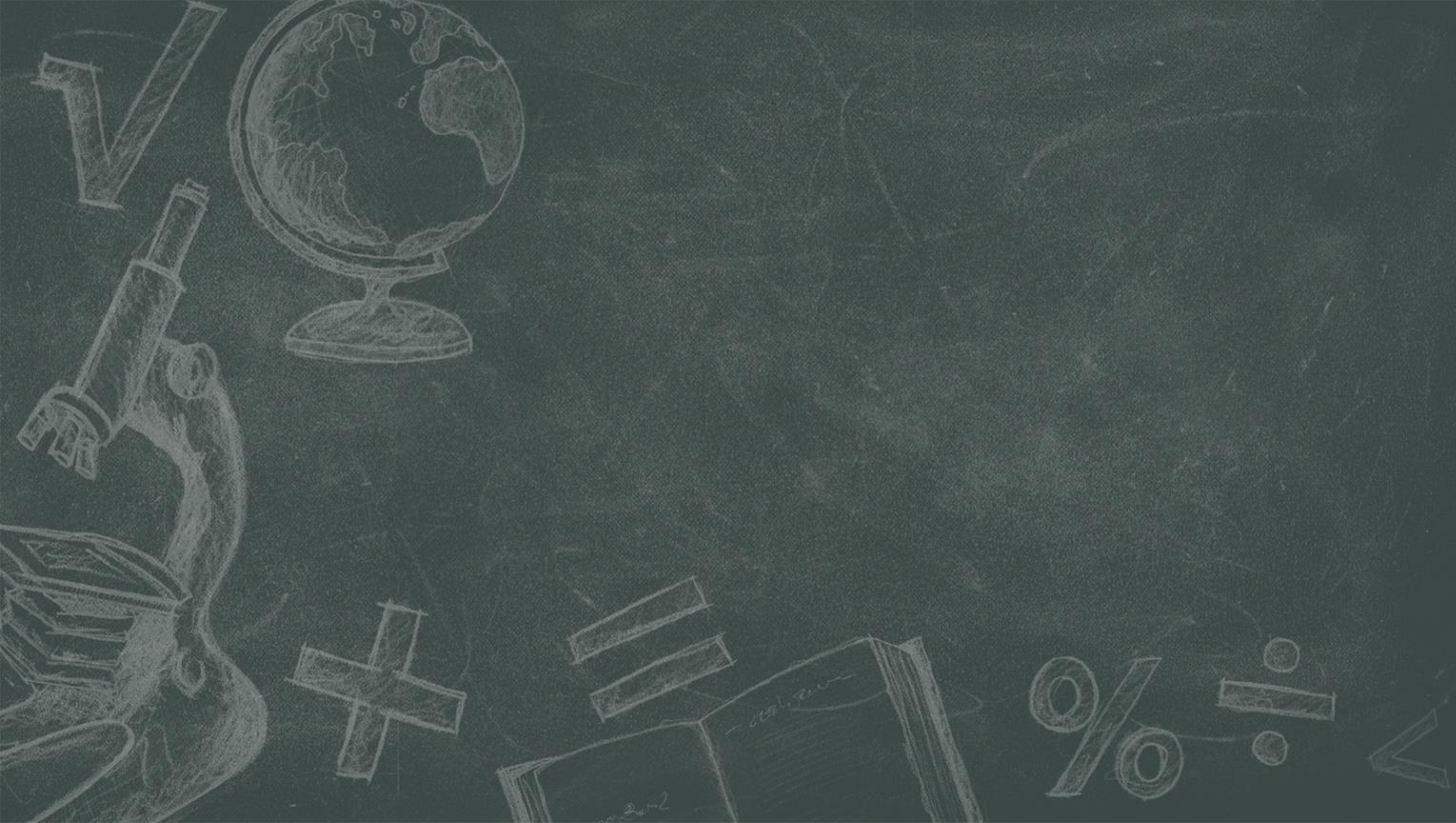


Phase 1

Requirements specification

1. The pass1 program is to execute by entering pass1 <source-file-name>
2. The source file for the main program for this phase is to be named pass1.c
3. You should build a parser that is capable of handling source lines that are instructions, storage declaration, comments, and assembler directives (a directive that is not implemented should be ignored possibly with a warning)
4. For instructions, the parser is to minimally be capable of decoding 2, 3 and 4-byte instructions as follows:

