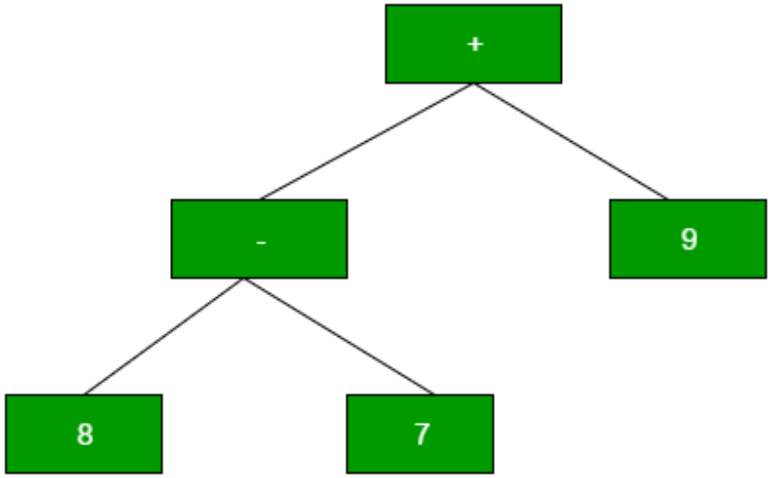
Interpreter Design Pattern

Interpreter design pattern is one of the **behavioral** design pattern. Interpreter pattern is used to defines a grammatical representation for a language and provides an interpreter to deal with this grammar.

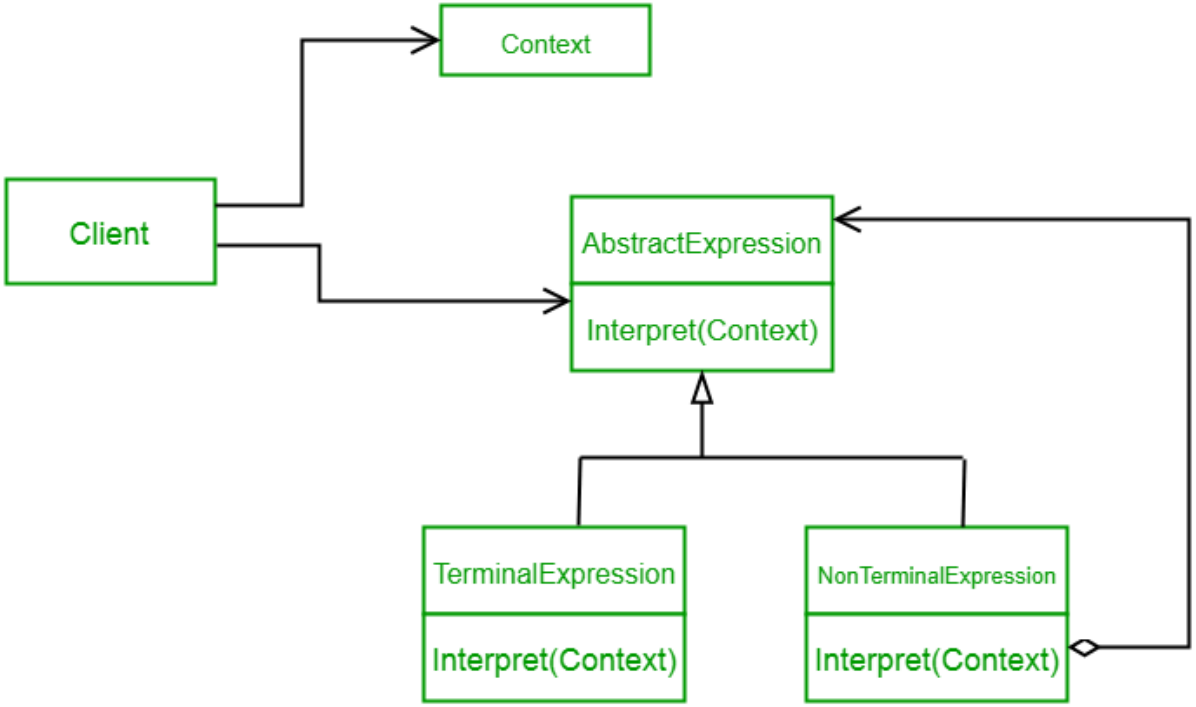
- This pattern involves implementing an expression interface which tells to interpret a particular context. This pattern is used in SQL parsing, symbol processing engine etc.
- This pattern performs upon a hierarchy of expressions. Each expression here is a terminal or non-terminal.
- The tree structure of Interpreter design pattern is somewhat similar to that defined by the composite design pattern with terminal expressions being leaf objects and non-terminal expressions being composites.
- The tree contains the expressions to be evaluated and is usually generated by a parser. The parser itself is not a part of the interpreter pattern.

