

---

## **First Program:**

control section

MAIN    START 0

----- EXDEF  ADDR1,ADDR2,ADDR3

----- EXREF  RTADDR,GETPAIR

----- CLEAR  X

----- +JSUB  GETPAIR

----- STCH  ADDR2

----- +JSUB  GETPAIR

----- STCH  ADDR3

----- LDB  ADDR1

----- +JSUB  GETPAIR

----- STCH  ADDR1

----- +JSUB  GETPAIR

----- STCH  ADDR2

LOOP    +JSUB  GETPAIR

----- STCH  ADDR1,X

----- TIXR  X

----- +STCH  RTADDR

----- J     LOOP

ADDR1   RESB  1

ADDR2   RESB  1

ADDR3   RESB  1

GETPAIR CSECT -----

----- EXDEF  RTADDR,ORADDR

----- EXREF  READ

----- STL  RTADDR

----- +JSUB  READ

----- SHIFL  A,4

----- STCH  HEX

----- OR    ORADDR

```
----- J    @RTADDR

RTADDR  RESB  1

ORADDR  RESB  1

HEX     RESB  1

READ    CSECT  -----

----- EXREF  ADDR1

----- TD    INDEV

----- JEQ   READ

----- CLEAR A

----- RD    INDEV

----- COMP  #48

----- JLT   EOFCK

----- SUB   #48

----- COMP  #10

----- JLT   GOBACK

----- SUB   #7

GOBACK  RSUB

----- EOFCK  COMP  #33

----- JEQ   EXIT

----- COMP  #4

----- JGT   READ

EXIT    CLEAR L

----- +J    ADDR1

INDEV   BYTE  X'F1'

----- END   MAIN
```

## Object code and enhanced symbol table:

first control section

External definitions

Name	Control section number
------	------------------------

ADDR1	1
ADDR2	1
ADDR3	1
GETPAIR	2
RTADDR	2
ORADDR	2
READ	3

External references

Name	Control section number
------	------------------------

RTADDR	1
GETPAIR	1
READ	2
ADDR1	3

symbol table

LOOP	R	21
ADDR1	R	31
ADDR2	R	32
ADDR3	R	33
GETPAIR	R	0
RTADDR	R	12
ORADDR	R	13
HEX	R	14
READ	R	0
GOBACK	R	1d
EOFCK	R	20
EXIT	R	2c
INDEV	R	32

Location	Label	mnemonic	Operand	Object code
----------	-------	----------	---------	-------------

0	-----	EXDEF	ADDR1,ADDR2,ADDR3	-----
0	-----	EXREF	RTADDR,GETPAIR	-----
0	-----	CLEAR	X	B410
2	-----	+JSUB	GETPAIR	4B100000
6	-----	STCH	ADDR2	572029
9	-----	+JSUB	GETPAIR	4B100000
d	-----	STCH	ADDR3	572023
10	-----	LDB	ADDR1	6B201E
13	-----	+JSUB	GETPAIR	4B100000
17	-----	STCH	ADDR1	572017
1a	-----	+JSUB	GETPAIR	4B100000
1e	-----	STCH	ADDR2	572011

21	LOOP	+JSUB	GETPAIR	4B100000					
25	-----	STCH	ADDR1,X	57A009					
28	-----	TIXR	X	B810					
2a	-----	+STCH	RTADDR	57100000					
2e	-----	J	LOOP	3F2FF0					
31	ADDR1	RESB	1	-----					
32	ADDR2	RESB	1	-----					
33	ADDR3	RESB	1	-----					
0	GETPAIR	CSECT	-----	-----					
0	-----	EXDEF	RTADDR,ORADDR	-----					
0	-----	EXREF	READ	-----					
0	-----	STL	RTADDR	17200F					
3	-----	+JSUB	READ	4B100000					
7	-----	SHIFL	A,4	A40					
9	-----	STCH	HEX	572008					
c	-----	OR	ORADDR	472004					
f	-----	J	@RTADDR	3E2000					
12	RTADDR	RESB	1	-----					
13	ORADDR	RESB	1	-----					
14	HEX	RESB	1	-----					
0	READ	CSECT	-----	-----					
0	-----	EXREF	ADDR1	-----					
0	-----	TD	INDEV	E3202F					
3	-----	JEQ	READ	332FFA					
6	-----	CLEAR	A	B400	8	-----	RD	INDEV	DB2027 b
-----	COMP	#48	290048	e	-----	JLT	EOFCK	3B200F	11
-----	SUB	#48	1D0048						
14	-----	COMP	#10	290010					
17	-----	JLT	GOBACK	3B2003					
1a	-----	SUB	#7	1D0007					
1d	GOBACK	RSUB	-----	4F0000					
20	EOFCK	COMP	#33	290033					
23	-----	JEQ	EXIT	332006					
26	-----	COMP	#4	290004					
29	-----	JGT	READ	372FD4					
2c	EXIT	CLEAR	L	B420					
2e	-----	+J	ADDR1	3F100000					
32	INDEV	BYTE	X'F1'	F1					
33	-----	END	MAIN	-----					

