Design and Implementation of Modern Compiler

Mini Project

Aim: Write a code to generate a predictive parsing table for a given set of production rules.

Description:

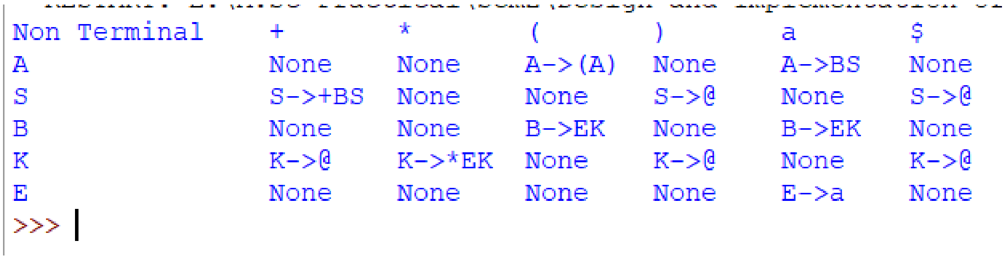
- **Predictive Parsing Table:**
  Predictive parsing uses a stack and a parsing table to parse the input and generate a parse tree. Both the stack and the input contains an end symbol $to denote that the stack is empty and the input is consumed. The parser refers to the parsing table to take any decision on the input and stack element combination

- **Python**:
  Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small- and large-scale projects .

Source code:

```
class PredictiveParser:

    def __init__(self):


        self.non_terminals = list("ASBKE")

        self.terminals = list("+*()a")

        self.production_rules = ["A->BS", "S->+BS", "S->@", "B->EK", "K->*EK", "K->@", "A->(A)", "E->a"]
        self.first = {"A":["(", "a"], "S":["+", "@"], "B":["(", "a"], "K":["*",
"@"], "E":["(", "a"]}

        self.follow = {"A":[")", "$"], "S":[")", "$"], "B":[")", "$", "+"],
"K":[")", "$", "+"], "E":[")", "$", "+", "*"]}



    def generate_parsing_table(self) -> dict[str, list[str]]:

        parsing_table = dict()

        for non_terminal in self.non_terminals:

            parsing_table[non_terminal] = [None for i in
range(len(self.terminals) + 1)]

        for production_rule in self.production_rules:

            non_terminal_at_left, remainder = production_rule.split("-
>") if "->" in production_rule else production_rule.split("-")

            if not (remainder[0].isupper() or remainder[0] == "@"):


    parsing_table[non_terminal_at_left][self.terminals.index(remainder[0])]
= production_rule

            else:

                update_locations = self.first[non_terminal_at_left]

                if "@" in update_locations:

                    update_locations.remove("@")

                    update_locations +=
self.follow[non_terminal_at_left]


                for update_location in update_locations:
                    try:
                        position =
self.terminals.index(update_location)
                    except ValueError:
                        position = len(self.terminals)

                    if
parsing_table[non_terminal_at_left][position] is not None:
                        continue

                    parsing_table[non_terminal_at_left][position]
= production_rule

        return parsing_table

    def print_parsing_table(self, parsing_table : dict[str, list[str]]):
        print("Non Terminal", end = "\t")
        for terminal in self.terminals:
            print(terminal, end = "\t")
        print("$", end = "\n")

        for entry in parsing_table:
            print(entry, end = "\t\t")
            for cell in parsing_table[entry]:
                print(cell, end = "\t")
            print(end = "\n")


if __name__ == '__main__':
    predictive_parser = PredictiveParser()
    parsing_table = predictive_parser.generate_parsing_table()
    predictive_parser.print_parsing_table(parsing_table)
```

Output:



```
Non Terminal    +       *       (       )       a       $
A               None    None    A->(A)  None    A->BS   None
S               S->+BS  None    None    S->@    None    S->@
B               None    None    B->EK   None    B->EK   None
K               K->@    K->*EK  None    K->@    None    K->@
E               None    None    None    None    E->a    None
>>> 
```