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SIC-XE ASSEMBLER (Program Blocks) Readme File

The code works majorly on the lines of the pseudocode for 2 pass assemblers mentioned in Leyland Beck.

The code takes strings representing instructions as input.

The first line of the input must contain START and the code expects an input till the input string does not contain the assembler directive END.

These instructions are stored in a vector of vector of strings where each string represents a part of the instruction.

The assembler expects all keywords to be in capitals only.

No spaces should be used between an expression.

E.g.- BUFFER+BUFFEND instead of BUFFER + BUFFEND

The first pass allocates the location counters to each instruction, makes the symbol table, literal table, and program block table, and recognizes & reports any errors by pushing all of them into a vector.

The second pass iterates through each instruction and generates the object code.

If after the first and second passes, the vector storing all errors is empty, we generate the object program using the object code produced and the details of modification records which are maintained in the modification vector.

Finally, the code displays the generated object program.

NOTES:

The code uses integers to store all values like addresses but converts them into hexadecimal while displaying using the function inttohex_param.

The code has been modularised and has a function defined for all major tasks like:

- getInstructions() : Takes strings of instructions as input and stores them
- firstPass() : Iterates over instructions and makes all tables
- secondPass() : Iterates over instructions and generates object codes for each instruction
- generateObjectProgram() : Is called if no errors are detected. It iterates over the object code vector and modification vector to generate the object code for the SIC-XE program.

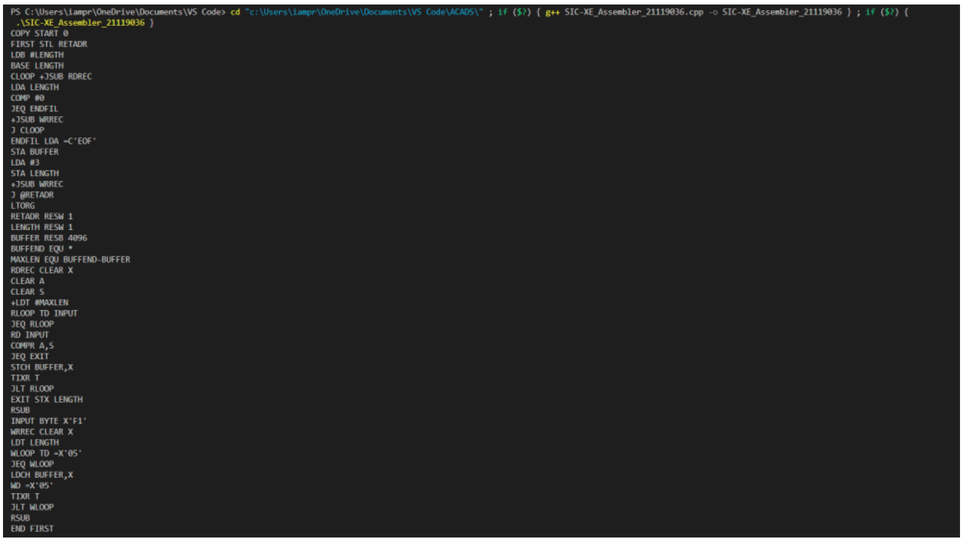
The rest of the functioning of the code can be understood by reading the comments in the code.

EXAMPLE FOR INPUT FORMAT:

```
COPY START 0
FIRST STL RETADR
CLOOP JSUB RDREC
LDA LENGTH
COMP #0
JEQ ENDFIL
JSUB WRREC
J CLOOP
ENDFIL LDA =C'EOF'
STA BUFFER
LDA #3
STA LENGTH
JSUB WRREC
J @RETADR
USE CDATA
RETADR RESW 1
LENGTH RESW 1
USE CBLKS
BUFFER RESB 4096
BUFFEND EQU *
MAXLEN EQU BUFFEND-BUFFER
USE DEFAULT
RDREC CLEAR X
CLEAR A
CLEAR S
+LDT #MAXLEN
RLOOP TD INPUT
JEQ RLOOP
RD INPUT
COMPR A,S
```