## First HTE Record

```

out.txt - Notepad
File Edit Format View Help
HMAIN ^000000^000034
D^ADDR1^31^ADDR2^32^ADDR3^33^
R^RTADDR^GETPAIR^
T^000000^1e^B410^4B100000^572029^4B100000^572023^6B201E^4B100000^572017^4B100000^
T^00001a^13^572011^4B100000^57A009^B810^57100000^3F2FF0^
M^000003^05^+GETPAIR
M^00000a^05^+GETPAIR
M^000014^05^+GETPAIR
M^00001b^05^+GETPAIR
M^000022^05^+GETPAIR
M^00002b^05^+RTADDR
E^000000

```

## Second HTE Record

```
out.txt - Notepad
File Edit Format View Help
HMAIN ^000000^000000
D^RTADDR^12^ORADDR^13^GETPAIR^00
R^READ^
T^000000^11^17200F^4B10000^A40^572008^472004^3E2000^
M^000004^05^+READ
E^000000
```

## Third HTE Record

```
out.txt - Notepad
File Edit Format View Help
HMAIN ^000000^000000
D^READ^000000
R^ADDR1^
T^000000^1e^E3202F^30^B400^D82027^290048^3B200F^1D0048^290010^3B2003^1D0007^4F0000^
T^00001d^11^290033^332006^290004^34^B420^3F100000^F1^
M^00002F^05^+ADDR1
E^000000
```

```
MAIN      START    0000

FIRST     +LDA      #BEGIN

SECOND    +LDX      #FINAL

LOOP      ADDR      X,A
-----    TIX      #11
-----    JLT      LOOP

BEGIN     EQU       FIRST - SECOND + LOOP

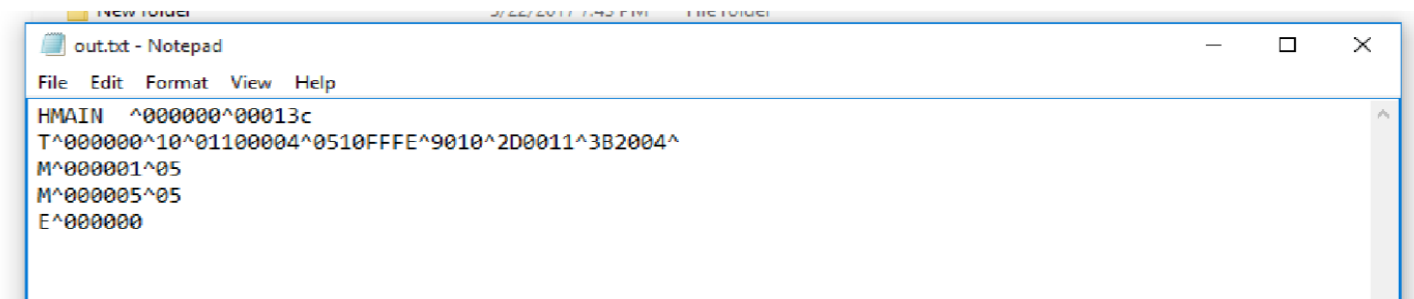
DUMP      RESW      100

FINAL     EQU       LOOP + SECOND - DUMP - BEGIN
-----    END      FIRST
```

