```
 1
 2  AVRASM ver. 2.2.7  E:\ESE_280\$MyDocuments$\Atmel Studio\7.0\lab_4      ⮑
       \four_bit_comparator\four_bit_comparator\main.asm Tue Sep 29 18:50:55 2020
 3
 4  E:\ESE_280\$MyDocuments$\Atmel Studio\7.0\lab_4\four_bit_comparator     ⮑
       \four_bit_comparator\main.asm(9): Including file 'C:/Program Files (x86)  ⮑
       \Atmel\Studio\7.0\Packs\atmel\ATmega_DFP\1.2.209\avrasm\inc\m4809def.inc'
 5  E:\ESE_280\$MyDocuments$\Atmel Studio\7.0\lab_4\four_bit_comparator     ⮑
       \four_bit_comparator\main.asm(9): Including file 'C:/Program Files (x86)  ⮑
       \Atmel\Studio\7.0\Packs\atmel\ATmega_DFP\1.2.209\avrasm\inc\m4809def.inc'
 6
 7
 8                                    ; FourBitComparator.asm
 9                                    ;
10                                    ; Created: 9/23/2020 7:39:07 AM
11                                    ; Author : hp
12                                    ;
13
14                                    .list
15
16
17                                    ; Replace with your application code
18                                    start:
19  000000 e000                          ldi r16, 0x00
20  000001 b900                          out VPORTA_DIR, r16
21  000002 ef0f                          ldi r16, 0xFF
22  000003 b90c                          out VPORTD_DIR, r16
23  000004 e000                          ldi r16, 0x00
24  000005 b90d                          out VPORTD_OUT, r16
25
26                                    main:
27  000006 b102                          in r16, VPORTA_IN
28  000007 2f10                          mov r17, r16
29  000008 2f20                          mov r18, r16
30  000009 7f10                          andi r17, 0xF0
31  00000a 702f                          andi r18, 0x0F
32  00000b 9516                          lsr r17
33  00000c 9516                          lsr r17
34  00000d 9516                          lsr r17
35  00000e 9516                          lsr r17
36  00000f 0712                          cpc r17, r18
37  000010 f011                          breq equal
38  000011 f420                          brsh greater
39  000012 f030                          brlo less
40
41                                    equal:
42  000013 e430                          ldi r19, 0x40
43  000014 b93d                          out VPORTD_OUT, r19
44  000015 cff0                          rjmp main
```

```
45
46                                      greater:
47  000016 e830                             ldi r19, 0x80
48  000017 b93d                             out VPORTD_OUT, r19
49  000018 cfed                             rjmp main
50
51                                      less:
52  000019 e230                             ldi r19, 0x20
53  00001a b93d                             out VPORTD_OUT, r19
54  00001b cfea                             rjmp main
55
56
57
58
59  RESOURCE USE INFORMATION
60  ------------------------
61
62  Notice:
63  The register and instruction counts are symbol table hit counts,
64  and hence implicitly used resources are not counted, eg, the
65  'lpm' instruction without operands implicitly uses r0 and z,
66  none of which are counted.
67
68  x,y,z are separate entities in the symbol table and are
69  counted separately from r26..r31 here.
