# Research Methodology

## Step 1: Case Language Selection

## Step 2: Solution Design

### Step 2.1: Python Script Development

### Step 2.2: Prompting Text Optimization

#### Initial Prompting Text

#### grammar\_1 is the initial grammar of the DSL. We evolved it to get grammar\_2. instance\_1 was originally a text instance that followed grammar\_1. Now I want you to analyze the differences between the two versions of the grammar, and based on this difference, modify instance\_1 and get instance\_2, which will follow grammar\_2.

#### Results

Execution Result of Claude：

A screenshot of a computer

Description automatically generated

Problems:

1. Claude adds optional element in the instance\_2 which is unnecessary.
2. Claude ignored the formats, such as tab symbol, empty line, and also added format which didn’t exist in the instance\_1.

Execution result of OpenAI:

A screenshot of a computer

Description automatically generated

Problems:

1. The same issues as in Claude, i.e., 1) OpenAI adds something that is added in grammar\_2 and optional in the instance. 2) OpenAI ignores the formats from the instance\_1, e.g., the empty line, the tab symbols, and also adds format which didn’t exist in the instance\_1.
2. OpenAI changes the comments as well which was not expected but very acceptable..

#### Strategy of Improvement/Adjustment

According to the issues we found in the initial round, we adjust as the following:

1. Tell the LLM models that don’t instantiate anything which is added in grammar\_2 and optional, and we don’t need the package path when invoke the objects from the same package.
2. Don’t miss the comments, and whitespace or tab symbols.

So, then the prompting text is changed to:

#### Second version of prompting text

grammar\_1 is the initial grammar of the DSL. We evolved it to get grammar\_2. instance\_1 was originally a text instance that followed grammar\_1. Now I want you to analyze the differences between the two versions of the grammar, and based on this difference, modify instance\_1 and get instance\_2, which will follow grammar\_2. And please note the following things:

1. If grammar\_2 add a new grammar rule or a new attribute which is optional or in an “OR” relationship (i.e., |), then please don’t instantiate it.
2. Don’t miss or add any formats in the instance, e.g., comments, formats (white-space, indents, tabs, empty lines, etc.).

Let's get started.

#### Results

Execution Result of Claude:

A screenshot of a computer

Description automatically generated

Problems:

1. No problem, just perfect.

Execution Result of OpenAI:

A screenshot of a computer

Description automatically generated

Problems:

1. OpenAI ignored the symbols and added unnecessary comments.

#### Strategy of Improvement/Adjustment

It seems that with just the current prompting text, Claude is already able to evolve the instance accurately, but OpenAI is not yet able to do so. So, we add a hint about symbols.

So the prompting text is changed to:

#### Third version of prompting text

grammar\_1 is the initial grammar of the DSL. We evolved it to get grammar\_2. instance\_1 was originally a text instance that followed grammar\_1. Now I want you to analyze the differences between the two versions of the grammar, and based on this difference, modify instance\_1 and get instance\_2, which will follow grammar\_2. Please address the following things:

1. When evolving the instance, please do not omit any mandatory elements, such as characters enclosed by single quotes

2. If grammar\_2 adds a new grammar rule or a new attribute that is optional or in an “OR” relationship (i.e., |), then please do not instantiate it.

3. Do not miss or add any auxiliary information inthe instance, e.g., comments, formats (white space, indents, tabs, empty lines, etc.).

#### Results

Execution Result of Claude:

A screenshot of a computer

Description automatically generated

Problems:

1. Just perfect, no problem!

Execution Result of OpenAI:

A screenshot of a computer

Description automatically generated

Problem:

1. OpenAI does evolve the instance correctly but it adds some comments which are unnecessary. But it is an acceptable issue.

### The Final Version

grammar\_1 is the initial grammar of the DSL. We evolved it to get grammar\_2. instance\_1 was originally a text instance that followed grammar\_1. Now I want you to analyze the differences between the two versions of the grammar, and based on this difference, modify instance\_1 and get instance\_2, which will follow grammar\_2. Please address the following things:

1. When evolving the instance, please do not omit any mandatory elements, such as characters enclosed by single quotes

2. If grammar\_2 adds a new grammar rule or a new attribute that is optional or in an “OR” relationship (i.e., |), then please do not instantiate it.

3. Do not miss or add any auxiliary information inthe instance, e.g., comments, formats (white space, indents, tabs, empty lines, etc.).

## Step 3: Solution Execution in Case Languages