Lex版本:
flex 2.6.4

作業平台:
Ubuntu 22.04

執行方式:

1. 先進到包含作業檔案的資料夾
2. make(若出現make: Nothing to be done for 'all'.的訊息，輸入make clean後，再重新輸入一次make)
3. 觀看開放測資之結果
   ./B113040047 < TestFile_Lab1_2025/Test1.java
   ./B113040047 < TestFile_Lab1_2025/Test2.java
   ./B113040047 < TestFile_Lab1_2025/Test3.java
4. 觀看自訂測資之結果
   ./B113040047 < TestFile_Lab1_2025/OwnTest1.java (針對string的測資)
   ./B113040047 < TestFile_Lab1_2025/OwnTest2.java (針對ID的測資)
   ./B113040047 < TestFile_Lab1_2025/OwnTest3.java (針對integer的測資)
   ./B113040047 < TestFile_Lab1_2025/OwnTest4.java (針對+/-的測資)

你如何處理這份規格書上的問題:

Lexical Definitions

- 會傳給**parser**的**tokens:**

1. Symbols
   以regular expression: [,:;\(\)\[\]\{\}]進行判斷，並輸出判斷到的symbol資訊。

2. Arithmetic, Relational, and Logical Operators
   以regular expression: \+(\+)?|-(-)?|*|\/|%|=|<|<=|>|>=|!=|==|&|\|\||! 進行判斷，並輸出判斷到的operator資訊。

3. Reserved words
   以regular expression:
   boolean|break|bute|case|catch|class|const|continue|default|do|double|else|extends|false|final|finally|float|for|if|implements|int|long|main|new|print|private|protected|public|return|short|static|string|switch|this|true|try|void|while 進行判斷。並輸出判斷到的reserved words資訊。

4. Identifiers
   以regular expression: [_a-zA-Z0-9]*進行判斷，其中，會把不合法的ID也讀入，例如1a，因此會在Lex Rules的部份額外進行判斷，把不合法的ID選出，最後輸出錯誤訊息或是判斷到的ID資訊。

5. Integer Constants
   以regular expression: [+-]?(([0-9]*)|0x[0-9A-F]*)進行判斷，能夠接收八進位、十進位、十六進位的整數。針對overflow進行額外判斷，若數值範圍超過2147483647～-2147483648，則視為overflow，出現錯誤訊息。也針對數字前方的'-'是減號還是負號('+'也進行相同的判斷)進行額外的判斷，作法是使用"isOperator"變數紀錄前面一個讀

到的內容是否為ID、integer、float或是')', 若符合這四種內容, 則將其視為減號, 否則視為負號。處理完後, 輸出錯誤訊息或是判斷到的integer constant資訊。

6. Float Constants
   以regular expression:
   [\+\-]?((([0-9]+)\.([0-9]+))|(\.([0-9]+))|([0-9]+\.)|[0-9]+)([eE][+-]?[0-9]+)?(f|d)?進行判斷, 此regular expression會將double和float都視為float, 並且支援科學記號表示法。另外, 和integer constants相同, 會判斷數字前方的'-'是減號還是負號('+'也進行相同的判斷)。處理完後, 輸出錯誤訊息或是判斷到的float constant資訊。

7. String Constants
   以regular expression: \".*\"進行判斷, 並且再額外判斷string內的雙引號前面是否加上反斜線, 若沒有, 則視為不合法的string, 並紀錄哪一個雙引號前面未加上反斜線, 而若有加上反斜線, 則會把該反斜線去除, 讓string能正常表示雙引號。令外使用regular expression: (\'.*\')|(\".*\\\")|(\"[^\"\n]*)來捕捉部份非法字串, 主要針對兩種錯誤string進行判斷, 包含以單引號標示的string, 以及缺少第二個雙引號的string。處理完後, 輸出錯誤訊息或是判斷到的string constant資訊。