For Example :
Here is the hierarchy of expressions for **“+ – 9 8 7”** :



Implementing the Interpreter Pattern

UML Diagram Interpreter Design Pattern



Design components

- **AbstractExpression** (Expression): Declares an interpret() operation that all nodes (terminal and nonterminal) in the AST overrides.
- **TerminalExpression** (NumberExpression): Implements the interpret() operation for terminal expressions.
- **NonterminalExpression** (AdditionExpression, SubtractionExpression, and MultiplicationExpression): Implements the interp operation for all nonterminal expressions.

- **Context** (String): Contains information that is global to the interpreter. It is this String expression with the Postfix notation that has to be interpreted and parsed.
- **Client** (ExpressionParser): Builds (or is provided) the AST assembled from TerminalExpression and NonTerminalExpression. The Client invokes the interpret() operation.

Let's see an example of Interpreter Design Pattern.

```
// Expression interface used to
// check the interpreter.
interface Expression
{
    boolean interpreter(String con);
}

// TerminalExpression class implementing
// the above interface. This interpreter
// just check if the data is same as the
// interpreter data.
class TerminalExpression implements Expression
{
    String data;

    public TerminalExpression(String data)
    {
        this.data = data;
    }

    public boolean interpreter(String con)
    {
        if(con.contains(data))
        {
            return true;
        }
        else
        {
            return false;
        }
    }
}
```

```
// OrExpression class implementing
// the above interface. This interpreter
// just returns the or condition of the
// data is same as the interpreter data.
class OrExpression implements Expression
{
    Expression expr1;
    Expression expr2;

    public OrExpression(Expression expr1, Expression expr2)
    {
        this.expr1 = expr1;
        this.expr2 = expr2;
    }
    public boolean interpreter(String con)
    {
        return expr1.interpreter(con) || expr2.interpreter(con);
    }
}

// AndExpression class implementing
// the above interface. This interpreter
// just returns the And condition of the
// data is same as the interpreter data.
class AndExpression implements Expression
{
    Expression expr1;
    Expression expr2;

    public AndExpression(Expression expr1, Expression expr2)
    {
        this.expr1 = expr1;
        this.expr2 = expr2;
    }
    public boolean interpreter(String con)
    {
        return expr1.interpreter(con) && expr2.interpreter(con);
    }
}

// Driver class
class InterpreterPattern
```

```
{

    public static void main(String[] args)
    {
        Expression person1 = new TerminalExpression("Kushagra");
        Expression person2 = new TerminalExpression("Lokesh");
        Expression isSingle = new OrExpression(person1, person2);

        Expression vikram = new TerminalExpression("Vikram");
        Expression committed = new TerminalExpression("Committed");
        Expression isCommitted = new AndExpression(vikram, committed);

        System.out.println(isSingle.interpreter("Kushagra"));
        System.out.println(isSingle.interpreter("Lokesh"));
        System.out.println(isSingle.interpreter("Achint"));

        System.out.println(isCommitted.interpreter("Committed, Vikram"));
        System.out.println(isCommitted.interpreter("Single, Vikram"));

    }
}
```

Output:

```
true
true
false
true
false
```

In the above code , We are creating an interface **Expression** and **concrete** classes implementing the Expression interface. A class **TerminalExpression** is defined which acts as a main interpreter and other classes **OrExpression**, **AndExpression** are used to create combinational expressions.

Advantages

- It's easy to change and extend the grammar. Because the pattern uses classes to represent grammar rules, you can use inheritance to change or extend the grammar. Existing expressions can be modified incrementally, and new expressions can be defined as variations on old ones.
- Implementing the grammar is easy, too. Classes defining nodes in the abstract syntax tree have similar implementations. These classes are easy to write, and often their generation can be automated with a compiler or parser generator.

Disadvantages

- Complex grammars are hard to maintain. The Interpreter pattern defines at least one class for every rule in the grammar. Hence grammars containing many rules can be hard to manage and maintain.

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