   a) 2-byte with 1 or 2 symbolic register reference (e.g., TIXR A, ADDR S,A)

   b) RSUB (ignoring any operand or perhaps issuing a warning)

   c) 3-byte PC-relative with symbolic operand to include immediate, indirect, and indexed addressing

   d) 3-byte absolute with non-symbolic operand to include immediate, indirect, and indexed addressing

   e) 4-byte absolute with symbolic or non-symbolic operand to include immediate, indirect, and indexed addressing
5. The parser is to handle all storage directives (BYTE, WORD, RESW, and RESB).

6. The output of this phase should contain (at least):

a) The symbol table.

b) The source program in a format similar to the listing file described in your text book except that the object code is not generated as shown below.

c) A meaningful error message should be printed below the line in which the error occurred

7. Support free-formatted assembly language programs. In a free-formatted assembly program, statements are not restricted to begin at a given position in the line. Many consecutive white spaces or tabs should be treated as a single space. (You may use regular expressions)

Design

We use object oriented programming concepts and divided the code to three main classes:

-parsing class : in which the regex handle the line of code and make sure that there is no syntax error .

-addressList class : set the address for each line of code.

-output class : which print the output table.

Main Data structures

Maps

- we store mnemonic in map ,this map its key is the string of mnemonic and its value is apair the first holds the format and the second holds the opcode
- there is vector stores string"BYTE"/"WORD"/"RESW"/"REWB"

Vector

- We use vector to store all possible instructions to handle them as :

  a) 2-byte instructions with 1 or 2 symbolic register reference.

  b) 3-byte PC-relative with symbolic operand to include immediate, indirect, and indexed addressing

  c) 3-byte absolute with non-symbolic operand to include immediate, indirect, and indexed addressing

  d) 4-byte absolute with symbolic or non-symbolic operand to include immediate, indirect, and indexed addressing 5

Algorithms Description

Parsing class

-We create a group of regex where each regex handle a type of instructions.

-By looping on the file and check that each line is acceptable by a regex .

-The line may not be acceptable if the instruction is unsupported instructions

or unsupported operand for the given instruction.

-If the line is not acceptable by any regex then the output print “Syntax error”.

-If the last line is not END , it will print “the last line is not END”.

AddressList Class

-if the given mnemonic in the problem contains in the map we add to the address the value in stored in pair->first

-if mnemonic in the problem stored in the vector if its BYTE we increase the address by number of bytes stored in given problem ex C'AB' so increase by 2,

- if it is RESB we increase address by given number of bytes

-if it is RESW we increase by given number of words multiplyed by 3

-if it is WORD we increase address by 3

Output class

-Take the vectors that contain the Mnemonicopcode,operand,address,labels from the previous two classes and print them with the line number.

-Print the errors if found .

