Computer Science III

2024-III

WorkShop No. 2 — Compilers

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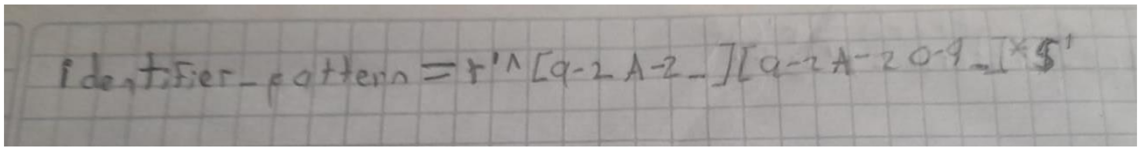
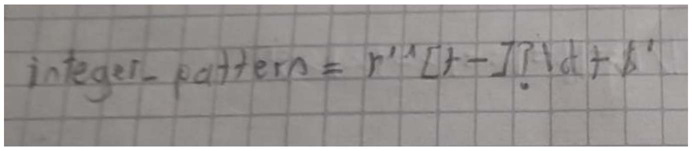
1. For each one of next cases definr a regular expression as used in a compiler based on the Python re library:

   (i) **Identifier:** A regular expression to match valid identifiers (variable names, function names, etc.).



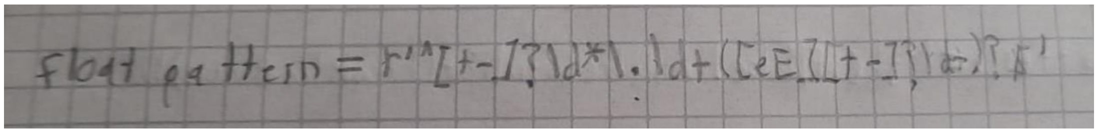
```
identifier_pattern = r'^[a-zA-Z_][a-zA-Z0-9_]*$'
```

   (ii) **Integer Literal:** A regular expression to match integer literals.



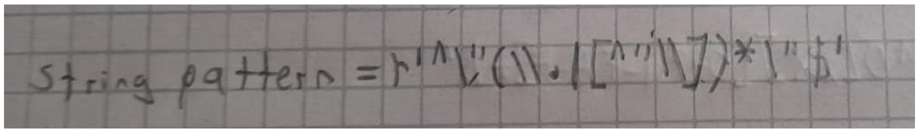
```
integer_pattern = r'^[+-]?\d+$'
```

   (iii) **Floating Point Literal:** A regular expression to match floating-point literals.



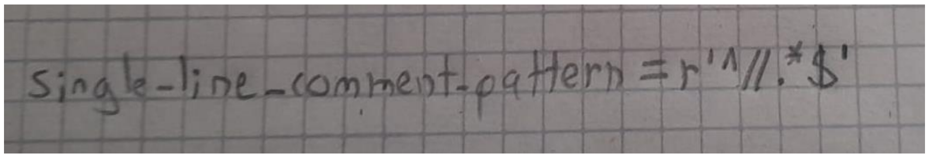
```
float pattern = r'^[+-]?\d*\.\d+([eE][+-]?\d+)?$'
```

   (iv) **String Literal:** A regular expression to match string literals enclosed in double quotes.



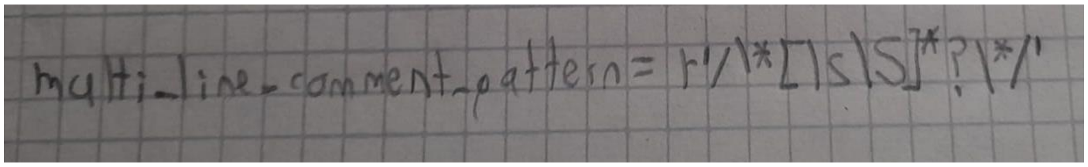
```
string pattern = r'^\"(\\.|[^"\\])*\"$'
```

   (v) **Single-line Comment:** A regular expression to match single-line comments starting with '//'.



