MSC CS – I

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Design and Implementation of Modern Compilers

Mini Project

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

Description:

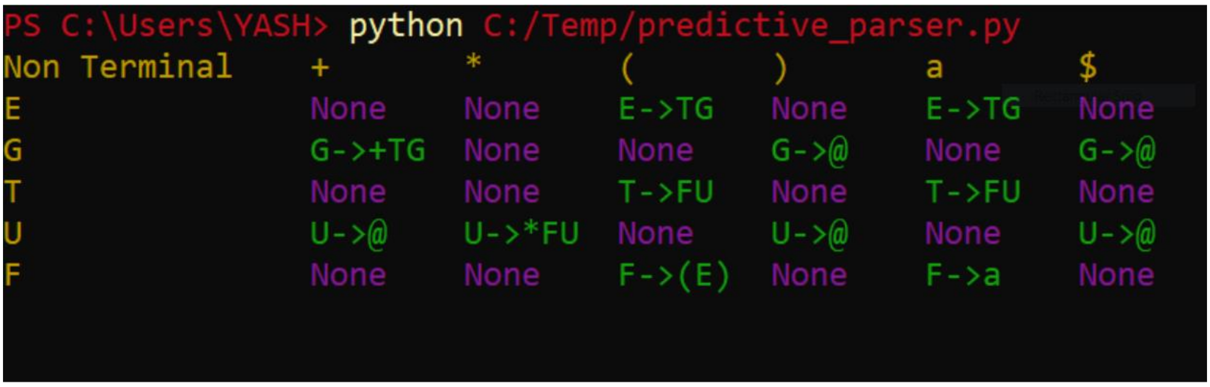
- **Predictive parsing:**
  - A predictive parser is a recursive descent parser with no backtracking or backup.
  - It is a top-down parser that does not require backtracking.
  - At each step, the choice of the rule to be expanded is made upon the next terminal symbol.

- **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.
  - Python is dynamically-typed and garbage-collected.
  - It supports multiple programming paradigms, including structured (particularly procedural), object-oriented and functional programming. It is often described as a "batteries included" language due to its comprehensive standard library.

Source Code:

```
!pip install colorama
from colorama import Fore, init

class PredictiveParser:
  def __init__(self):
    # self.non_terminals = list(input("Enter the list of non-terminals >"))
    # self.terminals = list(input("Enter the list of terminals >"))
    # print("Use `@` for denoting upsilon.")

    # rule_count = int(input("Enter the number of rules you want to add > "))
    # self.production_rules = list()
    # for i in range(rule_count):
    #   self.production_rules.append(input(f"Enter rule {i + 1} > ").replace(" ", ""))

    # self.first = self.follow = dict()
    # for non_terminal in self.non_terminals:
    #   self.first[non_terminal] = list(input(f"Enter first({non_terminal}) > "))

    # for non_terminal in self.non_terminals:
    #   self.follow[non_terminal] = list(input(f"Enter follow({non_terminal}) > "))

    self.non_terminals = list("EGTUF")
    self.terminals = list("+*()a")
    self.production_rules = ["E->TG", "G->+TG", "G->@", "T->FU", "U->*FU", "U->@", "F-
>(E)", "F->a"]
    self.first = {"E":["(", "a"], "G":["+", "@"], "T":["(", "a"], "U":["*", "@"], "F":["(", "a"]}
    self.follow = {"E":[")", "$"], "G":[")", "$"], "T":[")", "$", "+"], "U":[")", "$", "+"], "F":[")", "$",
"+", "*"]}


  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_r
ule
      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]]):
    init()
    yellow = Fore.YELLOW
    red = Fore.RED
    green = Fore.GREEN
    magenta = Fore.MAGENTA

    print(f"{yellow}Non Terminal", end = "\t")
    for terminal in self.terminals:
      print(f"{yellow}{terminal}", end = "\t")
    print(f"{yellow}$", end = "\n")

    for entry in parsing_table:
      print(f"{yellow}{entry}", end = "\t\t")
      for cell in parsing_table[entry]:
        color = green if cell is not None else magenta
        print(f"{color}{cell}", end = "\t")
      print(end = "\n")

    print("\n\n\n")

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

Output:



```
PS C:\Users\YASH> python C:/Temp/predictive_parser.py
Non Terminal    +       *       (       )       a       $
E               None    None    E->TG   None    E->TG   None
G               G->+TG  None    None    G->@    None    G->@
T               None    None    T->FU   None    T->FU   None
U               U->@    U->*FU  None    U->@    None    U->@
F               None    None    F->(E)  None    F->a    None
```