2/29/2020 Software Tools

Software Tools

Introduction

History

Software tools

A number of software tools are provided to help with development.

Design

Assembler

Circuit Design Architecture Conditional **Logic Semiconductors** Instruction Set

Summary: asm [options] filename.asm >filename.lst

Options:

-h, --help Print help

Usage

These assembly pseudo-ops are provided:

Keypad/Display Serial Console **Example Programs**

Software Tools Build/Dev Log

Project page Comments

	org	0x10	;	Set location to 0x10
	skip	1	;	Reserve one memory location
	data	0x23	;	Emit 8-bit data byte: upper bits are filled in with halt instruction.
	insn	0x4010ff00	;	Emit 32-bit instruction
fred	equ	0x50	;	Set label to value

Here is an example run:

```
./asm euc.asm
Pass 1...
0 errors detected in pass 1
Pass 2...
                         ; Euclid's algorithm
2
3
        00
                                          org
                                                  0x00
4
        00
                                                                   ; First number
                                          skip
                                                  1
                                                                   ; Second number
5
        01
                                          skip
                         b
                                                  1
        02
                                                                   ; Tmp variable
6
                         tmp
                                          skip
                                                  1
7
8
        10
                                          org
                                                  0x10
        10 4800_9000
9
                         euclid
                                          st
                                                  #144, a
                                                                  ; Initialize
Α
10
        11 4800 e901
                                          st
                                                  #233, b
                                                                   ; Initialize
В
        12 0062 011a
                         euclop
                                          jeq
                                                  b, eucdon
                                                                   ; Done ?
        13 0800 0002
                                          st
                                                  a, tmp
                                                                   ; A - B -> TMP
                                          rsbto
13
        14 08e0 0102
                                                  b, tmp
                                                                   ; A <= B ?
        15 0066_0218
                                                  tmp, over
14
                                          jls
        16 08e0_0100
                                          rsbto
15
                                                                   ; A - B -> A
                                                  b, a
16
        17 4018_ff12
                                                  euclop
                                          jmp
17
        18 08e0_0001
                         over
                                          rsbto
                                                  a, b
                                                                   ; B - A -> B
        19 4018_ff12
                                                  euclop
18
                                          jmp
                                          halt
        1a c810 ff00
19
                         eucdon
```

2/29/2020 Software Tools

```
0 errors detected in pass 2
Symbol table:
a = 0x0
b = 0x1
eucdon = 0x1a
euclid = 0x10
euclop = 0x12
over = 0x18
tmp = 0x2
Memory image:
10: 48009000
11: 4800e901
12: 0062011a
13: 08000002
14: 08e00102
15: 00660218
16: 08e00100
17: 4018ff12
18: 08e00001
19: 4018ff12
1a: c810ff00
```

Simulator

A simulator is provided which produces an instruction trace. The input to the simulator is the assembly listing output from the assembler.

Summary: sim [options] filename.lst

Optoins:

```
-h, --help
Print help
-pc xx
Set initial PC value
```

Here is an example run:

```
./sim -pc 0x10 euc.lst
10: 48009000
11: 4800e901
12: 0062011a
13: 08000002
14: 08e00102
15: 00660218
16: 08e00100
17: 4018ff12
18: 08e00001
19: 4018ff12
1a: c810ff00
Starting at 10
                                                 [00]=90 C=0
10: 4800_9000 (C=0)
                               #0x90, 0x00
                               #0xe9, 0x01
                                                 [01]=E9 C=0
11: 4800 e901 (C=0)
                       st
                               0x01, 0x1a
12: 0062 011a (C=0)
                                                 C=0
                       jeq
13: 0800_0002 (C=0)
                               0x00, 0x02
                                                 [02]=90 C=0
                       st
14: 08e0 0102 (C=0)
                       rsbto
                               0x01, 0x02
                                                [02]=A7 C=0
15: 0066_0218 (C=0)
                       jls
                               0x02, 0x18
                                                PC=18 C=0
18: 08e0_0001 (C=0)
                       rsbto
                               0x00, 0x01
                                                 [01]=59 C=1
19: 4018_ff12 (C=1)
                                                PC=12 C=1
                       jmp
                               0x12
12: 0062_011a (C=1)
                       jeq
                               0x01, 0x1a
                                                C=0
                                                 [02]=90 C=0
13: 0800_0002 (C=0)
                       st
                               0x00, 0x02
14: 08e0_0102 (C=0)
                               0x01, 0x02
                       rsbto
                                                 [02]=37 C=1
```

