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Week 3: Inferential Statistics(Total video duration= 3 hours. You will be required to spend 40 min/day along with practice datasets and quizzes)

Mentor Session Duration:	Faculty Name:	No. of videos: 23
2 hours	Mr. Abhinanda Sarkar	

Learning Outcomes from the Module:

From this week's learning content, learners will be able to understand:

- Hypothesis testing and Sampling Distributions
- Central Limit Theorem through experimentation
- Types of Hypothesis, Types of Errors, Hypothesis roadmap
- Types of Hypothesis tests- 1 tailed and 2 tailed, z-test, t-test, F-test
- Test of Variance

Video No.	Video Name	Duration of the video	Topics Covered	Conceptua/ Hands On
1	Usage of different Statistical Tools in Business	16:00	• Different statistical tools are used depending upon what is the kind of business operation you are into and the kind of data at hand and then using the right Statistical method to make decisions to profit the business	Conceptual
2	Hypothesis Testing Outline	02:00	• Hypothesis testing is a part of inferential statistics used to infer useful information from data versus describing patterns in data which is descriptive statistics.	Conceptual
3	Concepts of sampling distribution	03:00	• Sampling is used as a representative of a bigger data called Population. From a Population, we draw a Sample, on which we calculate statistics like Sample mean etc and from this Statistic, we can make inference on a parameter.	Conceptual
4	Sampling Distribution_CLT(Central Limit Theorem)	10:00	• Central Limit Theorem helps us assume that the data which when comes from a Population is sufficiently large. If n(sample size) is large, then the Z score transformation is Normally distributed. CLT is applicable to both discrete and continuous variables.	Conceptual
5	Central limit theorem - Experimentation	03:00	• Understanding Central LImit Theorem through an example of a dice rolled in sets of 4 trials and the faces are recorded to create a frequency distribution chart and we see that the histogram follows a bell shaped curve.	Conceptual
6	Hypothesis	04:00	• Hypothesis is an assumption for the Population without seeing the data. Whether the data supports the decision to be made will be proved/disproved after specifying Hypothesis. The Hypothesis is of 2 types- Null and Alternate and these are Not exchangeable ideas.	Conceptual

7	Hypothesis Formulation	06:00	• Using the Coca Cola volume to formulate and test Hypothesis.	Conceptual
8	Null and Alternate Hypothesis	02:00	• Null Hypothesis is the Status Quo, we either reject it (Alternate Hypothesis is supported) or fail to reject (does not mean Null Hypothesis is True) it but never accept it.	Conceptual
9	Type I and Type II errors	05:00	• Type 1 error means rejecting the Null Hypothesis when it's true. Type 2 error is failing to reject the Null Hypothesis when Null Hypothesis is False. Confidence Level= 1- Type 1 error and Power of the test= 1- Type 2 error.	Conceptual
10	Hypothesis Testing roadmap and Steps involved	05:00	• Roadmap to Hypothesis testing- 1. Figure out what you've trying to prove/disprove 2. State what you're trying to prove as Alternate Hypothesis and its counterpoint as Null Hypothesis 3. Determine the confidence level you want to work with (Alpha) 4. Find out the rule you'd use to reject/not before you see the data else the assumptions and the Type 1 and Type 2 errors will be flawed 5. Gather data to decide whether the null will be rejected or not. 6.Calculate the statistic to decide Null to be rejected/not 7. State conclusion based on p value 8. Make inference based on the conclusion	Conceptual

11	Types of Hypothesis tests - One tailed vs Two tailed	11:00	• When the rejection of Null Hypothesis is on both sides, its a two-tailed test. The purpose of both the tests is to get a statistic and say if its too large/small. Understanding how large of a deviation is acceptable for the Hypothesis to be successful. Standardize the deviation in the data by using the standard error. In a one sample test, the cut off is on one side	Conceptual
12	Confidence Intervals	07:00	• 95% of all sample means are hypothesized to be within the +/- 2 standard deviation of the bell shaped curve which means a confidence interval of 95% wherein Type one error would be 0.05. Confidence interval helps to reach conclusion about a population parameter.	Conceptual
13	Single sample z- test of mean	06:00	• Test Statistic, z= (Sample mean-population mean)/ standard error. p value means how much of the test statistics fall within the rejection region.	Conceptual
14	t - test of mean	09:00	• If the population is normally distributed but the standard deviation is unknown, we use the sample standard deviation and the test statistic, t test is done. Normal distribution is not done to find the cut-offs but t-distribution is done which is more spread out.	Conceptual

15	z - test of Proportion	06:00	• One sample and two sample comparisons can be extended to proportions/fractions using z-test.	Conceptual
16	Chi-Square Test	06:00	• When we take many samples of the same size from the normal population and find the sample variances,they do not follow a normal distribution but a Chi-Square distribution, which depends on the degrees of the freedom. It could also have one tailed or two tailed test depending on the variance distribution.	Conceptual
17	F- ratio test of variance	05:00	• In a two sampled version, when we have to compare variances, we look at the ratio of the two variances and its compared against a cut off by asking if they are equal or not and compare the statistic with the corresponding degrees of freedom that are based on corresponding sample sizes. This is F-distribution and the test is called F-test.	Conceptual
18	One Sample t-Test	16:00	• When we compare the sample average with a target value, one sample t-test is used.	Conceptual
19	One Sample t-Test-Hands-On	7:00	• Hands-on in Python using Daily intake of energy in kJ for 11 women case study to apply One Sample t-test	Hands-On

20	Two Sample t-Test	04:00	• Two Sample t-test compares the means of two different samples with each other as opposed to comparing the average of one sample with a target value.	Conceptual
21	Two Sample t-Test- Hands On	10:00	• Hands-on in Python using Energy expenditure in mJ and stature case study to apply Two Sample t-test	Hands-On
22	Hypothesis Testing Hands-On in Python	17:00	• Hands On example using Cardio Good Fitness dataset to understand how to perform Hypothesis Testing in Python	Hands-On
23	Module Summary	08:00	• Summary video of all the concepts covered in Statistical Methods in Decision Making course	Conceptual

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Few reading links that you can refer to:

1

https://www.statisticssolutions.com/hypothesis-testing/

2

https://www.thoughtco.com/null-hypothesis-vs-alternative-hypothesis-3126413

3

https://www.sophia.org/tutorials/z-test-for-population-means-7