		1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.674
29		1.311	1.699	2.045	2.462	2.756	3.038	3.396	3.659
30		1.310	1.697	2.042	2.457	2.750	3.030	3.385	3.646
31		1.309	1.695	2.040	2.453	2.744	3.022	3.375	3.633
32		1.309	1.694	2.037	2.449	2.738	3.015	3.365	3.622

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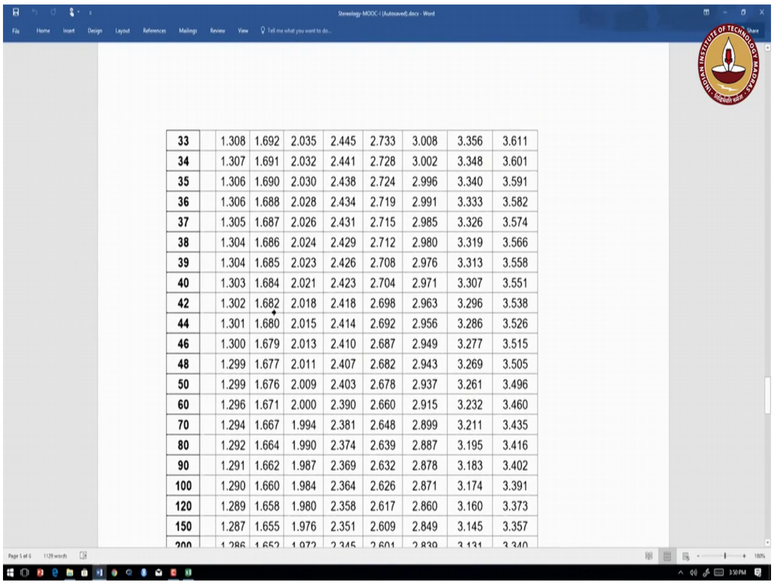

33		1.308	1.692	2.035	2.445	2.733	3.008	3.356	3.611
34		1.307	1.691	2.032	2.441	2.728	3.002	3.348	3.601
35		1.306	1.690	2.030	2.438	2.724	2.996	3.340	3.591
36		1.306	1.688	2.028	2.434	2.719	2.991	3.333	3.582
37		1.305	1.687	2.026	2.431	2.715	2.985	3.326	3.574
38		1.304	1.686	2.024	2.429	2.712	2.980	3.319	3.566
39		1.304	1.685	2.023	2.426	2.708	2.976	3.313	3.558
40		1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.551
42		1.302	1.682	2.018	2.418	2.698	2.963	3.296	3.538
44		1.301	1.680	2.015	2.414	2.692	2.956	3.286	3.526
46		1.300	1.679	2.013	2.410	2.687	2.949	3.277	3.515
48		1.299	1.677	2.011	2.407	2.682	2.943	3.269	3.505
50		1.299	1.676	2.009	2.403	2.678	2.937	3.261	3.496
60		1.296	1.671	2.000	2.390	2.660	2.915	3.232	3.460
70		1.294	1.667	1.994	2.381	2.648	2.899	3.211	3.435
80		1.292	1.664	1.990	2.374	2.639	2.887	3.195	3.416
90		1.291	1.662	1.987	2.369	2.632	2.878	3.183	3.402
100		1.290	1.660	1.984	2.364	2.626	2.871	3.174	3.391
120		1.289	1.658	1.980	2.358	2.617	2.860	3.160	3.373
150		1.287	1.655	1.976	2.351	2.609	2.849	3.145	3.357

So, n minus 1 we have to see. So, we are supposed to see 41, 41 is not there. So, you have 40. So, you take this as a t then we can use that and if you use that into this formula then you get this lower limit and this is higher limit and this is a lower limit and this is higher limit and.

Student: Sir this is for 1.96?

This for 95 percent.

Student: 1.96.

Yeah this, what here it is 1.96.

Student: (Refer Time: 04:10) this for normal distribution.

Yeah, say for z not for t yeah. So, what we are seeing is these 2 measurements again within it comes within this number, what we are seen. And for a t you can substitute instead of 1.96 it could be 2.02. Then you will this interval will be slightly wider, that is what we have said.

So, I think that is what we want to show here in this section about these calculations. Now, what I will do is I will also do that the demo of this Buffon's experiment like the probability. I think for that, I would come there and then that will be displayed here. You can also do a calculation and then see what we get.

