A white robot hand with red and blue stripes

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**LAB MANUAL**

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**Case Study 3.1: Inferential Statistics – Estimating COVID-19 Case Trends in Maharashtra Using Confidence Intervals.**

**Introduction**

The COVID-19 pandemic significantly impacted public health and government policies worldwide. Maharashtra, being one of India's most affected states, witnessed fluctuating case numbers over time. Accurate estimation of daily case trends is crucial for healthcare resource allocation, policy decisions, and early warnings for future outbreaks.

This case study uses **Inferential Statistics** to estimate the true average number of daily COVID-19 cases in Maharashtra using **Confidence Intervals (CI)**. By analyzing real-time data, we determine a range where the actual mean number of cases likely falls with a **95% confidence level**.

**Problem Statement**

Maharashtra has recorded fluctuating daily COVID-19 cases due to testing variations, seasonal changes, and new variants. Given a 30-day sample of reported daily cases, we aim to estimate the true mean daily cases with a 95% confidence interval. This will help determine whether the situation is improving or worsening.

**Objectives**

* To estimate the mean daily COVID-19 cases in Maharashtra using a sample dataset.
* To construct a 95% confidence interval (CI) for the true mean of daily cases.
* To interpret the confidence interval and its implications for policy decisions.
* To visualize the distribution of cases and confidence interval boundaries.

**Methodology**

1. **Data Collection**

We use real-time data from Maharashtra’s COVID-19 case reports over a 30-day period. The dataset is sourced from the Ministry of Health & Family Welfare (MoHFW) and publicly available COVID-19 dashboards.

Sample Data: Daily COVID-19 Cases in Maharashtra (of 30 Days)

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1. **Data Analysis**

**Step 1: Import Necessary Libraries**

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**Step 2: Load the Data into a Pandas DataFrame**

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**Step 3: Compute Sample Mean and Standard Deviation**

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**Step 4: Calculate the 95% Confidence Interval**

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**Step 5: Visualizing the Confidence Interval**

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A graph of covid-19 cases

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**Results and Discussion**

Confidence Interval Calculation

Based on the sample data, the 95% Confidence Interval (CI) for the true mean daily COVID-19 cases in Maharashtra is:

(4950.43, 5209.57)

Interpretation

* We are 95% confident that the true mean daily cases in Maharashtra fall between 4,950 and 5,210 cases per day.
* If future reported daily cases fall outside this range, it may indicate a significant change in the COVID-19 trend (e.g., a new wave or decline in cases).
* Government authorities can use this estimate for healthcare planning and intervention strategies.

**Conclusion**

1. The 95% confidence interval suggests that the true average daily COVID-19 cases in Maharashtra range between 4,950 and 5,210 cases.
2. The results indicate a stable case trend but should be monitored for changes beyond this range.
3. Policy Implications: If actual cases exceed the upper bound, stricter containment measures may be required. If cases drop below the lower bound, easing restrictions may be considered.
4. Future Work: More extensive sampling (e.g., 60- or 90-day trends) can improve prediction accuracy.