## Object code and enhanced symbol table:

The screenshot shows an IDE with the 'Output' window displaying the assembly results. The 'Source' window shows the assembly code with line numbers 583 to 604. The 'Output' window has tabs for 'Debugger Console' and 'assembler (run)'. The 'assembler (run)' tab shows the following output:

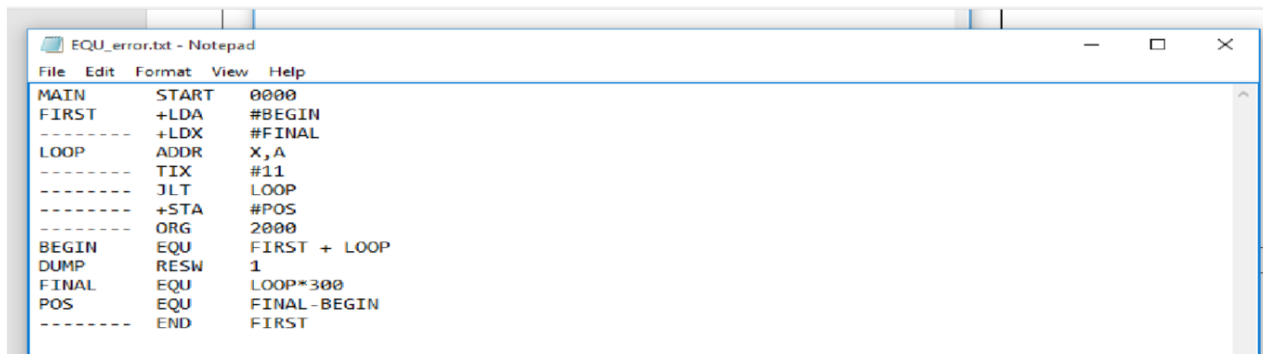
```
run:
symboltable
-----
FIRST  R      0000
SECOND R      4
LOOP   R      8
BEGIN  R      4
DUMP   R      10
FINAL  A      ffffffff
-----
Location  Label      mnemonic  Operand      Object code
-----
592 0000 MAIN START 0000 -----
593 0000 FIRST +LDA #BEGIN 01100004
594 4 SECOND +LDX #FINAL 0610FFFF
595 8 LOOP ADDR X,A 9010
596 a ----- TIX #11 2D0011
597 d ----- JLT LOOP 3E2004
598 4 BEGIN EQU FIRST - SECOND + LOOP -----
599 10 DUMP RESW 100 -----
600 ffffffff FINAL EQU LOOP + SECOND - DUMP - BEGIN -----
601 18c ----- END FIRST -----
BUILD SUCCESSFUL (total time: 0 seconds)
```



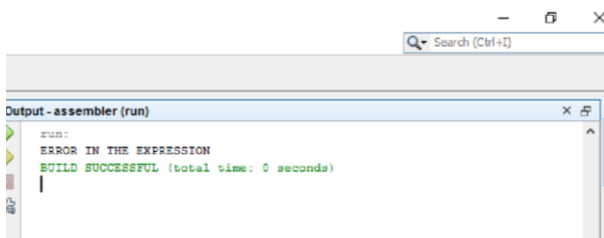
```
out.txt - Notepad
File Edit Format View Help
HMAIN ^000000^00013c
T^000000^10^01100004^0510FFFE^9010^2D0011^3B2004^
M^000001^05
M^000005^05
E^000000
```

### Third program:

### EQU\_ERROR



```
EQU_error.txt - Notepad
File Edit Format View Help
MAIN      START    0000
FIRST     +LDA      #BEGIN
-----   +LDX      #FINAL
LOOP      ADDR      X,A
-----   TIX       #11
-----   JLT       LOOP
-----   +STA      #POS
-----   ORG       2000
BEGIN     EQU       FIRST + LOOP
DUMP      RESW      1
FINAL     EQU       LOOP*300
POS       EQU       FINAL-BEGIN
-----   END       FIRST
```



```
Search (Ctrl+F)

Output - assembler (run)
Run:
ERROR IN THE EXPRESSION
BUILD SUCCESSFUL (total time: 0 seconds)
```