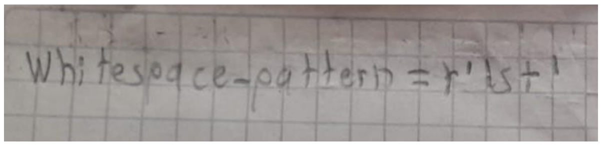
```
single-line-comment-pattern = r'^//.*$'
```

(vi) **Multi-line Comment:** A regular expression to match multi-line comments enclosed in '/* */'.



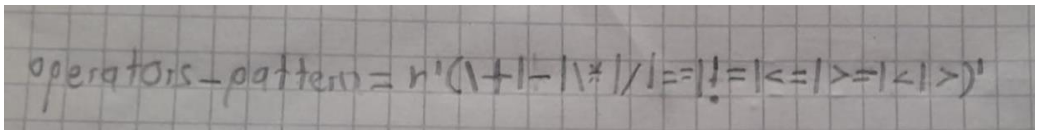
```
multi_line_comment_pattern= r'/\*[\s\S]*?\*/'
```

(vii) **Whitespace:** A regular expression to match whitespace characters (spaces, tabs, newlines).



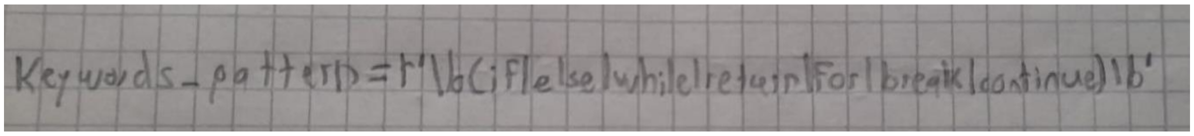
```
whitespace_pattern = r'\s+'
```

(viii) **Operators:** A regular expression to match common operators (e.g., '+', '-', '*', '/', '==', '!=').



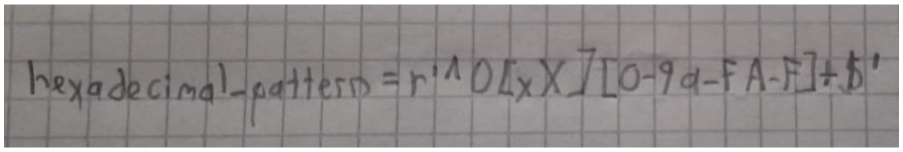
```
operators_pattern = r'(\+|-|\*|/|==|!=|<=|>=|<|>)'
```

(ix) **Keywords:** A regular expression to match reserved keywords (e.g., 'if', 'else', 'while', 'return').



```
Keywords_pattern=r'\b(if|else|while|return|for|break|continue)\b'
```

(x) **Hexadecimal Literal:** A regular expression to match hexadecimal literals.



```
hexadecimal_pattern =r'^0[xX][0-9a-fA-F]+$'
```

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Any comment or concern related to this document could be send to Carlos A. Sierra at e-mail: *cavirguezs@udistrital.edu.co*

2. Be *G* a context-free grammar with the following productions:

```
S -> Program
Program -> StatementList
StatementList -> Statement StatementList | <lambda>
Statement -> Assignment | IfStatement | WhileStatement | ReturnStatement
Assignment -> Identifier "=" Expression ";"
IfStatement -> "if" "(" Expression ")" "{" StatementList "}" ElsePart
ElsePart -> "else" "{" StatementList "}" | <lambda>
WhileStatement -> "while" "(" Expression ")" "{" StatementList "}"
ReturnStatement -> "return" Expression ";"
Expression -> Term Expression'
Expression' -> "+" Term Expression' | "-" Term Expression' |
<lambda>
Term -> Factor Term'
Term' -> "*" Factor Term' | "/" Factor Term' | <lambda>
Factor -> "(" Expression ")" | Identifier| Number
Identifier -> [a-zA-Z_][a-zA-Z0-9_]*
Number -> [0-9]+
```