2/29/2020 Software Tools

```
15: 0066 0218 (C=1)
                                 0x02, 0x18
                        jls
                                                  C=0
16: 08e0 0100 (C=0)
                                 0x01, 0x00
                                                   [00]=37 C=1
                        rsbto
17: 4018_ff12 (C=1)
                        jmp
                                 0x12
                                                  PC=12 C=1
12: 0062 011a (C=1)
                                 0x01, 0x1a
                                                  C=0
                        jeq
13: 0800 0002 (C=0)
                        st
                                 0x00, 0x02
                                                  [02]=37 C=0
14: 08e0 0102 (C=0)
                        rsbto
                                0x01, 0x02
                                                   [02]=DE C=0
15: 0066_0218 (C=0)
                        jls
                                 0x02, 0x18
                                                  PC=18 C=0
18: 08e0_0001 (C=0)
                                 0x00, 0x01
                        rsbto
                                                   [01]=22 C=1
19: 4018_ff12 (C=1)
                                                  PC=12 C=1
                                 0x12
                        jmp
12: 0062_011a (C=1)
                                 0x01, 0x1a
                                                  C=0
                        jeq
                                                   [02]=37 C=0
13: 0800_0002 (C=0)
                                 0x00, 0x02
                        st
14: 08e0_0102 (C=0)
                        rsbto
                                 0x01, 0x02
                                                   [02]=15 C=1
                                 0x02, 0x18
15: 0066 0218 (C=1)
                        jls
                                                  C=0
16: 08e0 0100 (C=0)
                        rsbto
                                 0x01, 0x00
                                                   [00]=15 C=1
17: 4018 ff12 (C=1)
                        jmp
                                 0x12
                                                  PC=12 C=1
12: 0062 011a
                                 0x01, 0x1a
              (C=1)
                        jeq
                                                  C=0
13: 0800 0002
                                 0x00, 0x02
                                                   [02]=15 C=0
              (C=0)
                        st
14: 08e0_0102 (C=0)
                                 0x01, 0x02
                                                   [02]=F3 C=0
                        rsbto
15: 0066_0218 (C=0)
                                 0x02, 0x18
                                                  PC=18 C=0
                        jls
                                                   [01]=0D C=1
18: 08e0 0001 (C=0)
                                 0x00, 0x01
                        rsbto
19: 4018 ff12 (C=1)
                                                  PC=12 C=1
                                 0x12
                        jmp
12: 0062 011a (C=1)
                                 0x01, 0x1a
                                                  C=0
                        jeq
13: 0800 0002 (C=0)
                        st
                                 0x00, 0x02
                                                   [02]=15 C=0
14: 08e0 0102 (C=0)
                        rsbto
                                 0x01, 0x02
                                                  [02]=08 C=1
15: 0066 0218 (C=1)
                                 0x02, 0x18
                                                  C=0
                        jls
16: 08e0_0100 (C=0)
                        rsbto
                                 0x01, 0x00
                                                  [00]=08 C=1
17: 4018_ff12 (C=1)
                        jmp
                                 0x12
                                                  PC=12 C=1
12: 0062 011a (C=1)
                        jeq
                                 0x01, 0x1a
                                                  C=0
13: 0800_0002 (C=0)
                                 0x00, 0x02
                                                   [02]=08 C=0
                        st
14: 08e0_0102 (C=0)
                                 0x01, 0x02
                                                   [02]=FB C=0
                        rsbto
15: 0066_0218 (C=0)
                        jls
                                 0x02, 0x18
                                                  PC=18 C=0
                                0x00, 0x01
                        rsbto
18: 08e0_0001 (C=0)
                                                   [01]=05 C=1
19: 4018 ff12 (C=1)
                                                  PC=12 C=1
                        jmp
                                 0x12
