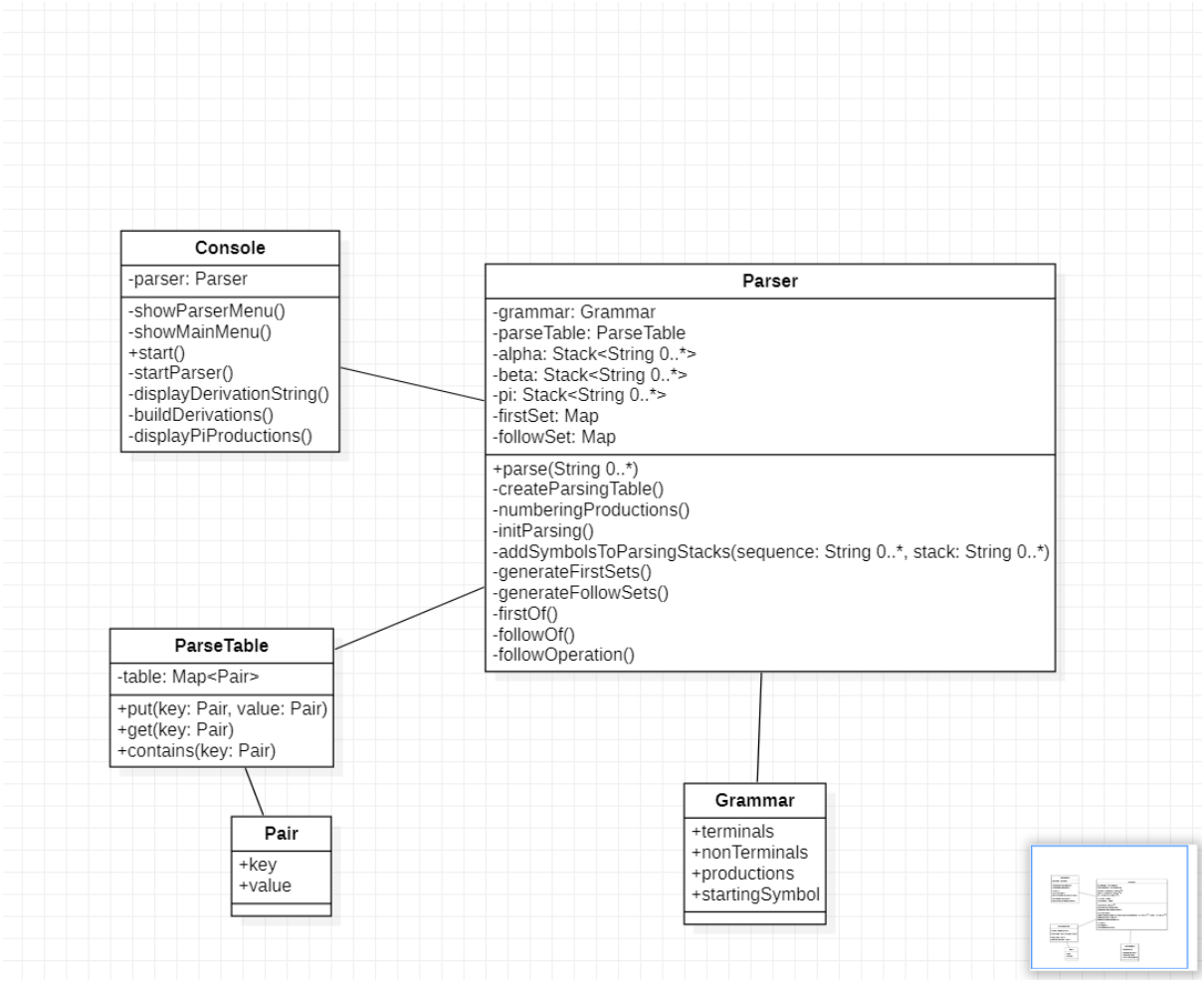
```
https://github.com/mocadavid/LFTC/tree/Lab7
/**
* Represents the parsing table.
* Key is formed from the pair row head and column head
* Value is formed from the pair of production result symbols and its number.
*/
public class ParseTable {
  private Map<Pair<String, String>, Pair<List<String>, Integer>> table = new
HashMap<>();

  /**
   * Adds a new entry in the parsing table
   * @param key given row and column: Pair<String, String>
   * @param value formed by the production result symbols and its
numbering: Pair<List<String>, Integer>
   */
  public void put(Pair<String, String> key, Pair<List<String>, Integer> value);

  /**
   * Gets the entry from the parsing table by its key.
   * @param key given row and column: Pair<String, String>
   * @return formed by the production result symbols and its numbering:
Pair<List<String>, Integer>
   */
  public Pair<List<String>, Integer> get(Pair<String, String> key);

  /**
   * Checks if a given key is already present in the parsing table.
   * @param key given row and column: Pair<String, String>
   * @return true if it is contained, false otherwise
   */
  public boolean containsKey(Pair<String, String> key) ;

  /**
   * Transforms the parsing table into a readable string form of key value pairs.
   * @return the content of the parsing table :String
   */
  @Override
  public String toString();
}
```

```java
/**
* Class which can generate the first and follow sets.
