# Outline for 1st Paper

## Introduction

My research idea focuses on to access the ability of LLM to optimize memory usage and time cost of a given python code. As we know, for small scripts, optimization for code might be unnecessary, but for large-scale applications, slight improvements can lead to significant savings in resources and time. For most human developers, a time-consuming code can hold lots of resources and especially for small groups, it means that their devices may be prevented from being used for other tasks and experiments so that the efficiency can be undermined. However, optimizing code usually is a boring and time-consuming job for human developer even the experts in these fields. Thus, if LLM can deal with the problem for optimizing code to reduce memory usage and time cost effectively, lots of resource can be saved.

## Problem Definition & Metrics

Considering making our experiment more convincing, some metrics are utilized for measuring and comparing. The first metric is the runtime of the code. We will compare runtime between original code and optimized code by LLM. Another metric is the memory usage. Usually, more memory to make a program run faster, and use less memory, making it run slower. Additionally, accessing or allocating data from memory, especially if it's not in the cache, can be also time-consuming, which can remarkably affect performance.

## Experiments Design

For accessing the ability of LLM to optimize memory usage and time cost of a given python code, several experiments should be designed for evaluation. Given a task and a raw code solving it, let LLM generate a new code by modifying the raw code. After that, we will compare the runtime and memory usage between the new code and the raw one.

By trying different tasks and various raw codes, several related results can be obtained for providing a comprehensive evaluation about the ability of LLM to optimize memory usage and time cost of a given python code. Apparently, the ground truth can be collected from the raw code.

## Conclusion

According the results of evaluation for experiments, we can access the ability of LLM to optimize memory usage and time cost of a given python code. If LLM can provide a remarkable effect for optimizing runtime and memory usage, there will be many groups and individuals of human developers who are benefited.