Assumptions

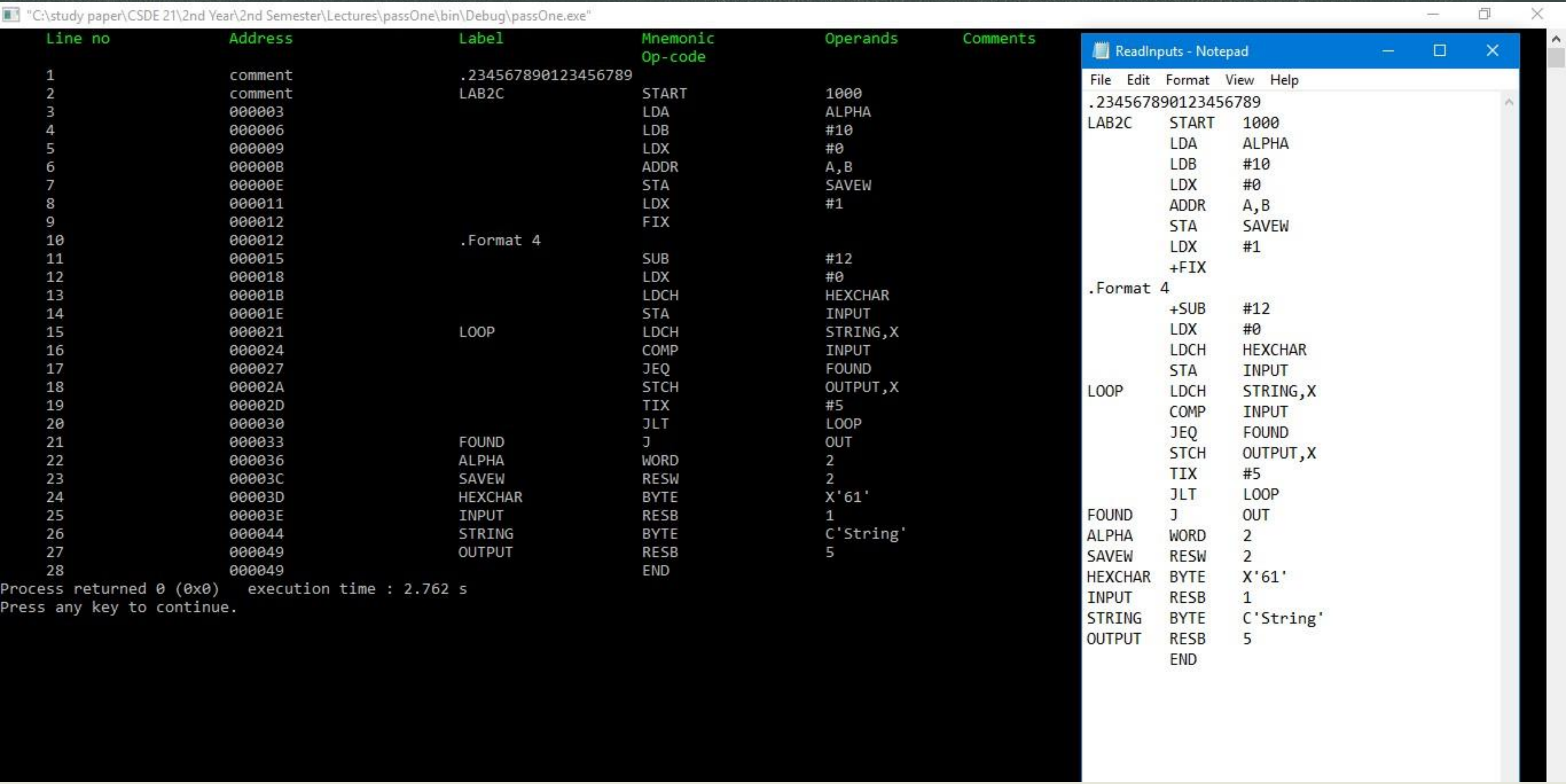
Assumptions

-If there is no start address given with START instructions, we set the default address by 0000.
-Start address less than 7 characters.
-The last line must be END.
– START must be the first line or it can be preceded by a Comment line.

-Label name and variable name must start with a letter.

-All characters are in uppercase.