- 不會傳給**parser**的**tokens:**

1. Whitespace
   以regular expression: space [\t]進行判斷。不輸出任何資訊, 僅紀錄字元數量增加。
2. Comments
   以regular expression:\/*.**\/|\/*.*(\n.*)**\/|\/\/.*進行判斷, 並輸出判斷到的Comment, 另外, 由於comment可能出現跨行的情況, 因此若comment內存在'\n', 會將目前進行判斷的行數額外加一。

Recovery:

以下的幾種Recovery的處理方式都寫於Lexical Definitions的說明中。

- 為了盡可能處理所有的input, 上述的token判斷會額外讀入不符合規定的tokens, 例如identifier和string constants都進行的此處理, 並在lex rules中進行處理, 提出錯誤token的資訊。
- 針對符合規定, 但不符合該token類型的基本要求的token進行判斷, 例如integer constants若發生overflow的狀況, 雖然這個token符合integer constants的規定, 但仍會將其視為不合法的token
- 針對'+'和'-', 對於是正號或是加號以及是減號或是負號進行判斷。

Symbol Table:

使用hash的方式除存identifier。
table中除存的ID是一個struct的結構, 裡面包含三個資訊:

1. order:代表此ID是第幾個被發現的ID
2. ID:代表此ID的內容
3. next:代表此ID的下一個order的ID存於table中的哪個位置

hash function的計算方式會取ID的第一個字元的ASCII*80, 將其放到table中此值的位置。
若發生collision, 選擇linear probing來解決, 即是到發生collision的位置的下一格檢查是否已放入ID, 若無, 則放到該位置, 若有, 則再檢查下一格。
以下說明symbol table的四個function之實現方式:

1. create():分配記憶體空間給symbol table

2. lookup(s)：到ID的第一個字元的ASCII*80的位置尋找是否有符合的字串，若沒有，則到下一格尋找，直到尋找到符合的字串，或是將symbol table的所有位置都尋找過
3. insert(s)：先判斷s是否存在於symbol table中，若不存在，則將其放到ASCII*80的位置，若發生collision，則以linear probing的方式尋找下一個格子。同時會將前一個放入table的Identifier struct之next改為s所放入的位置。
4. dump()：配合Identifier struct所儲存的next資訊，將ID依照放入table的順序一一印出。

你寫這個作業所遇到的問題

1. 為了提升放入以及搜尋的速度，使用hash table作為symbol table，但在輸出所有ID時，無法依照儲存的順序輸出。最後是將下一個被除存的ID於symbol table的位置也存入symbol table才解決此問題。
2. 負號和減號的判斷因為不知道哪些情況會被視為負號，哪些情況又該視為減號，使用java online compiler嘗試了非常多種狀況，最後才整理出前述的幾種會被視為減號的可能。