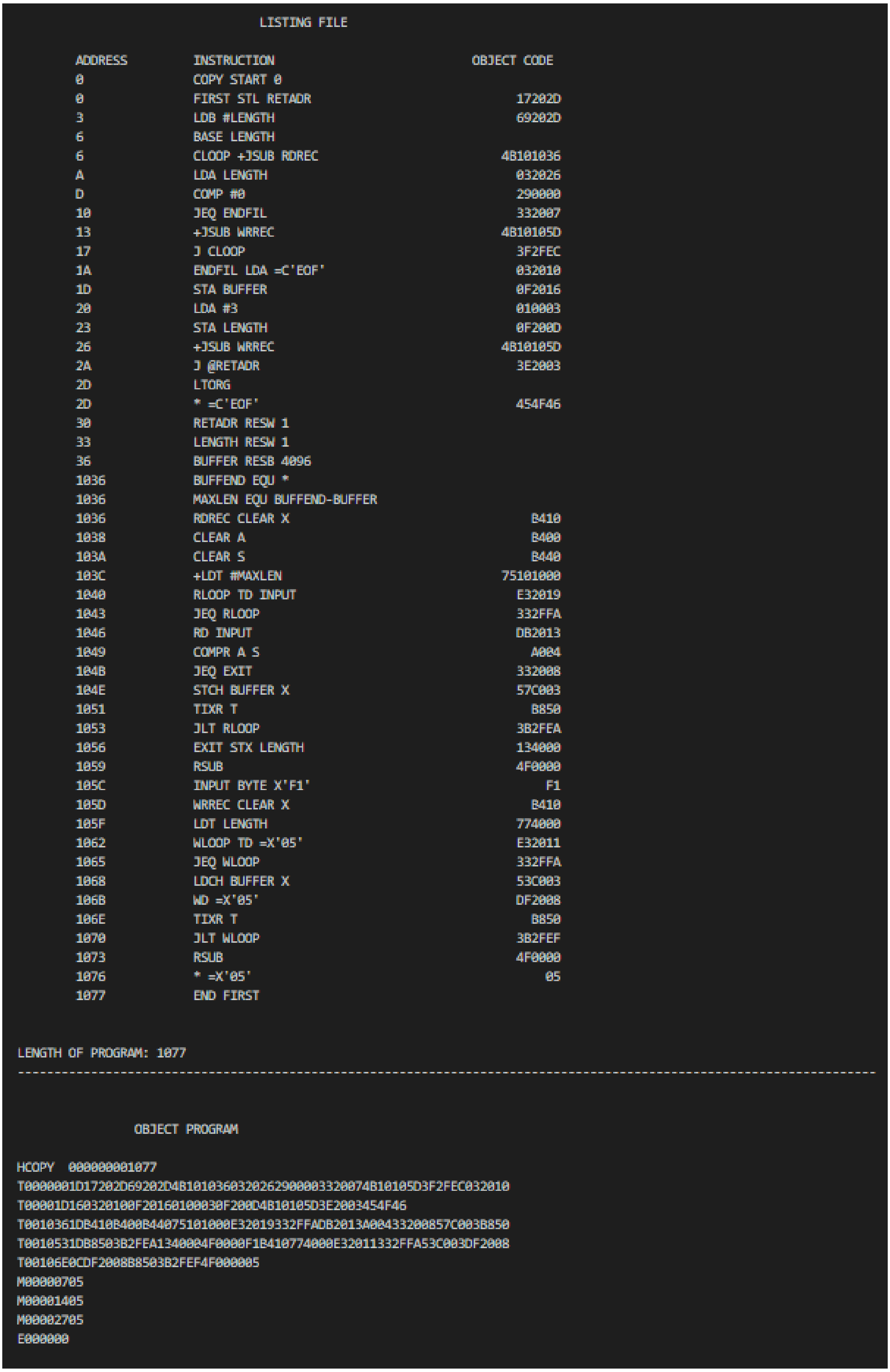
```
JEQ EXIT
STCH BUFFER,X
TIXR T
JLT RLOOP
EXIT STX LENGTH
RSUB
USE CDATA
INPUT BYTE X'F1'
USE
WRREC CLEAR X
LDT LENGTH
WLOOP TD =X'05'
JEQ WLOOP
LDCH BUFFER,X
WD =X'05'
TIXR T
JLT WLOOP
RSUB
USE CDATA
LTORG
END FIRST
```