Sample runs

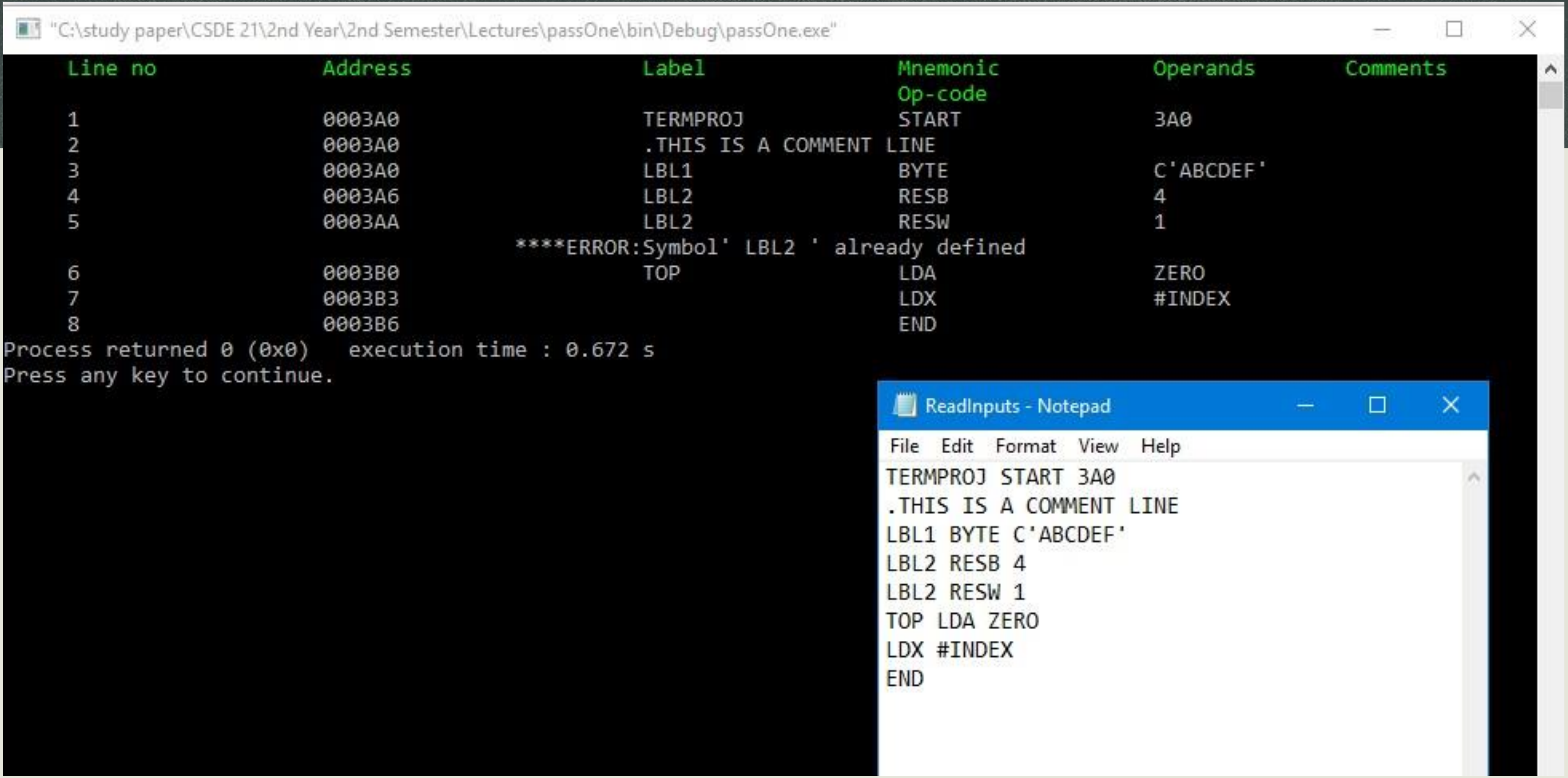


"C:\study paper\CSDE 21\2nd Year\2nd Semester\Lectures\passOne\bin\Debug\passOne.exe"

```
    Line no              Address              Label               Mnemonic            Operands       Comments
                                                                  Op-code
    1                    comment              .234567890123456789
    2                    comment              LAB2C               START               1000
    3                    000003                                   LDA                 ALPHA
    4                    000006                                   LDB                 #10
    5                    000009                                   LDX                 #0
    6                    00000B                                   ADDR                A,B
    7                    00000E                                   STA                 SAVEW
    8                    000011                                   LDX                 #1
    9                    000012                                   FIX
    10                   000012               .Format 4
    11                   000015                                   SUB                 #12
    12                   000018                                   LDX                 #0
    13                   00001B                                   LDCH                HEXCHAR
    14                   00001E                                   STA                 INPUT
    15                   000021               LOOP                LDCH                STRING,X
    16                   000024                                   COMP                INPUT
    17                   000027                                   JEQ                 FOUND
    18                   00002A                                   STCH                OUTPUT,X
    19                   00002D                                   TIX                 #5
    20                   000030                                   JLT                 LOOP
    21                   000033               FOUND               J                   OUT
    22                   000036               ALPHA               WORD                2
    23                   00003C               SAVEW               RESW                2
    24                   00003D               HEXCHAR             BYTE                X'61'
    25                   00003E               INPUT               RESB                1
    26                   000044               STRING              BYTE                C'String'
    27                   000049               OUTPUT              RESB                5
    28                   000049                                   END
Process returned 0 (0x0)   execution time : 2.762 s
Press any key to continue.
```