測試檔的執行結果：

Test1.java:

```
chenze@chenze-TravelMate-P238-M:~/Compiler_Homework/lab1$ ./B113040047 < TestFile_Lab1_2025/Test1.java
Line: 2, 1st char: 1, "public" is a "reserved word".
Line: 2, 1st char: 8, "class" is a "reserved word".
Line: 2, 1st char: 14, "Test1" is a "ID".
Line: 2, 1st char: 20, "{" is a "symbol".
Line: 3, 1st char: 5, "public" is a "reserved word".
Line: 3, 1st char: 12, "static" is a "reserved word".
Line: 3, 1st char: 19, "int" is a "reserved word".
Line: 3, 1st char: 23, "add" is a "ID".
Line: 3, 1st char: 26, "(" is a "symbol".
Line: 3, 1st char: 27, "int" is a "reserved word".
Line: 3, 1st char: 31, "a" is a "ID".
Line: 3, 1st char: 32, "," is a "symbol".
Line: 3, 1st char: 34, "int" is a "reserved word".
Line: 3, 1st char: 38, "b" is a "ID".
Line: 3, 1st char: 39, ")" is a "symbol".
Line: 3, 1st char: 41, "{" is a "symbol".
Line: 4, 1st char: 9, "return" is a "reserved word".
Line: 4, 1st char: 16, "a" is a "ID".
Line: 4, 1st char: 18, "+" is an "operator".
Line: 4, 1st char: 20, "b" is a "ID".
Line: 4, 1st char: 21, ";" is a "symbol".
Line: 5, 1st char: 5, "}" is a "symbol".
Line: 7, 1st char: 5, "public" is a "reserved word".
Line: 7, 1st char: 12, "static" is a "reserved word".
Line: 7, 1st char: 19, "void" is a "reserved word".
Line: 7, 1st char: 24, "main" is a "reserved word".
Line: 7, 1st char: 28, "(" is a "symbol".
Line: 7, 1st char: 29, ")" is a "symbol".
Line: 7, 1st char: 31, "{" is a "symbol".
Line: 9, 1st char: 9, "int" is a "reserved word".
Line: 9, 1st char: 13, "c" is a "ID".
Line: 9, 1st char: 14, ";" is a "symbol".
Line: 10, 1st char: 9, "int" is a "reserved word".
Line: 10, 1st char: 13, "a" is a "ID".
Line: 10, 1st char: 15, "=" is an "operator".
Line: 10, 1st char: 17, "5" is a "integer".
Line: 10, 1st char: 18, ";" is a "symbol".
Line: 11, 1st char: 9, "c" is a "ID".
Line: 11, 1st char: 11, "=" is an "operator".
Line: 11, 1st char: 13, "add" is a "ID".
Line: 11, 1st char: 16, "(" is a "symbol".
Line: 11, 1st char: 17, "a" is a "ID".
Line: 11, 1st char: 18, "," is a "symbol".
Line: 11, 1st char: 20, "10" is a "integer".
Line: 11, 1st char: 22, ")" is a "symbol".
Line: 11, 1st char: 23, ";" is a "symbol".
Line: 12, 1st char: 9, "if" is a "reserved word".
Line: 12, 1st char: 12, "(" is a "symbol".
Line: 12, 1st char: 13, "c" is a "ID".
Line: 12, 1st char: 15, ">" is an "operator".
Line: 12, 1st char: 17, "10" is a "integer".
```

```
Line: 12, 1st char: 19, ")" is a "symbol".
Line: 13, 1st char: 13, "print" is a "reserved word".
Line: 13, 1st char: 18, "(" is a "symbol".
Line: 13, 1st char: 19, "c = " is a "string".
Line: 13, 1st char: 26, "+" is an "operator".
Line: 13, 1st char: 28, "-" is an "operator".
Line: 13, 1st char: 29, "c" is a "ID".
Line: 13, 1st char: 30, ")" is a "symbol".
Line: 13, 1st char: 31, ";" is a "symbol".
Line: 14, 1st char: 9, "else" is a "reserved word".
Line: 15, 1st char: 13, "print" is a "reserved word".
Line: 15, 1st char: 18, "(" is a "symbol".
Line: 15, 1st char: 19, "c" is a "ID".
Line: 15, 1st char: 20, ")" is a "symbol".
Line: 15, 1st char: 21, ";" is a "symbol".
Line: 16, 1st char: 9, "print" is a "reserved word".
Line: 16, 1st char: 14, "(" is a "symbol".
Line: 16, 1st char: 15, "Hello World" is a "string".
Line: 16, 1st char: 28, ")" is a "symbol".
Line: 16, 1st char: 29, ";" is a "symbol".
Line: 18, 1st char: 5, "}" is a "symbol".
Line: 20, 1st char: 1, "}" is a "symbol".

Symbol table:
1.  Test1
2.  add
3.  a
4.  b
5.  c
```