70
71  .dseg memory usage only counts static data declared with .byte
72
73  "ATmega4809" register use summary:
74  x  :    0 y  :    0 z  :    0 r0 :    0 r1 :    0 r2 :    0 r3 :    0 r4 :    0
75  r5 :    0 r6 :    0 r7 :    0 r8 :    0 r9 :    0 r10:    0 r11:    0 r12:    0
76  r13:    0 r14:    0 r15:    0 r16:    9 r17:    7 r18:    3 r19:    6 r20:    0
77  r21:    0 r22:    0 r23:    0 r24:    0 r25:    0 r26:    0 r27:    0 r28:    0
78  r29:    0 r30:    0 r31:    0
79  Registers used: 4 out of 35 (11.4%)
80
81  "ATmega4809" instruction use summary:
82  .lds  :    0 .sts  :    0 adc   :    0 add   :    0 adiw  :    0 and   :    0
83  andi  :    2 asr   :    0 bclr  :    0 bld   :    0 brbc  :    0 brbs  :    0
84  brcc  :    0 brcs  :    0 break :    0 breq  :    1 brge  :    0 brhc  :    0
85  brhs  :    0 brid  :    0 brie  :    0 brlo  :    1 brlt  :    0 brmi  :    0
86  brne  :    0 brpl  :    0 brsh  :    1 brtc  :    0 brts  :    0 brvc  :    0
87  brvs  :    0 bset  :    0 bst   :    0 call  :    0 cbi   :    0 cbr   :    0
88  clc   :    0 clh   :    0 cli   :    0 cln   :    0 clr   :    0 cls   :    0
89  clt   :    0 clv   :    0 clz   :    0 com   :    0 cp    :    0 cpc   :    1
90  cpi   :    0 cpse  :    0 dec   :    0 des   :    0 eor   :    0 fmul  :    0
91  fmuls :    0 fmulsu:    0 icall :    0 ijmp  :    0 in    :    1 inc   :    0
92  jmp   :    0 ld    :    0 ldd   :    0 ldi   :    6 lds   :    0 lpm   :    0
93  lsl   :    0 lsr   :    4 mov   :    2 movw  :    0 mul   :    0 muls  :    0
```

```
 94  mulsu :    0 neg    :    0 nop    :    0 or     :    0 ori    :    0 out    :    6
 95  pop    :    0 push   :    0 rcall  :    0 ret    :    0 reti   :    0 rjmp   :    3
 96  rol    :    0 ror    :    0 sbc    :    0 sbci   :    0 sbi    :    0 sbic   :    0
 97  sbis   :    0 sbiw   :    0 sbr    :    0 sbrc   :    0 sbrs   :    0 sec    :    0
 98  seh    :    0 sei    :    0 sen    :    0 ser    :    0 ses    :    0 set    :    0
 99  sev    :    0 sez    :    0 sleep  :    0 spm    :    0 st     :    0 std    :    0
100  sts    :    0 sub    :    0 subi   :    0 swap   :    0 tst    :    0 wdr    :    0
101
102  Instructions used: 11 out of 114 (9.6%)
103
104  "ATmega4809" memory use summary [bytes]:
105  Segment   Begin     End         Code    Data    Used     Size    Use%
106  -------------------------------------------------------------
107  [.cseg] 0x000000 0x000038       56       0      56     49152    0.1%
108  [.dseg] 0x002800 0x002800        0       0       0      6144    0.0%
109  [.eseg] 0x000000 0x000000        0       0       0       256    0.0%
110
111  Assembly complete, 0 errors, 0 warnings
112
```

```
    1
    2  AVRASM ver. 2.2.7  E:\ESE_280\$MyDocuments$\Atmel Studio\7.0\lab_4         ⇗
        \three_to_eight_decoder\three_to_eight_decoder\main.asm Tue Sep 29 18:52:05  ⇗
        2020
    3
    4  E:\ESE_280\$MyDocuments$\Atmel Studio\7.0\lab_4\three_to_eight_decoder      ⇗
        \three_to_eight_decoder\main.asm(9): Including file 'C:/Program Files (x86)  ⇗
        \Atmel\Studio\7.0\Packs\atmel\ATmega_DFP\1.2.209\avrasm\inc\m4809def.inc'
    5  E:\ESE_280\$MyDocuments$\Atmel Studio\7.0\lab_4\three_to_eight_decoder      ⇗
        \three_to_eight_decoder\main.asm(9): Including file 'C:/Program Files (x86)  ⇗
        \Atmel\Studio\7.0\Packs\atmel\ATmega_DFP\1.2.209\avrasm\inc\m4809def.inc'
    6
    7
    8                                    ; three_to_eight_decoder.asm
    9                                    ;
   10                                    ; Created: 9/23/2020 9:29:18 AM
   11                                    ; Author : user38x
   12                                    ;
   13
   14                                    .list
   15
   16                                    ; Replace with your application code
   17
   18                                    start:
   19  000000 e000                          ldi r16, 0x00
   20  000001 ef1f                          ldi r17, 0xFF
   21  000002 b91c                          out VPORTD_DIR, r17
   22  000003 b900                          out VPORTA_DIR, r16
   23  000004 b91d                          out VPORTD_OUT, r17
   24
   25                                    main:
   26  000005 b102                          in r16, VPORTA_IN
   27  000006 e020                          ldi r18, 0x00
   28  000007 e031                          ldi r19, 0x01
   29  000008 e040                          ldi r20, 0x00
   30  000009 710c                          andi r16, 0x1C
   31  00000a 3100                          cpi r16, 0x10
   32  00000b f529                          brne output
   33  00000c b102                          in r16, VPORTA_IN
   34  00000d 2f10                          mov r17, r16
   35  00000e 9512                          swap r17
   36  00000f 9516                          lsr r17
   37  000010 7017                          andi r17, 0x07
   38  000011 3010                          cpi r17, 0x00
   39  000012 f071                          breq zero
   40  000013 3011                          cpi r17, 0x01
   41  000014 f071                          breq one
   42  000015 3012                          cpi r17, 0x02
   43  000016 f071                          breq two
```

```
44  000017 3013                              cpi r17, 0x03
45  000018 f071                              breq three
46  000019 3014                              cpi r17, 0x04
47  00001a f071                              breq four
48  00001b 3015                              cpi r17, 0x05
49  00001c f071                              breq five
50  00001d 3016                              cpi r17, 0x06
51  00001e f071                              breq six
52  00001f 3017                              cpi r17, 0x07
53  000020 f071                              breq seven
54
55                                      zero:
56  000021 e041                              ldi r20, 0x01
57  000022 c00e                              rjmp output
58                                      one:
59  000023 e042                              ldi r20, 0x02
60  000024 c00c                              rjmp output
61                                      two:
62  000025 e044                              ldi r20, 0x04
63  000026 c00a                              rjmp output
64                                      three:
65  000027 e048                              ldi r20, 0x08
66  000028 c008                              rjmp output
67                                      four:
68  000029 e140                              ldi r20, 0x10
69  00002a c006                              rjmp output
70                                      five:
71  00002b e240                              ldi r20, 0x20
72  00002c c004                              rjmp output
73                                      six:
74  00002d e440                              ldi r20, 0x40
75  00002e c002                              rjmp output
76                                      seven:
77  00002f e840                              ldi r20, 0x80
78  000030 c000                              rjmp output
79
80                                      output:
81  000031 9540                              com r20
82  000032 b94d                              out VPORTD_OUT, r20
83  000033 cfd1                              rjmp main
84
85
86  RESOURCE USE INFORMATION
87  ------------------------
88
89  Notice:
90  The register and instruction counts are symbol table hit counts,
91  and hence implicitly used resources are not counted, eg, the
92  'lpm' instruction without operands implicitly uses r0 and z,
```

```
 93  none of which are counted.

 94

 95  x,y,z are separate entities in the symbol table and are
 96  counted separately from r26..r31 here.