ReadInputs - Notepad

```
.234567890123456789
LAB2C     START    1000
          LDA      ALPHA
          LDB      #10
          LDX      #0
          ADDR     A,B
          STA      SAVEW
          LDX      #1
          +FIX
.Format 4
          +SUB     #12
          LDX      #0
          LDCH     HEXCHAR
          STA      INPUT
LOOP      LDCH     STRING,X
          COMP     INPUT
          JEQ      FOUND
          STCH     OUTPUT,X
          TIX      #5
          JLT      LOOP
FOUND     J        OUT
ALPHA     WORD     2
SAVEW     RESW     2
HEXCHAR   BYTE     X'61'
INPUT     RESB     1
STRING    BYTE     C'String'
OUTPUT    RESB     5
          END
```

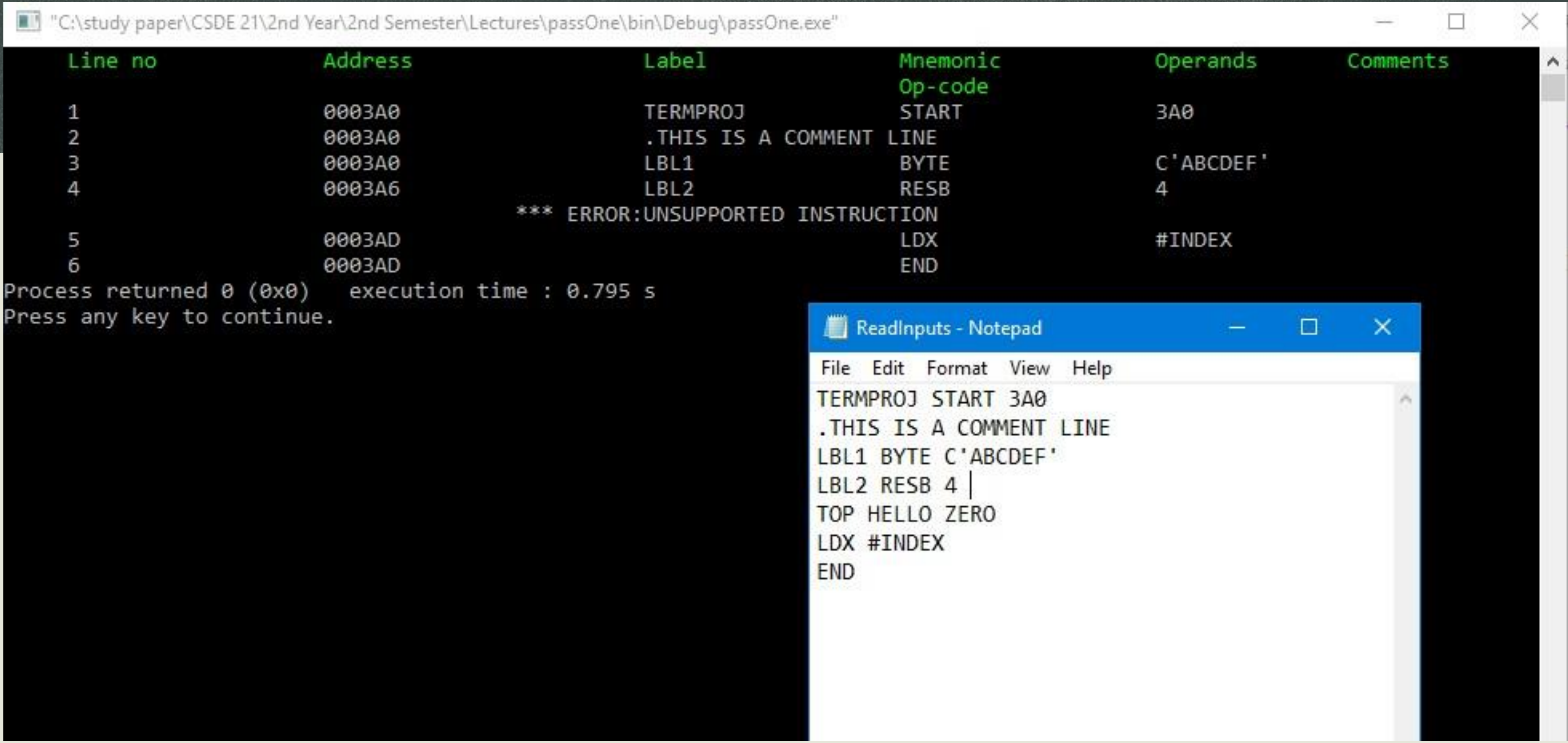


"C:\study paper\CSDE 21\2nd Year\2nd Semester\Lectures\passOne\bin\Debug\passOne.exe"

```
    Line no             Address                  Label               Mnemonic            Operands       Comments
                                                                     Op-code
    1                   0003A0                   TERMPROJ            START               3A0