12: 0062_011a (C=1)
                                 0x01, 0x1a
                                                  C=0
                        jeq
13: 0800_0002 (C=0)
                        st
                                 0x00, 0x02
                                                   [02]=08 C=0
14: 08e0 0102 (C=0)
                                0x01, 0x02
                                                  [02]=03 C=1
                        rsbto
15: 0066 0218 (C=1)
                                 0x02, 0x18
                        jls
                                                  C=0
16: 08e0_0100 (C=0)
                        rsbto
                                 0x01, 0x00
                                                   [00]=03 C=1
17: 4018_ff12 (C=1)
                        jmp
                                 0x12
                                                  PC=12 C=1
12: 0062 011a (C=1)
                        jeq
                                 0x01, 0x1a
                                                  C=0
13: 0800 0002 (C=0)
                                 0x00, 0x02
                                                   [02]=03 C=0
                        st
14: 08e0 0102
                                 0x01, 0x02
                                                   [02]=FE C=0
              (C=0)
                        rsbto
15: 0066_0218 (C=0)
                                 0x02, 0x18
                                                  PC=18 C=0
                        jls
18: 08e0_0001 (C=0)
                                                   [01]=02 C=1
                        rsbto
                                 0x00, 0x01
19: 4018 ff12 (C=1)
                        jmp
                                 0x12
                                                  PC=12 C=1
12: 0062 011a (C=1)
                                 0x01, 0x1a
                                                  C=0
                        jeq
13: 0800 0002 (C=0)
                        st
                                 0x00, 0x02
                                                   [02]=03 C=0
14: 08e0 0102 (C=0)
                        rsbto
                                 0x01, 0x02
                                                  [02]=01 C=1
15: 0066 0218 (C=1)
                                 0x02, 0x18
                                                  C=0
                        jls
16: 08e0 0100 (C=0)
                        rsbto
                                 0x01, 0x00
                                                   [00]=01 C=1
                        jmp
17: 4018 ff12 (C=1)
                                 0x12
                                                  PC=12 C=1
12: 0062_011a (C=1)
                        jeq
                                 0x01, 0x1a
                                                  C=0
13: 0800_0002 (C=0)
                                 0x00, 0x02
                                                  [02]=01 C=0
                        st
                                                   [02]=FF C=0
14: 08e0_0102 (C=0)
                                0x01, 0x02
                        rsbto
15: 0066_0218 (C=0)
                        jls
                                 0x02, 0x18
                                                  PC=18 C=0
18: 08e0_0001 (C=0)
                        rsbto
                                 0x00, 0x01
                                                   [01]=01 C=1
19: 4018 ff12 (C=1)
                                 0x12
                                                  PC=12 C=1
                        jmp
12: 0062 011a (C=1)
                                 0x01, 0x1a
                                                  C=0
                        jeq
13: 0800 0002 (C=0)
                                                  [02]=01 C=0
                        st
                                 0x00, 0x02
14: 08e0 0102 (C=0)
                        rsbto
                                 0x01, 0x02
                                                   [02]=00 C=1
15: 0066_0218 (C=1)
                                 0x02, 0x18
                                                  PC=18 C=1
                        jls
18: 08e0_0001 (C=1)
                        rsbto
                                 0x00, 0x01
                                                   [01]=00 C=1
19: 4018 ff12 (C=1)
                        jmp
                                 0x12
                                                  PC=12 C=1
12: 0062 011a
              (C=1)
                        jeq
                                 0x01, 0x1a
                                                  PC=1A C=1
1a: c810_ff00 (C=1)
                        halt
                                                  C=1 halt
```

Note that the right-most column is showing the data transfers which occur as a result of the executed instruction.

2/29/2020 Software Tools

If the **inwait** instruction is encountered, the simulator will prompt for a numeric input.