 97

 98  .dseg memory usage only counts static data declared with .byte

 99

100  "ATmega4809" register use summary:
101  x  :    0 y  :    0 z  :    0 r0 :    0 r1 :    0 r2 :    0 r3 :    0 r4 :    0
102  r5 :    0 r6 :    0 r7 :    0 r8 :    0 r9 :    0 r10:    0 r11:    0 r12:    0
103  r13:    0 r14:    0 r15:    0 r16:    7 r17:   15 r18:    1 r19:    1 r20:   11
104  r21:    0 r22:    0 r23:    0 r24:    0 r25:    0 r26:    0 r27:    0 r28:    0
105  r29:    0 r30:    0 r31:    0
106  Registers used: 5 out of 35 (14.3%)

107

108  "ATmega4809" instruction use summary:
109  .lds  :    0 .sts  :    0 adc   :    0 add   :    0 adiw  :    0 and   :    0
110  andi  :    2 asr   :    0 bclr  :    0 bld   :    0 brbc  :    0 brbs  :    0
111  brcc  :    0 brcs  :    0 break :    0 breq  :    8 brge  :    0 brhc  :    0
112  brhs  :    0 brid  :    0 brie  :    0 brlo  :    0 brlt  :    0 brmi  :    0
113  brne  :    1 brpl  :    0 brsh  :    0 brtc  :    0 brts  :    0 brvc  :    0
114  brvs  :    0 bset  :    0 bst   :    0 call  :    0 cbi   :    0 cbr   :    0
115  clc   :    0 clh   :    0 cli   :    0 cln   :    0 clr   :    0 cls   :    0
116  clt   :    0 clv   :    0 clz   :    0 com   :    1 cp    :    0 cpc   :    0
117  cpi   :    9 cpse  :    0 dec   :    0 des   :    0 eor   :    0 fmul  :    0
118  fmuls :    0 fmulsu:    0 icall :    0 ijmp  :    0 in    :    2 inc   :    0
119  jmp   :    0 ld    :    0 ldd   :    0 ldi   :   13 lds   :    0 lpm   :    0
120  lsl   :    0 lsr   :    1 mov   :    1 movw  :    0 mul   :    0 muls  :    0
121  mulsu :    0 neg   :    0 nop   :    0 or    :    0 ori   :    0 out   :    4
122  pop   :    0 push  :    0 rcall :    0 ret   :    0 reti  :    0 rjmp  :    9
123  rol   :    0 ror   :    0 sbc   :    0 sbci  :    0 sbi   :    0 sbic  :    0
124  sbis  :    0 sbiw  :    0 sbr   :    0 sbrc  :    0 sbrs  :    0 sec   :    0
125  seh   :    0 sei   :    0 sen   :    0 ser   :    0 ses   :    0 set   :    0
126  sev   :    0 sez   :    0 sleep :    0 spm   :    0 st    :    0 std   :    0
127  sts   :    0 sub   :    0 subi  :    0 swap  :    0 tst   :    1 wdr   :    0

128

129  Instructions used: 12 out of 114 (10.5%)

130

131  "ATmega4809" memory use summary [bytes]:
132  Segment   Begin      End        Code    Data   Used    Size    Use%
133  -------------------------------------------------------------
134  [.cseg] 0x000000 0x000068     104       0     104    49152    0.2%
135  [.dseg] 0x002800 0x002800       0       0       0     6144    0.0%
136  [.eseg] 0x000000 0x000000       0       0       0      256    0.0%

137

138  Assembly complete, 0 errors, 0 warnings

139
```

1
2 AVRASM ver. 2.2.7 E:\ESE_280\$MyDocuments$\Atmel Studio\7.0\lab_4   ↵
     \color_computer\color_computer\main.asm Tue Sep 29 18:49:53 2020
3
4 E:\ESE_280\$MyDocuments$\Atmel Studio\7.0\lab_4\color_computer\color_computer   ↵
     \main.asm(9): Including file 'C:/Program Files (x86)\Atmel\Studio\7.0\Packs   ↵
     \atmel\ATmega_DFP\1.2.209\avrasm\inc\m4809def.inc'
5 E:\ESE_280\$MyDocuments$\Atmel Studio\7.0\lab_4\color_computer\color_computer   ↵
     \main.asm(9): Including file 'C:/Program Files (x86)\Atmel\Studio\7.0\Packs   ↵
     \atmel\ATmega_DFP\1.2.209\avrasm\inc\m4809def.inc'
6
7
8   ; color_computer.asm
9   ;
10   ; Created: 9/23/2020 11:00:26 AM
11   ; Author : user38x
12   ;
13
14   .list
15
16
17   ; Replace with your application code
18   start:
19 000000 e000   ldi r16, 0x00
20 000001 ef1f   ldi r17, 0xFF
21 000002 b900   out VPORTA_DIR, r16
22 000003 b91c   out VPORTD_DIR, r17
23 000004 b91d   out VPORTD_OUT, r17
24 000005 b918   out VPORTC_DIR, r17
25 000006 b909   out VPORTC_OUT, r16
26
27   main:
28 000007 b102   in r16, VPORTA_IN
29 000008 b909   out VPORTC_OUT, r16
30 000009 9500   com r16
31 00000a b90d   out VPORTD_OUT, r16
32 00000b cffb   rjmp main
33
34
35 RESOURCE USE INFORMATION
36 -----------------------
37
38 Notice:
39 The register and instruction counts are symbol table hit counts,
40 and hence implicitly used resources are not counted, eg, the
41 'lpm' instruction without operands implicitly uses r0 and z,
42 none of which are counted.