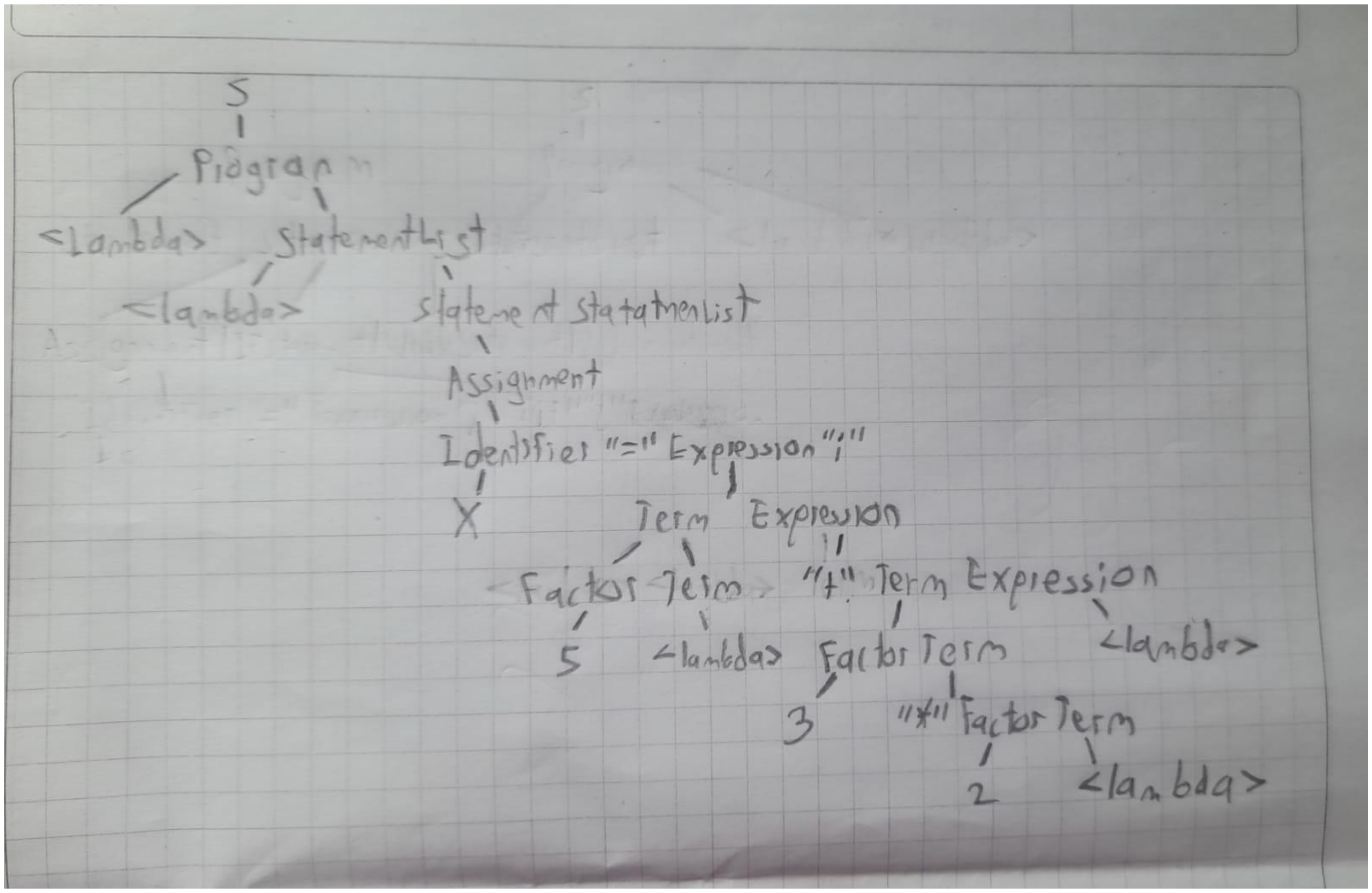
Explanation:

- **S** is the start symbol.
- **Program** consists of a list of statements.
- **StatementList** is a sequence of statements or an empty sequence (< *lambda* >).
- **Statement** can be an assignment, an if statement, a while statement, or a return statement.
- **Assignment** assigns an expression to an identifier.
- **IfStatement** includes an optional else part.
- **WhileStatement** represents a while loop.
- **ReturnStatement** returns an expression.
- **Expression** consists of terms combined with addition or subtraction.
- **Term** consists of factors combined with multiplication or division.
- **Factor** can be an expression in parentheses, an identifier, or a number.
- **Identifier** matches typical variable names.
- **Number** matches sequences of digits.