    2                   0003A0                   .THIS IS A COMMENT LINE
    3                   0003A0                   LBL1                BYTE                C'ABCDEF'
    4                   0003A6                   LBL2                RESB                4
    5                   0003AA                   LBL2                RESW                1
                                        ****ERROR:Symbol' LBL2 ' already defined
    6                   0003B0                   TOP                 LDA                 ZERO
    7                   0003B3                                       LDX                 #INDEX
    8                   0003B6                                       END
Process returned 0 (0x0)   execution time : 0.672 s
Press any key to continue.
```

ReadInputs - Notepad
File Edit Format View Help

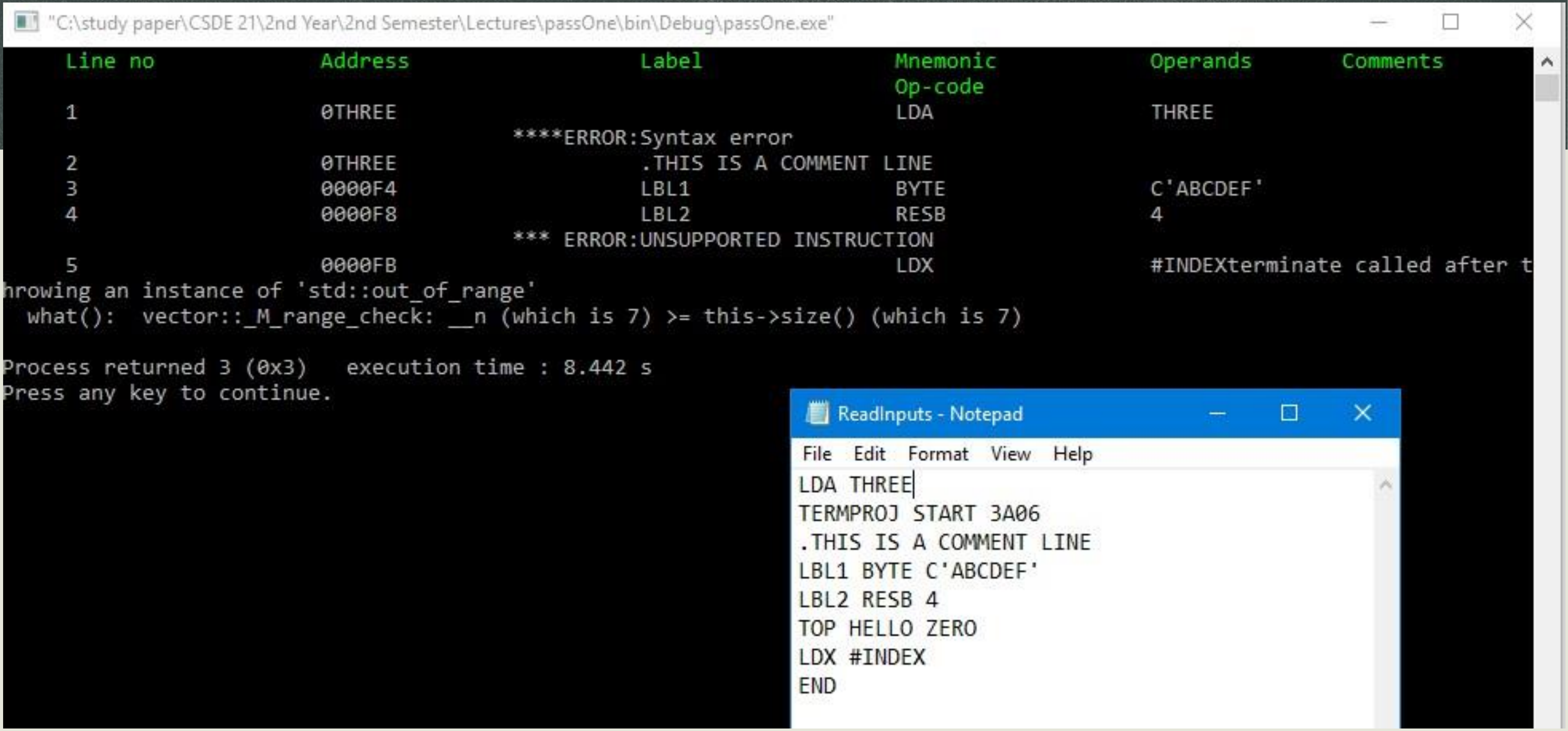
```
TERMPROJ START 3A0
.THIS IS A COMMENT LINE
LBL1 BYTE C'ABCDEF'
LBL2 RESB 4
LBL2 RESW 1
TOP LDA ZERO
LDX #INDEX
END
```