Test2.java:

```
chenze@chenze-TravelMate-P238-M:~/Compiler_Homework/lab1$ ./B113040047 < TestFile_Lab1_2025/Test2.java
" is a "comment".: 1, "// this is a comment // line */ /* with /* delimiters */ before the end
Line: 3, 1st char: 1, "public" is a "reserved word".
Line: 3, 1st char: 8, "class" is a "reserved word".
Line: 3, 1st char: 14, "Test2" is a "ID".
Line: 3, 1st char: 20, "{" is a "symbol".
Line: 4, 1st char: 5, "int" is a "reserved word".
Line: 4, 1st char: 9, "i" is a "ID".
Line: 4, 1st char: 11, "=" is an "operator".
Line: 4, 1st char: 13, "-100" is a "integer".
Line: 4, 1st char: 17, ";" is a "symbol".
Line: 5, 1st char: 5, "double" is a "reserved word".
Line: 5, 1st char: 12, "d" is a "ID".
Line: 5, 1st char: 14, "=" is an "operator".
Line: 5, 1st char: 16, "12.25e+6" is a "float".
Line: 5, 1st char: 24, ";" is a "symbol".
Line: 7, 1st char: 5, "public" is a "reserved word".
Line: 7, 1st char: 12, "static" is a "reserved word".
Line: 7, 1st char: 19, "void" is a "reserved word".
Line: 7, 1st char: 24, "main" is a "reserved word".
Line: 7, 1st char: 28, "(" is a "symbol".
Line: 7, 1st char: 29, ")" is a "symbol".
Line: 7, 1st char: 31, "{" is a "symbol".
Line: 8, 1st char: 1, "/* this is a comment // line with some /* and
// delimiters */" is a "comment".
Line: 10, 1st char: 5, "}" is a "symbol".
Line: 11, 1st char: 1, "}" is a "symbol".

Symbol table:
1.  Test2
2.  i
3.  d
```

Test3.java:

```
chenze@chenze-TravelMate-P238-M:~/Compiler_Homework/lab1$ ./B113040047 < TestFile_Lab1_2025/Test3.java
Line: 2, 1st char: 1, "public" is a "reserved word".
Line: 2, 1st char: 8, "class" is a "reserved word".
Line: 2, 1st char: 14, "Test3" is a "ID".
Line: 2, 1st char: 20, "{" is a "symbol".
Line: 3, 1st char: 5, "int" is a "reserved word".
Line: 3, 1st char: 9, "A" is a "ID".
Line: 3, 1st char: 10, ";" is a "symbol".
Line: 4, 1st char: 5, "int" is a "reserved word".
Line: 4, 1st char: 9, "a" is a "ID".
Line: 5, 1st char: 5, "double" is a "reserved word".
Line: 5, 1st char: 12, "b" is a "ID".
Line: 5, 1st char: 13, ";" is a "symbol".
Line: 6, 1st char: 5, "double" is a "reserved word".
Line: 6, 1st char: 12, "A" is a "ID".
Line: 6, 1st char: 13, ";" is a "symbol".
Line: 8, 1st char: 5, "public" is a "reserved word".
Line: 8, 1st char: 12, "Test3" is a "ID".
Line: 8, 1st char: 17, "(" is a "symbol".
Line: 8, 1st char: 18, ")" is a "symbol".
Line: 8, 1st char: 20, "{" is a "symbol".
Line: 9, 1st char: 9, "a" is a "ID".
Line: 9, 1st char: 11, "=" is an "operator".
Line: 9, 1st char: 13, "1" is a "integer".
Line: 9, 1st char: 14, ";" is a "symbol".
Line: 10, 1st char: 9, "A" is a "ID".
Line: 10, 1st char: 11, "=" is an "operator".
Line: 10, 1st char: 13, "2" is a "integer".
Line: 10, 1st char: 14, ";" is a "symbol".
Line: 11, 1st char: 9, "b" is a "ID".
Line: 11, 1st char: 11, "=" is an "operator".
Line: 11, 1st char: 13, "-1.2" is a "float".
Line: 11, 1st char: 17, ";" is a "symbol".
Line: 12, 1st char: 5, "}" is a "symbol".
Line: 13, 1st char: 1, "}" is a "symbol".

Symbol table:
1.  Test3
2.  A
3.  a
4.  b
```