43
44 x,y,z are separate entities in the symbol table and are

```
45  counted separately from r26..r31 here.
46
47  .dseg memory usage only counts static data declared with .byte
48
49  "ATmega4809" register use summary:
50  x  :   0 y  :   0 z  :   0 r0 :   0 r1 :   0 r2 :   0 r3 :   0 r4 :   0
51  r5 :   0 r6 :   0 r7 :   0 r8 :   0 r9 :   0 r10:   0 r11:   0 r12:   0
52  r13:   0 r14:   0 r15:   0 r16:   7 r17:   4 r18:   0 r19:   0 r20:   0
53  r21:   0 r22:   0 r23:   0 r24:   0 r25:   0 r26:   0 r27:   0 r28:   0
54  r29:   0 r30:   0 r31:   0
55  Registers used: 2 out of 35 (5.7%)
56
57  "ATmega4809" instruction use summary:
58  .lds  :   0 .sts  :   0 adc   :   0 add   :   0 adiw  :   0 and   :   0
59  andi  :   0 asr   :   0 bclr  :   0 bld   :   0 brbc  :   0 brbs  :   0
60  brcc  :   0 brcs  :   0 break :   0 breq  :   0 brge  :   0 brhc  :   0
61  brhs  :   0 brid  :   0 brie  :   0 brlo  :   0 brlt  :   0 brmi  :   0
62  brne  :   0 brpl  :   0 brsh  :   0 brtc  :   0 brts  :   0 brvc  :   0
63  brvs  :   0 bset  :   0 bst   :   0 call  :   0 cbi   :   0 cbr   :   0
64  clc   :   0 clh   :   0 cli   :   0 cln   :   0 clr   :   0 cls   :   0
65  clt   :   0 clv   :   0 clz   :   0 com   :   1 cp    :   0 cpc   :   0
66  cpi   :   0 cpse  :   0 dec   :   0 des   :   0 eor   :   0 fmul  :   0
67  fmuls :   0 fmulsu:   0 icall :   0 ijmp  :   0 in    :   1 inc   :   0
68  jmp   :   0 ld    :   0 ldd   :   0 ldi   :   2 lds   :   0 lpm   :   0
69  lsl   :   0 lsr   :   0 mov   :   0 movw  :   0 mul   :   0 muls  :   0
70  mulsu :   0 neg   :   0 nop   :   0 or    :   0 ori   :   0 out   :   7
71  pop   :   0 push  :   0 rcall :   0 ret   :   0 reti  :   0 rjmp  :   1
72  rol   :   0 ror   :   0 sbc   :   0 sbci  :   0 sbi   :   0 sbic  :   0
73  sbis  :   0 sbiw  :   0 sbr   :   0 sbrc  :   0 sbrs  :   0 sec   :   0
74  seh   :   0 sei   :   0 sen   :   0 ser   :   0 ses   :   0 set   :   0
75  sev   :   0 sez   :   0 sleep :   0 spm   :   0 st    :   0 std   :   0
76  sts   :   0 sub   :   0 subi  :   0 swap  :   0 tst   :   0 wdr   :   0
77
78  Instructions used: 5 out of 114 (4.4%)
79
80  "ATmega4809" memory use summary [bytes]:
81  Segment    Begin    End      Code   Data   Used    Size   Use%
82  ------------------------------------------------------------
83  [.cseg] 0x000000 0x000018    24      0     24    49152   0.0%
84  [.dseg] 0x002800 0x002800     0      0      0     6144   0.0%
85  [.eseg] 0x000000 0x000000     0      0      0      256   0.0%
86
87  Assembly complete, 0 errors, 0 warnings
88
```