Based on the provided context-free grammar, create derivation trees for the following statements:

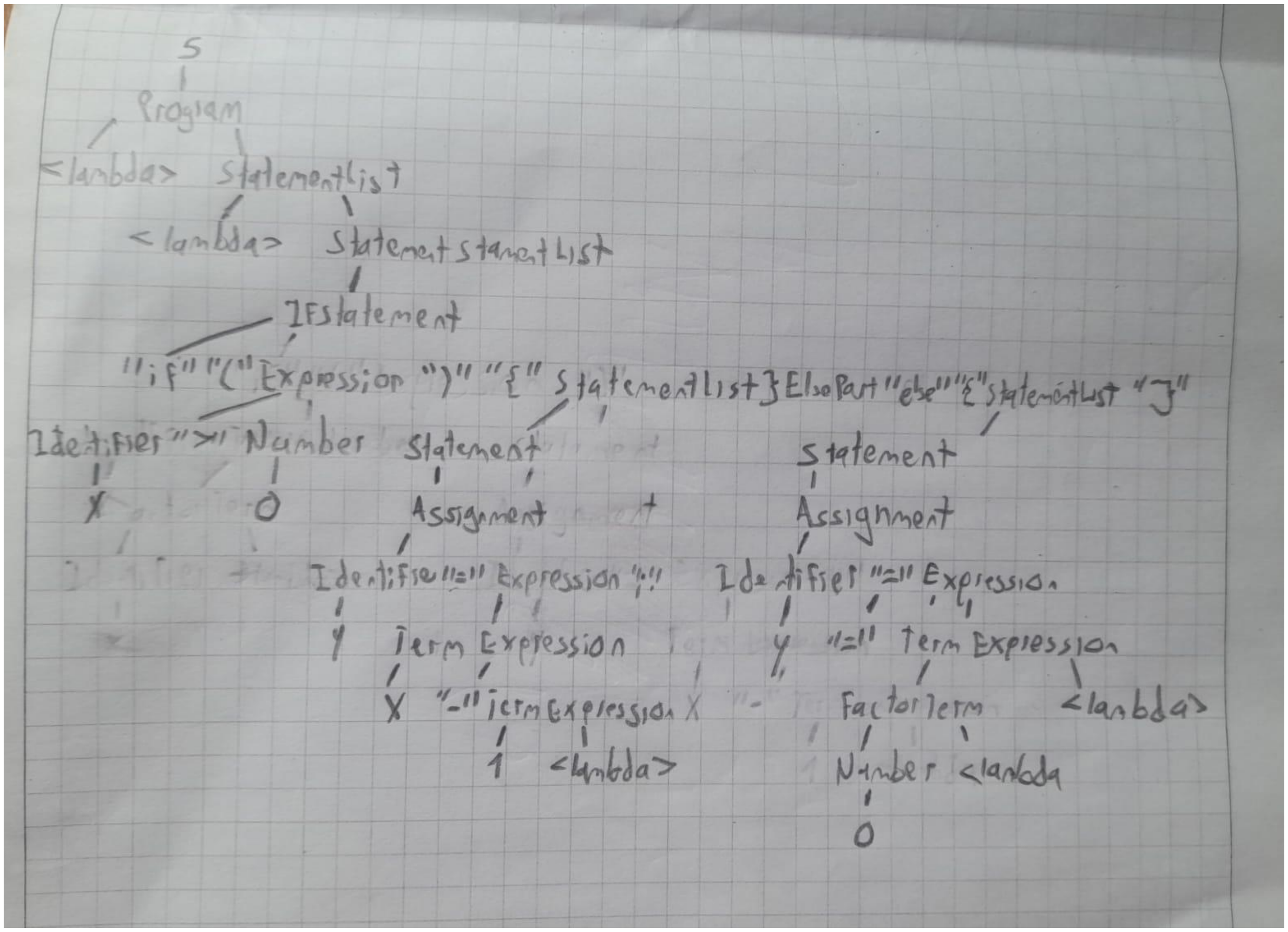
(a) **Exercise 1:**

```
x = 5 + 3 * 2;
```