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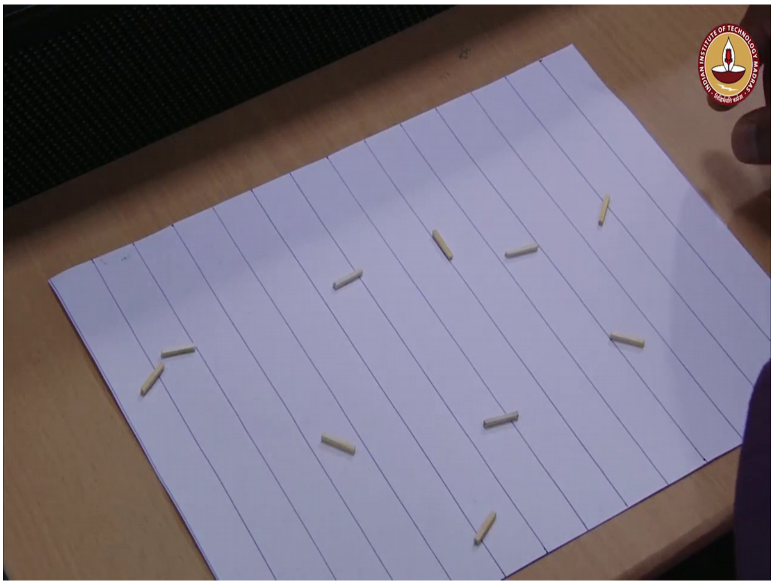

So, what is Buffon's experiment like I am going to throw this it is 10 small sticks with the length of 1.5 mm and I am going to throw this on this sheet which is this lines are separated by about 20 mm.

So, the probability of this small sticks making an intersections in this line is 2 lambda by pi t right. So, that is about 0.477 right. So, what I am going to do is I will do this experiment 5 times, I will take the average and then will see whether that comes to close to what that the theory predicts.

So, I will start my experiment. Now I will start counting 1, 2, 3, 4. So, my first experiment is first event is 4, now I will collect it again.

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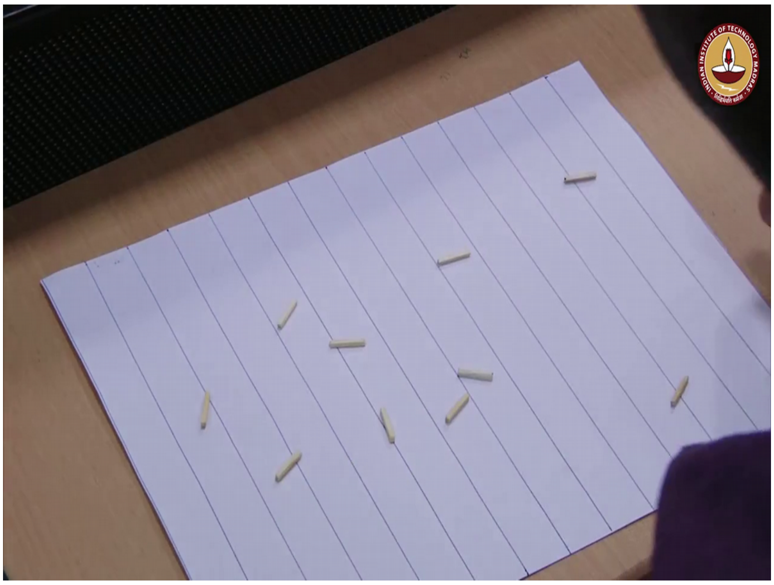

Now, I can put 1, 2, I will count again 1, 2 3, 4, 5, 6, 7, this time it is 7. So, you are noting down right?

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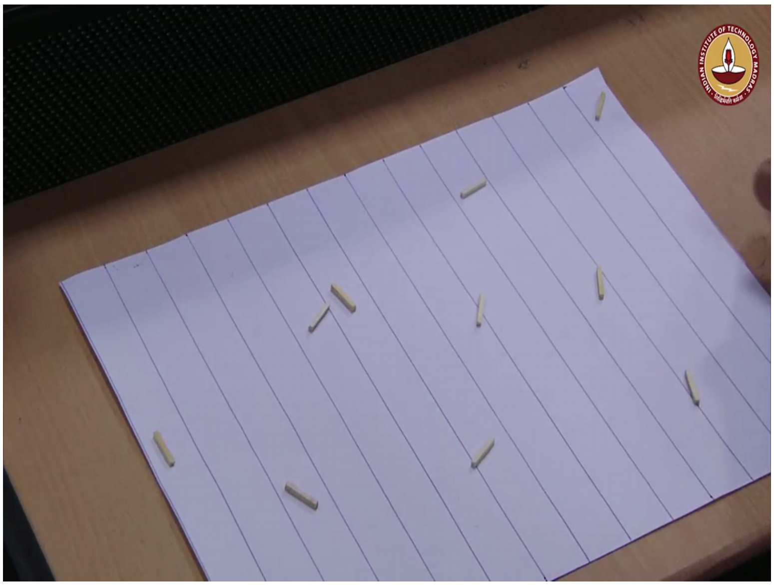

So, I will throw third time. Now I will start count 1, 2, 3 and then 4.

