

Introduction and Methods for Capstone

Overview

This week, your task is to develop the **Introduction** and **Methods** sections of your capstone project, which should focus on mathematical, statistical, or data science concepts relevant to your research. These sections are fundamental to your final report, laying the theoretical and practical foundations for your project. Below are the specific guidelines for structuring your work.

Introduction

In the **Introduction**, you should frame the research problem in a mathematical, statistical, or data science context. Be sure to include:

- **Problem definition:** Clearly articulate the research question or problem you are addressing. Explain why this problem is significant within the fields of mathematics, statistics, or data science.
- **Context and background:** Review relevant theories, mathematical models, statistical techniques, or data science methodologies that inform your project. Reference key research papers, algorithms, or theorems that provide the foundation for your work.
- **Objectives and goals:** Define the specific objectives of your project. What do you aim to accomplish or discover through your analysis or modeling?
- **Summary of approach:** Provide a brief overview of the techniques, algorithms, or mathematical models you plan to use. This will lead naturally into the Methods section.

Methods

The **Methods** section should detail the technical approach and methodologies you will employ. This section is critical for explaining how you plan to perform your analysis or modeling. Be sure to include the following:

- **Data acquisition and sources:** Describe the datasets you will use, including their origin, structure, and any preprocessing steps required (e.g., data cleaning, transformation, or feature engineering).
- **Mathematical or statistical models:** Clearly outline the models, algorithms, or analytical frameworks you plan to implement (e.g., regression models, machine learning algorithms, time series analysis, Monte Carlo simulations). Specify why these models are appropriate for your research question.

- **Experimental design or analytical procedures:** Provide a step-by-step breakdown of your methodology, such as training machine learning models, performing hypothesis testing, or constructing mathematical proofs. Include details on model evaluation metrics (e.g., accuracy, RMSE, AUC) or statistical significance tests (e.g., p-values, confidence intervals) you plan to use.
- **Software and tools:** List the software (e.g., Python, R, MATLAB, SAS) and libraries (e.g., NumPy, pandas, scikit-learn, TensorFlow) that will support your analysis or computations. Include any computational resources you plan to use, such as cloud computing or local clusters.
- **Ethical considerations (if applicable):** If your project involves sensitive data or human subjects, include a brief discussion on how you will ensure ethical use of data, privacy, or confidentiality.

You may choose to focus on either the Introduction or Methods section this week. If your research question and background are still evolving, prioritize the Introduction. If your methodology is already planned, focus more on the technical details in the Methods section.

Feel free to reach out if you have any questions or need further clarification on what to include in these sections.