OwnTest1.java:

```
chenze@chenze-TravelMate-P238-M:~/Compiler_Homework/lab1$ ./B113040047 < TestFile_Lab1_2025/OwnTest1.java
Line: 1, 1st char: 1, "// used to test invalid string" is a "comment".
Line: 2, 1st char: 1, "public" is a "reserved word".
Line: 2, 1st char: 8, "class" is a "reserved word".
Line: 2, 1st char: 14, "OwnTest1" is an "ID".
Line: 2, 1st char: 23, "{" is a "symbol".
Line: 3, 1st char: 5, "public" is a "reserved word".
Line: 3, 1st char: 12, "static" is a "reserved word".
Line: 3, 1st char: 19, "void" is a "reserved word".
Line: 3, 1st char: 24, "main" is a "reserved word".
Line: 3, 1st char: 28, "(" is a "symbol".
Line: 3, 1st char: 29, ")" is a "symbol".
Line: 3, 1st char: 31, "{" is a "symbol".
Line: 4, 1st char: 9, "String" is an "ID".
Line: 4, 1st char: 16, "a" is an "ID".
Line: 4, 1st char: 18, "=" is an "operator".
"'test1'" is a wrong string. Cannot use (') as the quote of a string
Line: 4, 1st char: 27, ";" is a "symbol".
Line: 5, 1st char: 9, "String" is an "ID".
Line: 5, 1st char: 16, "b" is an "ID".
Line: 5, 1st char: 18, "=" is an "operator".
""test2\"" is a wrong string. The quoting is not closed.
Line: 5, 1st char: 28, ";" is a "symbol".
Line: 6, 1st char: 9, "String" is an "ID".
Line: 6, 1st char: 16, "c" is an "ID".
Line: 6, 1st char: 18, "=" is an "operator".
"tes"t3" is a wrong string. Unvalid syntax of '"'(Position: 3).
If you want to include '"' in the string, you have to add '\' immediately before it.
Line: 6, 1st char: 28, ";" is a "symbol".
Line: 7, 1st char: 9, "String" is an "ID".
Line: 7, 1st char: 16, "d" is an "ID".
Line: 7, 1st char: 18, "=" is an "operator".
""test4;" is a wrong string. The quoting is not closed.
Line: 8, 1st char: 9, "String" is an "ID".
Line: 8, 1st char: 16, "e" is an "ID".
Line: 8, 1st char: 18, "=" is an "operator".
Line: 8, 1st char: 20, "test5" is a "string".
Line: 8, 1st char: 27, ";" is a "symbol".
Line: 9, 1st char: 5, "}" is a "symbol".
Line: 11, 1st char: 1, "}" is a "symbol".

Symbol table:
1.  OwnTest1
2.  String
3.  a
4.  b
5.  c
6.  d
7.  e
```

```java
// used to test invalid string
public class OwnTest1 {
    public static void main() {
        String a = 'test1';
        String b = "test2\";
        String c = "tes"t3";
        String d = "test4;
        String e = "test5";
    }

}
```