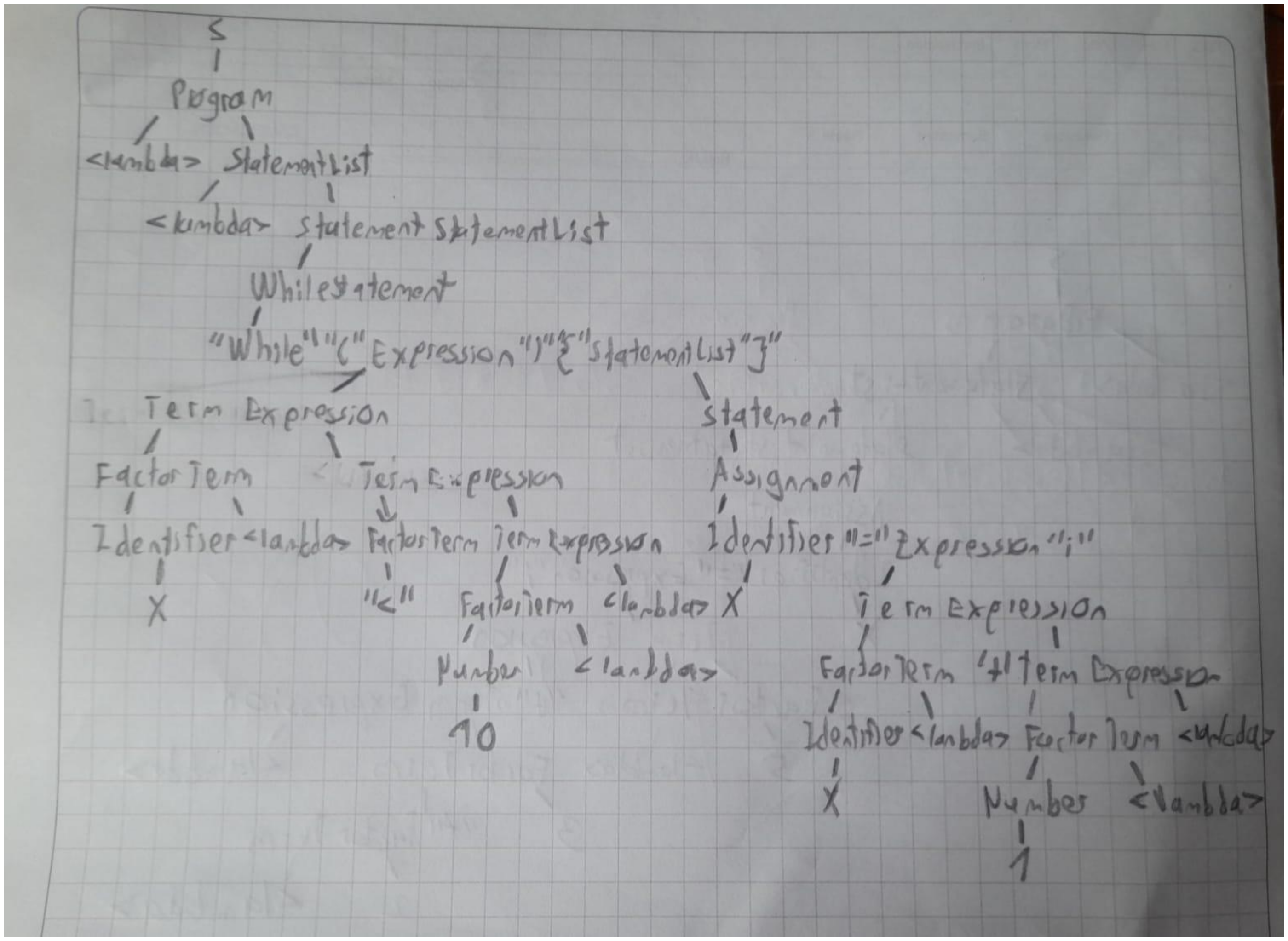
(b) **Exercise 2:**

```
if (x > 0) {
    y = x - 1;
} else {
    y = 0;
}
```