*/
public class Parser {
  private Map<String, Set<String>> firstSet;
  private Map<String, Set<String>> followSet;
  private Grammar grammar;
  private static Stack<List<String>> rules = new Stack<>();
  private ParseTable parseTable = new ParseTable();
  private Map<Pair<String, List<String>>, Integer> productionsNumbered = new HashMap<>();
  private Stack<String> alpha = new Stack<>();
  private Stack<String> beta = new Stack<>();
  private Stack<String> pi = new Stack<>();

  /**
   *Constructor
   */
  public Parser();

  /**
   * getter
   */
  public Map<String, Set<String>> getFirstSet();

  /**
   * getter
   */
  public Map<String, Set<String>> getFollowSet();

  /**
   * getter
   */
  public ParseTable getParseTable();

  /**
   * getter
   */
  public Stack<String> getPi();

  /**
   * getter
   */
  public Map<Pair<String, List<String>>, Integer> getProductionsNumbered();

  /**
   * Initializing the first and follow sets
   */
  private void generateSets();

  /**
   * Generating first for every nonTerminal.
```

```
    */
    private void generateFirstSet();

    /**
     *Generates the first set for the given nonTerminal.
     * @param nonTerminal: nonTerminal: String
     * @return The set of terminals for the given nonTerminal.
     */
    private Set<String> firstOf(String nonTerminal);

    /**
     *Generating the follow set for all the nonTerminals.
     */
    private void generateFollowSet();

    /**
     * Parses a sequence of the form: a list with symbols.
     * @param givenSequence The list with symbols: List<String>
     * @return true if the parsing succeeded, false otherwise
     */
    public boolean parse(List<String> givenSequence);

  /**
     * Creates the parsing table adding two pairs consisting of the index and column and the production
with its number.
     */
    private void createParsingTable();

    /**
     * Function used to index the productions in order
     */
    private void numberingProductions();
    /**
     * Used to set up the alpha, beta and pi stacks.
     * @param givenSequence The list with symbols to be parsed: List<String>
     */
    private void initParsing(List<String> givenSequence);

    /**
     * Used to add symbols to the stacks used in parsing.
     * @param parsingSequence The list with symbols to be parsed: List<String>
     * @param parsingStacks The stack where to add the symbol.
     */
    private void addSymbolsToParsingStacks(List<String> parsingSequence, Stack<String>
parsingStacks);

    /*
     * Analyses the productions in which the given nonTerminal is present and calls accordingly the
follow operations with the needed values.
     * @param nonTerminal the given nonTerminal which we examine: String
     * @param initialNonTerminal the starting point for which we search for the follow set: String
     * @return the finalResult of the follow set: Set<String>
```

```
    */
    private Set<String> followOf(String nonTerminal, String initialNonTerminal);

    /**
     * Decides upon the case of the follow in which we are.
     * @param nonTerminal the nonTerminal for which we search follow: String
     * @param intermediaryResult the list in we save the found elements so far: Set<String>
     * @param terminals the terminals from the grammar: Set<String>
     * @param productionStart the starting nonTerminal of the production
     * @param rule the current production we analyse: String
     * @param indexNonTerminal the index of the nonTerminal: int
     * @param initialNonTerminal the given nonTerminal: String
     * @return the result of the follow operation for the given nonTerminal staring from the
initialNonTerminal: Set<String>
     */
    private Set<String> followOperation(String nonTerminal, Set<String> intermediaryResult,
Set<String> terminals, String productionStart, List<String> rule, int indexNonTerminal, String
initialNonTerminal);
}

//manages menus and displaying
public class Console {

    private Parser parser;
    private Grammar grammar;
    private FA fa;

    public Console() {
        this.parser = new Parser();
        this.grammar = new Grammar();
        fa = new FA();
    }

//shows the menu of the grammar
    private void showGrammarMenu();
// main function of the console app
    public void start() throws FileNotFoundException;
//manages options for the parser
    private void startParser() throws FileNotFoundException;

    /**
     * Wrapper function for displaying derivation strings
     * @param pi: The stack with the order of derivations: Stack<String>
     * @param parser the parser which parsed: Parser
     * @return The content to be displayed as derivation Strings: String
     */
    private String displayDerivationString(Stack<String> pi, Parser parser);
```

```
    /**
     * Builds the derivations string based on the productions and productions order in the pi stack.
     * @param replaceNonTerminal nonTerminals which need to be replaced in order given by pi: List<String>
     * @param productionReplacement the production which needs to take place in the order given by pi: List<List<String>>
     * @return The content to be displayed as derivation Strings: String
     */
    private String buildDerivations(List<String> replaceNonTerminal, List<List<String>> productionReplacement);

    /**
     * Displays productions string.
     * @param pi: The stack with the order of derivations: Stack<String>
     * @param parser the parser which parsed: Parser
     * @return String as productions string.
     */
    private String displayPiProductions(Stack<String> pi, Parser parser);
//manages the options for the grammar
    private void startGrammar();
//manages options for the scanner
    private void startScanner();
}
```


Console
-parser: Parser
-showParserMenu()
-showMainMenu()
+start()
-startParser()
-displayDerivationString()
-buildDerivations()
-displayPiProductions()
Parser
-grammar: Grammar
-parseTable: ParseTable
-alpha: Stack<String 0..*>
-beta: Stack<String 0..*>
-pi: Stack<String 0..*>
-firstSet: Map
-followSet: Map
+parse(String 0..*)
-createParsingTable()
-numberingProductions()
-initParsing()
-addSymbolsToParsingStacks(sequence: String 0..*, stack: String 0..*)
-generateFirstSets()
-generateFollowSets()
-firstOf()
-followOf()
-followOperation()
ParseTable
-table: Map<Pair>
+put(key: Pair, value: Pair)
+get(key: Pair)
+contains(key: Pair)
Pair
+key
+value
Grammar
+terminals
+nonTerminals
+productions
+startingSymbol