```
1           j start                 # 0
2           add zero, zero, zero    # 4
3           add zero, zero, zero    # 8
4           add zero, zero, zero    # C
5           add zero, zero, zero    # 10
6           add zero, zero, zero    # 14
7           add zero, zero, zero    # 18
8           add zero, zero, zero    # 1C
9   start:
10          lw t0, 12(zero)             # t0
            =非0。没有nor违反布尔代数公理。怎么得到FFFFFFFF?
11          nop
12          nop
13          slt t1, zero, t0        # t1 =0000_0001H
14          nop
15          nop
16          add t2, t1, t1          # t2 =0000_0002H
17          nop
18          nop
19          add t3, t2, t1          # t3 =0000_0003H
20          add a4, t2, t2          # a4 =0000_0004H: 常数4
21          nop
22          add t0, t3, t3          # t0 =0000_0006H
23          nop
24          nop
25          add t0, t0, t0          # t0 =0000_000CH
26          nop
27          nop
28          add t4, t0, t3          # t4 =0000_000FH: F
29          nop
30          nop
31          add t5, t4, t4          # t5 =0000_001EH
32          nop
33          nop
34          add t5, t5, t5          # t5 =0000_003CH
35          nop
36          nop
37          add s0, t5, t3          # s0 =0000_003FH: 常数3F
38          add t5, t5, t5          # t5 =0000_0078H
39          nop
40          nop
41          add t5, t5, t5          # t5 =0000_00F0H
42          nop
43          nop
44          add t6, t5, t4          # t6 =0000_00FFH: FF
45          add t5, t5, t5          # t5 =0000_01E0H
46          nop
47          nop
48          add t5, t5, t5          # t5 =0000_03C0H
49          nop
50          nop
51          add t5, t5, t5          # t5 =0000_0780H
52          nop
53          nop
54          add t5, t5, t5          # t5 =0000_0F00H
55          nop
56          nop
57          add t5, t5, t5          # t5 =0000_1E00H
58          nop
59          nop
60          add t5, t5, t5          # t5 =0000_3C00H
61          nop
62          nop
63          add t5, t5, t5          # t5 =0000_7800H
64          nop
65          nop
66          add t5, t5, t5          # t5 =0000_F000H
67          nop
68          nop
69          add t5, t5, t5          # t5 =0001_7000H
70          nop
71          nop
72          add t5, t5, t5          # t5 =0003_C000H
```

```
73          nop
74          nop
75          add t5, t5, t5          # t5 =0007_8000H
76          nop
77          nop
78          add t5, t5, t5          # t5 =000F_0000H
79          nop
80          nop
81          add t5, t5, t5          # t5 =001E_0000H
82          nop
83          nop
84          add t5, t5, t5          # t5 =003C_0000H
85          nop
86          nop
87          add t5, t5, t5          # t5 =0078_0000H
88          nop
89          nop
90          add t5, t5, t5          # t5 =00F0_0000H
91          nop
92          nop
93          add t5, t5, t5          # t5 =01E0_0000H
94          nop
95          nop
96          add t5, t5, t5          # t5 =03C0_0000H
97          nop
98          nop
99          add t5, t5, t5          # t5 =0780_0000H
100         nop
101         nop
102         add t5, t5, t5          # t5 =0F00_0000H
103         nop
104         nop
105         add t5, t5, t5          # t5 =1E00_0000H
106         nop
107         nop
108         add t5, t5, t5          # t5 =3C00_0000H
109         nop
110         nop
111         add t5, t5, t5          # t5 =7800_0000H
112         nop
113         nop
114         add s1, t5, t5          # S1 =F000_0000H:   GPIO地址
115         nop
116         nop
117         or  a2, s1, t5          # a2 =F8000_0000H:  计数器时常数
118         add s2, s1, s1          # S2 =E000_0000H:   七段显示地址
119         nop
120         nop
121         add t0, s2, s2          # t0 =C000_0000H
122         nop
123         nop
124         add t0, t0, t0          # t0 =8000_0000H:   常数，最高有效位掩码
125                                 # t1 =0000_0001H:   常数
126                                 # s0 =0000_003FH:   常数，计数通道设置
127                                 # S1 =F000_0000H:   GPIO地址
128                                 # S2 =E000_0000H:   DISPLAY地址
129                                 # 4(S1)
                                    =F000_0004H: COUNTER地址

130 loop:
131         sub a3, zero, t1        # x13 =FFFFFFFF(MIPS: nor $t2, zero, zero)
132         sw a2, 0x4(s1)          # 计数器端口: F0000004，送计数常数x12 =F8000000
133         lw a1, 0x0(s1)          #
            读GPIO端口F0000000状态:x11={out0，out1，out2，9'h00，BTN3-BTN0，SW15-SW0}
134         nop
135         nop
136         add a1, a1, a1          # 左移
137         nop
138         nop
139         add a1, a1, a1          # 左移2位将SW与LED对齐，同时D1D0置00，选择计数器通道0
140         nop