OwnTest2.java:

```
chenze@chenze-TravelMate-P238-M:~/Compiler_Homework/lab1$ ./B113040047 < TestFile_Lab1_2025/OwnTest2.java
Line: 1, 1st char: 1, "// used to test invalid identifier" is a "comment".
Line: 2, 1st char: 1, "public" is a "reserved word".
Line: 2, 1st char: 8, "class" is a "reserved word".
Line: 2, 1st char: 14, "OwnTest2" is an "ID".
Line: 2, 1st char: 23, "{" is a "symbol".
Line: 3, 1st char: 5, "public" is a "reserved word".
Line: 3, 1st char: 12, "static" is a "reserved word".
Line: 3, 1st char: 19, "void" is a "reserved word".
Line: 3, 1st char: 24, "main" is a "reserved word".
Line: 3, 1st char: 28, "(" is a "symbol".
Line: 3, 1st char: 29, ")" is a "symbol".
Line: 3, 1st char: 31, "{" is a "symbol".
Line: 4, 1st char: 9, "int" is a "reserved word".
Line: 4, 1st char: 13, "abcvsdcgsdfg" is an "ID".
Line: 4, 1st char: 25, ";" is a "symbol".
Line: 5, 1st char: 9, "int" is a "reserved word".
Line: 5, 1st char: 13, "_asdfks123fs$$" is an "ID".
Line: 5, 1st char: 27, ";" is a "symbol".
Line: 6, 1st char: 9, "int" is a "reserved word".
12kjcvjkhsd is not a valid identifier, because it begin with a digit
Line: 6, 1st char: 24, ";" is a "symbol".
Line: 7, 1st char: 5, "}" is a "symbol".
Line: 9, 1st char: 1, "}" is a "symbol".

Symbol table:
1.  OwnTest2
2.  abcvsdcgsdfg
3.  _asdfks123fs$$
```

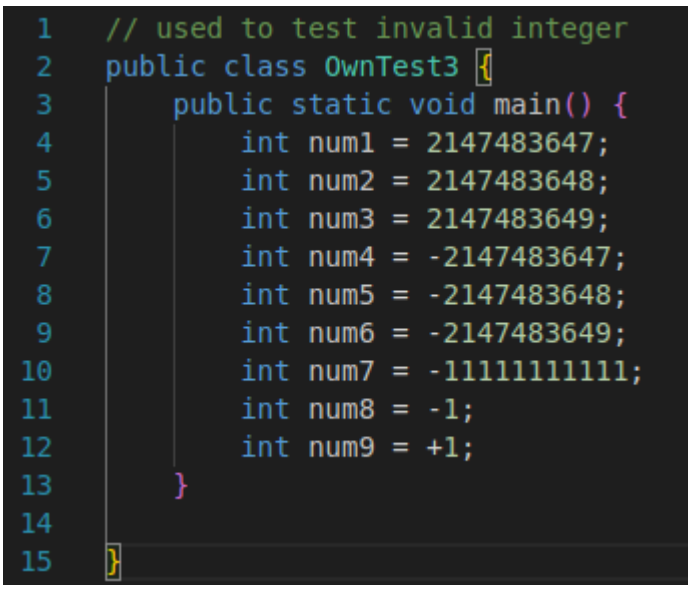
```java
// used to test invalid identifier
public class OwnTest2 {
    public static void main() {
        int abcvsdcgsdfg;
        int _asdfks123fs$$;
        int 12kjcvjkhsd;
    }

}
```