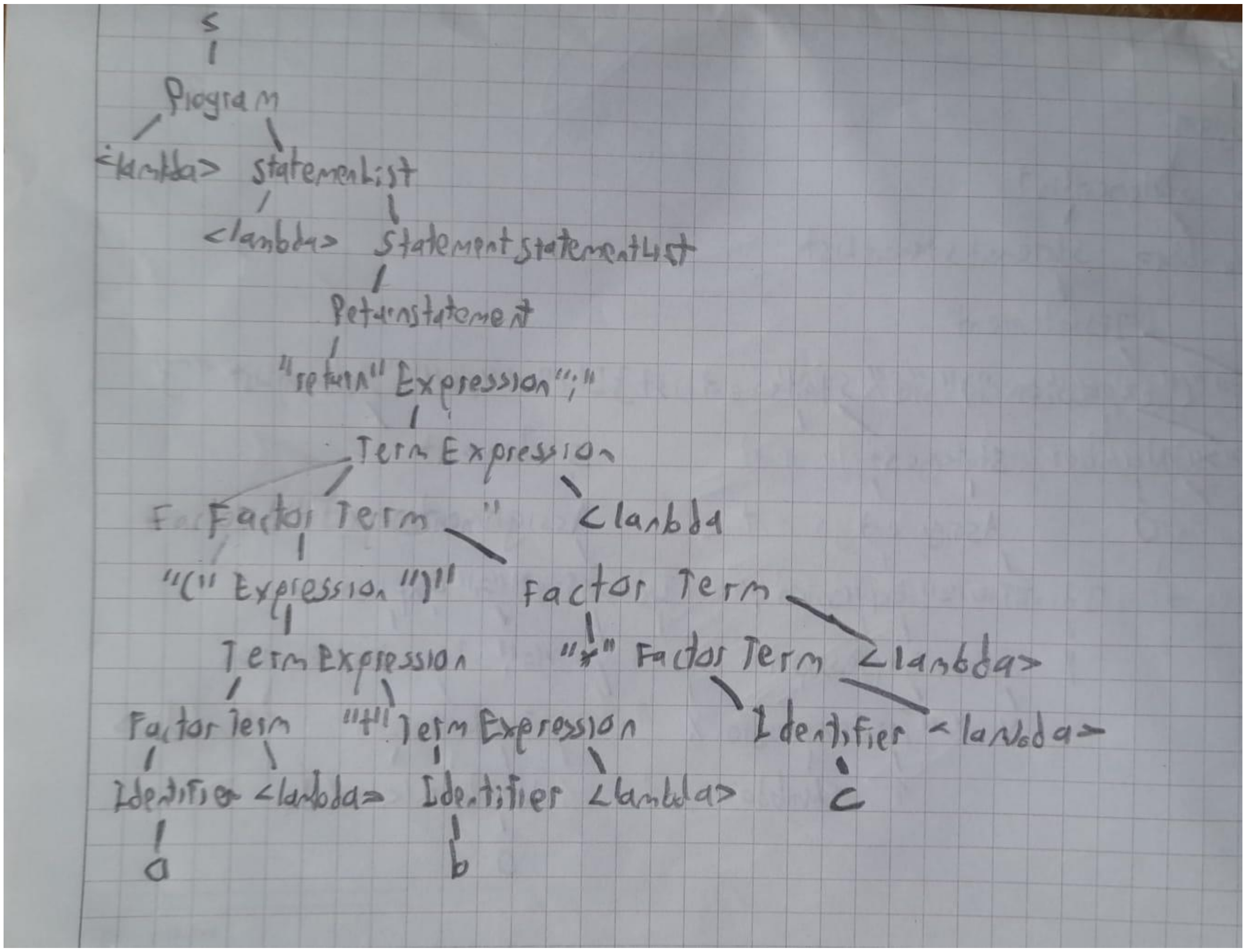
(c) **Exercise 3:**

```
while (x < 10) {
    x = x + 1;
}
```



(d) **Exercise 4:**

```
return (a + b) * c;
```



Deadline: Saturday, 8th of February, 2025, 14:00 (local time).