"C:\study paper\CSDE 21\2nd Year\2nd Semester\Lectures\passOne\bin\Debug\passOne.exe"

```
    Line no             Address                   Label               Mnemonic            Operands       Comments
                                                                      Op-code
    1                   0003A0                    TERMPROJ            START               3A0
    2                   0003A0                    .THIS IS A COMMENT LINE
    3                   0003A0                    LBL1                BYTE                C'ABCDEF'
    4                   0003A6                    LBL2                RESB                4
                                          *** ERROR:UNSUPPORTED INSTRUCTION
    5                   0003AD                                        LDX                 #INDEX
    6                   0003AD                                        END
Process returned 0 (0x0)   execution time : 0.795 s
Press any key to continue.
```

ReadInputs - Notepad

```
TERMPROJ START 3A0
.THIS IS A COMMENT LINE
LBL1 BYTE C'ABCDEF'
LBL2 RESB 4
TOP HELLO ZERO
LDX #INDEX
END
```


"C:\study paper\CSDE 21\2nd Year\2nd Semester\Lectures\passOne\bin\Debug\passOne.exe"

```
    Line no              Address                  Label               Mnemonic            Operands       Comments
                                                                      Op-code
    1                    0THREE                                       LDA                 THREE
                                   ****ERROR:Syntax error
    2                    0THREE                   .THIS IS A COMMENT LINE
    3                    0000F4                   LBL1                BYTE                C'ABCDEF'
    4                    0000F8                   LBL2                RESB                4
                                   *** ERROR:UNSUPPORTED INSTRUCTION
    5                    0000FB                                       LDX                 #INDEXterminate called after t
hrowing an instance of 'std::out_of_range'
  what():  vector::_M_range_check: __n (which is 7) >= this->size() (which is 7)

Process returned 3 (0x3)   execution time : 8.442 s
Press any key to continue.
```

```
LDA THREE
TERMPROJ START 3A06
.THIS IS A COMMENT LINE
LBL1 BYTE C'ABCDEF'
LBL2 RESB 4
TOP HELLO ZERO
LDX #INDEX
END
```