OwnTest3.java:

```
chenze@chenze-TravelMate-P238-M:~/Compiler_Homework/lab1$ ./B113040047 < TestFile_Lab1_2025/OwnTest3.java
Line: 1, 1st char: 1, "// used to test invalid integer" is a "comment".
Line: 2, 1st char: 1, "public" is a "reserved word".
Line: 2, 1st char: 8, "class" is a "reserved word".
Line: 2, 1st char: 14, "OwnTest3" is an "ID".
Line: 2, 1st char: 23, "{" is a "symbol".
Line: 3, 1st char: 5, "public" is a "reserved word".
Line: 3, 1st char: 12, "static" is a "reserved word".
Line: 3, 1st char: 19, "void" is a "reserved word".
Line: 3, 1st char: 24, "main" is a "reserved word".
Line: 3, 1st char: 28, "(" is a "symbol".
Line: 3, 1st char: 29, ")" is a "symbol".
Line: 3, 1st char: 31, "{" is a "symbol".
Line: 4, 1st char: 9, "int" is a "reserved word".
Line: 4, 1st char: 13, "num1" is an "ID".
Line: 4, 1st char: 18, "=" is an "operator".
Line: 4, 1st char: 20, "2147483647" is an "integer".
Line: 4, 1st char: 30, ";" is a "symbol".
Line: 5, 1st char: 9, "int" is a "reserved word".
Line: 5, 1st char: 13, "num2" is an "ID".
Line: 5, 1st char: 18, "=" is an "operator".
2147483648 is not a valid integer, because it overflows
Line: 5, 1st char: 30, ";" is a "symbol".
Line: 6, 1st char: 9, "int" is a "reserved word".
Line: 6, 1st char: 13, "num3" is an "ID".
Line: 6, 1st char: 18, "=" is an "operator".
2147483649 is not a valid integer, because it overflows
Line: 6, 1st char: 30, ";" is a "symbol".
Line: 7, 1st char: 9, "int" is a "reserved word".
Line: 7, 1st char: 13, "num4" is an "ID".
Line: 7, 1st char: 18, "=" is an "operator".
Line: 7, 1st char: 20, "-2147483647" is an "integer".
Line: 7, 1st char: 31, ";" is a "symbol".
Line: 8, 1st char: 9, "int" is a "reserved word".
Line: 8, 1st char: 13, "num5" is an "ID".
Line: 8, 1st char: 18, "=" is an "operator".
Line: 8, 1st char: 20, "-2147483648" is an "integer".
Line: 8, 1st char: 31, ";" is a "symbol".
Line: 9, 1st char: 9, "int" is a "reserved word".
Line: 9, 1st char: 13, "num6" is an "ID".
Line: 9, 1st char: 18, "=" is an "operator".
-2147483649 is not a valid integer, because it overflows
Line: 9, 1st char: 31, ";" is a "symbol".
Line: 10, 1st char: 9, "int" is a "reserved word".
Line: 10, 1st char: 13, "num7" is an "ID".
Line: 10, 1st char: 18, "=" is an "operator".
-11111111111 is not a valid integer, because it overflows
Line: 10, 1st char: 32, ";" is a "symbol".
Line: 11, 1st char: 9, "int" is a "reserved word".
Line: 11, 1st char: 13, "num8" is an "ID".
Line: 11, 1st char: 18, "=" is an "operator".
Line: 11, 1st char: 20, "-1" is an "integer".
Line: 11, 1st char: 22, ";" is a "symbol".
Line: 12, 1st char: 9, "int" is a "reserved word".
Line: 12, 1st char: 13, "num9" is an "ID".
Line: 12, 1st char: 18, "=" is an "operator".
Line: 12, 1st char: 20, "+1" is an "integer".
Line: 12, 1st char: 22, ";" is a "symbol".
Line: 13, 1st char: 5, "}" is a "symbol".
Line: 15, 1st char: 1, "}" is a "symbol".

Symbol table:
1.  OwnTest3
2.  num1
3.  num2
4.  num3
5.  num4
6.  num5
7.  num6
8.  num7
9.  num8
10.  num9
```



```java
// used to test invalid integer
public class OwnTest3 {
    public static void main() {
        int num1 = 2147483647;
        int num2 = 2147483648;
        int num3 = 2147483649;
        int num4 = -2147483647;
        int num5 = -2147483648;
        int num6 = -2147483649;
        int num7 = -11111111111;
        int num8 = -1;
        int num9 = +1;
    }

}
```