141         nop
142         sw a1, 0x0(s1)          #
```

```
          x11输出到GPIO端口F0000000，设置计数器通道counter_set=00端口、LED=SW：{GPIOf0[15:2], LED, GPIOf0[1:0]/counter_set}
143       add s5, s5, t1            # x21=x21+1
144       nop
145       nop
146       sw s5, 0x0(s2)            # x21送s2=E0000000七段码端口
147       lw s6, 0x14(zero)         # 取存储器20单元预存数据至x22，程序计数延时常数
148
149 loop2:
150       lw a1, 0x0(s1)            # 读GPIO端口F0000000状态：{out0，out1，out2，D28-D21，BTN3-BTN0，SW15-SW0}
151       nop
152       nop
153       add a1, a1, a1
154       nop
155       nop
156       add a1, a1, a1            # 左移2位将SW与LED对齐，同时D1D0置00，选择计数器通道0
157       nop
158       nop
159       sw a1, 0x0(s1)            # x11输出到GPIO端口F0000000，计数器通道counter_set=00端口不变、LED=SW：{GPIOf0[15:2], LED, GPIOf0[1:0]/counter_set}
160       lw a1, 0x0(s1)            # 再读GPIO端口F0000000状态
161       nop
162       nop
163       and s8, a1, t0            # 取最高位=out0，屏蔽其余位送x14
164       add s6, s6, t1            # 程序计数延时
165       nop
166       nop
167       #beq    s8, t0, C_init    # 若硬件计数启用：C0=0，Counter通道0溢出，转计数器初始化，修改7段码显示
168       beq s6, zero, C_init      # 程序计数x22=0，转计数器初始化，修改7段码显示：C_init
169       nop
170       nop
171       nop
172 l_next:
173       lw a1, 0x0(s1)            # 再读GPIO端口F0000000开关SW状态
174       add s7, a4, a4            # x14=4，x23=00000008
175       nop
176       nop
177       add s9, s7, s7            # x25=00000010
178       nop
179       nop
180       add s7, s7, s9            # x23=00000018(00011000)：11对应SWO[4:3]
181       nop
182       nop
183       and s8, a1, s7            # 取SW[4:3]：屏蔽其余位送x24
184       nop
185       nop
186       beq s8, zero, L00         # SW[4:3]=00，L00：7段显示"点"循环移位，SW0=0
187       nop
188       nop
189       nop
190       beq s8, s7, L11           # SW[4:3]=11，L11：显示七段图形，SW0=0：Display显示点阵
191       nop
192       nop
193       nop
194       add s7, a4, a4            # x23=8(00001000)
195       nop
196       nop
197       beq s8, s7, L01           # SW[4:3]=01，L01：显示内存预置16进制值，SW0=1，Display显示16进制数
198       nop
199       nop
200       nop
201 L10:  sw s5, 0x0(s2)            # SW[4:3]=10，L10：显示x21(即时值+1)，SW0=1：Display显示16进制数
202       j loop2
203       nop
204       nop
205       nop
206 L00:
```

```
207             beq a5, a3, L4          # x15=ffffffff, 转移L4
208             nop
209             nop
210             nop
211             j L3
212             nop
213             nop
214             nop
215     L4:
216             add a5, a3, a3          # x15=fffffffe:a3=FFFFFFFFH
217             nop
218             nop
219     L3:
220             sw a5, 0x0(s2)          # SW[4:3]=00, 7段显示点移位后显示
221             j loop2
222             nop
223             nop
224     L11:
225             lw s5, 0x60(s3)         # SW[4:3]=11，从内存取预存七段图形
226             nop
227             nop
228             sw s5, 0x0(s2)          # SW[4:3]=11，显示七段图形
229             j loop2
230             nop
231             nop
232             nop
233     L01:
234             lw s5, 0x20(s3)         # SW[4:3]=01，从内存取预存数字
235             nop
236             nop
237             sw s5, 0x0(s2)          # SW[4:3]=01，七段显示预置数字
238             j loop2
239             nop
240             nop
241             nop
242     C_init:
243             lw s6, 0x14(zero)       # 取程序计数延时初始化常数
244             add a5, a5, a5          # X15左移，7段图形点左移
245             nop
246             nop
247             or a5, a5, t1           # x15末位置1，对应右上角不显示
248             add s3, s3, a4          # x14=00000004，LED图形访存地址+4
249             nop
250             nop
251             and s3, s3, s0          # x19=000000XX，屏蔽地址高位，只取6位
252             add s5, s5, t1          # x21+1
253             nop
254             nop
255             beq s5, a3, L6          # x21=ffffffff，重置x21=5
256             j L7
257             nop
258             nop
259             nop
260     L6:
261             add s5, zero, a4        # x21=4
262             nop
263             nop
264             add s5, s5, t1          # 重置x21=5
265     L7:
266             lw a1, 0x0(s1)          # 读GPIO端口F0000000状态
267             nop
268             nop
269             add s8, a1, a1
270             nop
271             nop
272             add s8, s8, s8          # 左移2位将SW与LED对齐，同时D1D0置00，选择计数器通道0
273             nop
274             nop
275             sw s8, 0x0(s1)          #
                x24输出到GPIO端口F0000000，计数器通道counter_set=00端口不变、LED=SW:
                {GPIOf0[15:2], LED, GPIOf0[1:0]/counter_set}
276             sw a2, 0x4(s1)          # 计数器端口：F0000004，送计数常数x12=F8000000
277             j l_next
```

```
278             nop
279             nop
280             nop
281
```