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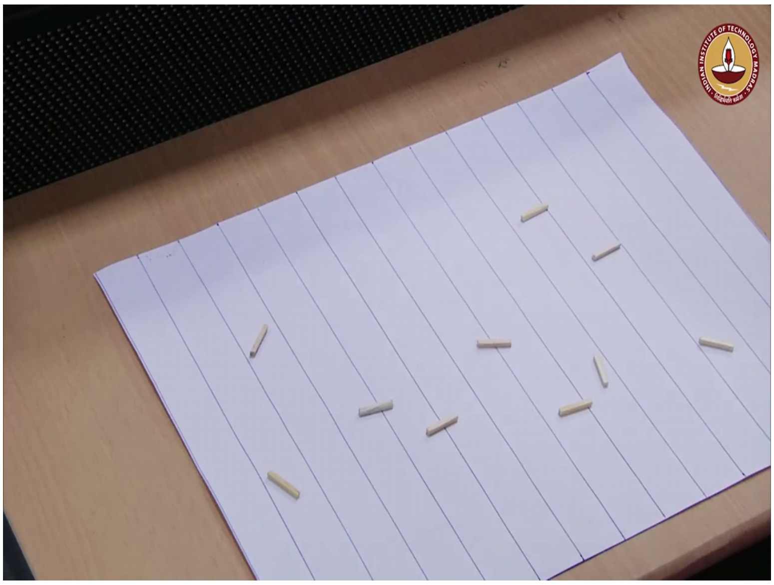

So, I will start again 1, 2, 3, 4, 5, the last event.

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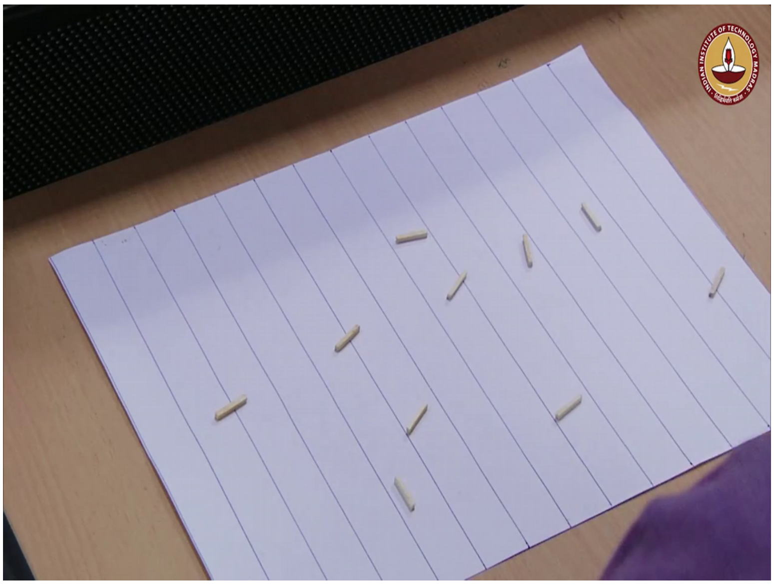

So, 1, 2, 3, 4, so what is the average I am getting?

Student: (Refer Time: 07:47) 4 point sir.

4 point.

Student: 48.

So, that is it.

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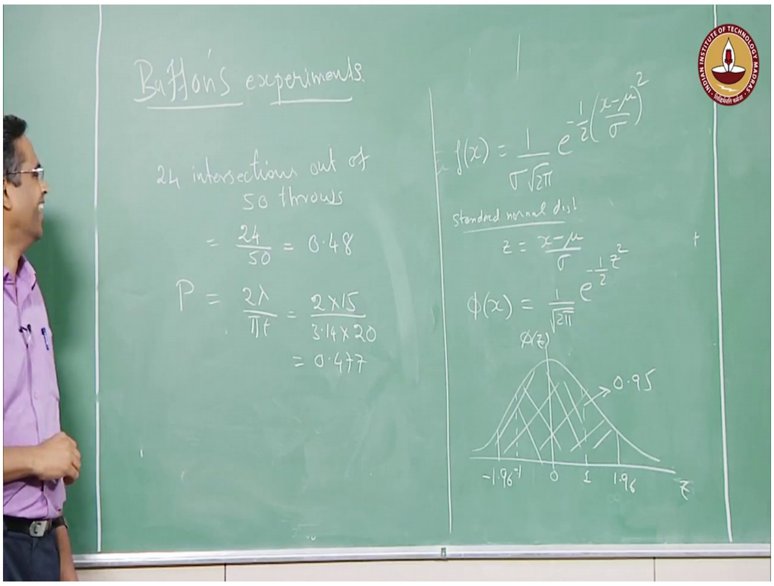

So, 24 intersection.

Student: (Refer Time: 08:19) 50.

Out of 50.

Student: 54.

Ha.

Student: 50 throw sir.

Ok.

Student: 10 (Refer Time: 08:26).

Intersections: So what we have is how much you get?

Student: 0 point.

Ok so, what you get by the theory is like 2 lambda by pi t; so it is also 2 into 15 and this is 3.14 into 20 right, this what it is right.

Student: 0.47.

So, this is 0.477; so, that is what it is.

Thank you.