OwnTest4.java

```
chenze@chenze-TravelMate-P238-M:~/Compiler_Homework/lab1$ ./B113040047 < TestFile_Lab1_2025/OwnTest4.java
Line: 1, 1st char: 1, "// used to test '-' and '+'" is a "comment".
Line: 2, 1st char: 1, "public" is a "reserved word".
Line: 2, 1st char: 8, "class" is a "reserved word".
Line: 2, 1st char: 14, "OwnTest4" is an "ID".
Line: 2, 1st char: 23, "{" is a "symbol".
Line: 3, 1st char: 5, "public" is a "reserved word".
Line: 3, 1st char: 12, "static" is a "reserved word".
Line: 3, 1st char: 19, "void" is a "reserved word".
Line: 3, 1st char: 24, "main" is a "reserved word".
Line: 3, 1st char: 28, "(" is a "symbol".
Line: 3, 1st char: 29, ")" is a "symbol".
Line: 3, 1st char: 31, "{" is a "symbol".
Line: 4, 1st char: 9, "int" is a "reserved word".
Line: 4, 1st char: 13, "a" is an "ID".
Line: 4, 1st char: 15, "=" is an "operator".
Line: 4, 1st char: 17, "-1" is an "integer".
Line: 4, 1st char: 19, ";" is a "symbol".
Line: 5, 1st char: 9, "int" is a "reserved word".
Line: 5, 1st char: 13, "b" is an "ID".
Line: 5, 1st char: 15, "=" is an "operator".
Line: 5, 1st char: 17, "1" is an "integer".
Line: 5, 1st char: 18, "-" is a "operator".
Line: 5, 1st char: 19, "1" is an "integer".
Line: 5, 1st char: 20, ";" is a "symbol".
Line: 6, 1st char: 9, "int" is a "reserved word".
Line: 6, 1st char: 13, "c" is an "ID".
Line: 6, 1st char: 15, "=" is an "operator".
Line: 6, 1st char: 17, "+123" is an "integer".
Line: 6, 1st char: 21, ";" is a "symbol".
Line: 7, 1st char: 9, "int" is a "reserved word".
Line: 7, 1st char: 13, "d" is an "ID".
Line: 7, 1st char: 15, "=" is an "operator".
Line: 7, 1st char: 17, "423" is an "integer".
Line: 7, 1st char: 20, "+" is a "operator".
Line: 7, 1st char: 21, "5" is an "integer".
Line: 7, 1st char: 22, ";" is a "symbol".
Line: 8, 1st char: 9, "int" is a "reserved word".
Line: 8, 1st char: 13, "e" is an "ID".
Line: 8, 1st char: 15, "=" is an "operator".
Line: 8, 1st char: 17, "(" is a "symbol".
Line: 8, 1st char: 18, "12" is an "integer".
Line: 8, 1st char: 20, "-" is a "operator".
Line: 8, 1st char: 21, "34" is an "integer".
Line: 8, 1st char: 23, ")" is a "symbol".
Line: 8, 1st char: 24, "-" is a "operator".
Line: 8, 1st char: 25, "56" is an "integer".
Line: 8, 1st char: 27, ";" is a "symbol".
Line: 9, 1st char: 9, "int" is a "reserved word".
Line: 9, 1st char: 13, "f" is an "ID".
Line: 9, 1st char: 15, "=" is an "operator".
Line: 9, 1st char: 17, "e" is an "ID".
Line: 9, 1st char: 18, "+" is a "operator".
Line: 9, 1st char: 19, "65" is an "integer".
Line: 9, 1st char: 21, ";" is a "symbol".
```

```
Line: 10, 1st char: 5, "}" is a "symbol".
Line: 11, 1st char: 1, "}" is a "symbol".

Symbol table:
1.  OwnTest4
2.  a
3.  b
4.  c
5.  d
6.  e
7.  f
chenze@chenze-TravelMate-P238-M:~/Compiler_Homework/lab1$
```

```java
// used to test '-' and '+'
public class OwnTest4 {
    public static void main() {
        int a = -1;
        int b = 1-1;
        int c = +123;
        int d = 423+5;
        int e = (12-34)-56;
        int f = e+65;
    }
}
```