<u>SAMPLE INPUT:</u>



```
PS C:\Users\iampr\OneDrive\Documents\VS Code> cd "c:\Users\iampr\OneDrive\Documents\VS Code\ACADS\" ; if ($?) { g++ SIC-XE_Assembler_21119036.cpp -o SIC-XE_Assembler_21119036 } ; if ($?) {
 .\SIC-XE_Assembler_21119036 }
COPY START 0
FIRST STL RETADR
LDB #LENGTH
BASE LENGTH
CLOOP +JSUB RDREC
LDA LENGTH
COMP #0
JEQ ENDFIL
+JSUB WRREC
J CLOOP
ENDFIL LDA =C'EOF'
STA BUFFER
LDA #3
STA LENGTH
+JSUB WRREC
J @RETADR
LTORG
RETADR RESW 1
LENGTH RESW 1
BUFFER RESB 4096
BUFFEND EQU *
MAXLEN EQU BUFFEND-BUFFER
RDREC CLEAR X
CLEAR A
CLEAR S
+LDT #MAXLEN
RLOOP TD INPUT
JEQ RLOOP
RD INPUT
COMPR A,S
JEQ EXIT
STCH BUFFER,X
TIXR T
JLT RLOOP
EXIT STX LENGTH
RSUB
INPUT BYTE X'F1'
WRREC CLEAR X
LDT LENGTH
WLOOP TD =X'05'
JEQ WLOOP
LDCH BUFFER,X
WD =X'05'
TIXR T
JLT WLOOP
RSUB
END FIRST
```

SAMPLE OUTPUT:



```
                                  LISTING FILE

         ADDRESS         INSTRUCTION                          OBJECT CODE
         0               COPY START 0
         0               FIRST STL RETADR                           17202D
         3               LDB #LENGTH                                69202D
         6               BASE LENGTH
         6               CLOOP +JSUB RDREC                        4B101036
         A               LDA LENGTH                                 032026
         D               COMP #0                                    290000
         10              JEQ ENDFIL                                 332007
         13              +JSUB WRREC                              4B10105D
         17              J CLOOP                                    3F2FEC
         1A              ENDFIL LDA =C'EOF'                         032010
         1D              STA BUFFER                                 0F2016
         20              LDA #3                                     010003
         23              STA LENGTH                                 0F200D
         26              +JSUB WRREC                              4B10105D
         2A              J @RETADR                                  3E2003
         2D              LTORG
         2D              * =C'EOF'                                  454F46
         30              RETADR RESW 1
         33              LENGTH RESW 1
         36              BUFFER RESB 4096
         1036            BUFFEND EQU *
         1036            MAXLEN EQU BUFFEND-BUFFER
         1036            RDREC CLEAR X                                B410
         1038            CLEAR A                                      B400
         103A            CLEAR S                                      B440
         103C            +LDT #MAXLEN                             75101000
         1040            RLOOP TD INPUT                             E32019
         1043            JEQ RLOOP                                  332FFA
         1046            RD INPUT                                   DB2013
         1049            COMPR A S                                    A004
         104B            JEQ EXIT                                   332008
         104E            STCH BUFFER X                              57C003
         1051            TIXR T                                       B850
         1053            JLT RLOOP                                  3B2FEA
         1056            EXIT STX LENGTH                            134000
         1059            RSUB                                       4F0000
         105C            INPUT BYTE X'F1'                               F1
         105D            WRREC CLEAR X                                B410
         105F            LDT LENGTH                                 774000
         1062            WLOOP TD =X'05'                            E32011
         1065            JEQ WLOOP                                  332FFA
         1068            LDCH BUFFER X                              53C003
         106B            WD =X'05'                                  DF2008
         106E            TIXR T                                       B850
         1070            JLT WLOOP                                  3B2FEF
         1073            RSUB                                       4F0000
         1076            * =X'05'                                       05
         1077            END FIRST


LENGTH OF PROGRAM: 1077
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               OBJECT PROGRAM

HCOPY  000000001077
T0000001D17202D69202D4B1010360320262900003320074B10105D3F2FEC032010
T00001D160320100F20160100030F200D4B10105D3E2003454F46
T0010361DB410B400B44075101000E32019332FFADB2013A00433200857C003B850
T0010531DB8503B2FEA1340004F0000F1B410774000E32011332FFA53C003DF2008
T00106E0CDF2008B8503B2FEF4F000005
M00000705
M00001405
M00002705
E000000
```