	PC	Machine Code	Basic Code	Original Code	Comment
1	PC	Machine Code	**Basic** Code	Original Code	Comment
2	0x0000_0000	0x0200006F	jal x0 32	j start	# 0
3	0x0000_0004	0x00000033	**add** x0 x0 x0	**add** zero, zero, zero	# 4
4	0x0000_0008	0x00000033	**add** x0 x0 x0	**add** zero, zero, zero	# 8
5	0x0000_000c	0x00000033	**add** x0 x0 x0	**add** zero, zero, zero	# C
6	0x0000_0010	0x00000033	**add** x0 x0 x0	**add** zero, zero, zero	# 10
7	0x0000_0014	0x00000033	**add** x0 x0 x0	**add** zero, zero, zero	# 14
8	0x0000_0018	0x00000033	**add** x0 x0 x0	**add** zero, zero, zero	# 18
9	0x0000_001c	0x00000033	**add** x0 x0 x0	**add** zero, zero, zero	# 1C
10				start:	
11	0x0000_0020	0x00002283	lw x5 20(x0)	lw t0, 0(zero)	# t0 =非0。没有nor违反布尔代数公理。怎么得到FFFFFFFF？
12	0x0000_0024	0x00502333	slt x6 x0 x5	slt t1, zero, t0	# t1 =0000_0001H
13	0x0000_0028	0x006303B3	**add** x7 x6 x6	**add** t2, t1, t1	# t2 =0000_0002H
14	0x0000_002c	0x00638E33	**add** x28 x7 x6	**add** t3, t2, t1	# t3 =0000_0003H
15	0x0000_0030	0x00738733	**add** x14 x7 x7	**add** a4, t2, t2	# a4 =0000_0004H: 常数4
16	0x0000_0034	0x01CE02B3	**add** x5 x28 x28	**add** t0, t3, t3	# t0 =0000_0006H
17	0x0000_0038	0x005282B3	**add** x5 x5 x5	**add** t0, t0, t0	# t0 =0000_000CH
18	0x0000_003c	0x01C28EB3	**add** x29 x5 x28	**add** t4, t0, t3	# t4 =0000_000FH: F
19	0x0000_0040	0x01DE8F33	**add** x30 x29 x29	**add** t5, t4, t4	# t5 =0000_001EH
20	0x0000_0044	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0000_003CH
21	0x0000_0048	0x01CF0433	**add** x8 x30 x28	**add** s0, t5, t3	# s0 =0000_003FH: 常数3F
22	0x0000_004c	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0000_0078H
23	0x0000_0050	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0000_0F0H
24	0x0000_0054	0x01DF0FB3	**add** x31 x30 x29	**add** t6, t5, t4	# t6 =0000_00FFH: FF
25	0x0000_0058	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0000_01E0H
26	0x0000_005c	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0000_03C0H
27	0x0000_0060	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0000_0780H
28	0x0000_0064	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0000_0F00H
29	0x0000_0068	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0000_1E00H
30	0x0000_006c	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0000_3C00H
31	0x0000_0070	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0000_7800H
32	0x0000_0074	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0000_F000H
33	0x0000_0078	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0001_7000H
34	0x0000_007c	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0003_C000H
35	0x0000_0080	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0007_8000H
36	0x0000_0084	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =000F_0000H
37	0x0000_0088	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =001E_0000H
38	0x0000_008c	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =003C_0000H
39	0x0000_0090	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =0078_0000H
40	0x0000_0094	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t5 =00F0_0000H
41	0x0000_0098	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t6 =01E0_0000H
42	0x0000_009c	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t6 =03C0_0000H
43	0x0000_00a0	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t6 =0780_0000H
44	0x0000_00a4	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t6 =0F00_0000H
45	0x0000_00a8	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t6 =1E00_0000H
46	0x0000_00ac	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t6 =3C00_0000H
47	0x0000_00b0	0x01EF0F33	**add** x30 x30 x30	**add** t5, t5, t5	# t6 =7800_0000H
48	0x0000_00b4	0x01EF04B3	**add** x9 x30 x30	**add** s1, t5, t5	# S1 =F000_0000H: GPIO地址
49	0x0000_00b8	0x01E4E633	**or** x12 x9 x30	**or** a2, s1, t5	# a2 =F8000_0000H: 计数器时常数
50	0x0000_00bc	0x00948933	**add** x18 x9 x9	**add** s2, s1, s1	# S2 =E000_0000H: 七段显示地址
51	0x0000_00c0	0x012902B3	**add** x5 x18 x18	**add** t0, s2, s2	# t0 =C000_0000H
52	0x0000_00c4	0x005282B3	**add** x5 x5 x5	**add** t0, t0, t0	# t0 =8000_0000H: 常数，最高有效位掩码
53					# t1 =0000_0001H: 常数
54					# s0 =0000_003FH: 常数，计数通道设置
55					# S1 =F000_0000H: GPIO地址
56					# S2 =E000_0000H: DISPLAY地址
57					# 4(S1) =F000_0004H: COUNTER地址
58				loop:	
59	0x0000_00c8	0x406006B3	**sub** x13 x0 x6	**sub** a3, zero, t1	# x13 =FFFFFFFF(MIPS: nor $t2, zero, zero)
60	0x0000_00cc	0x00C4A223	sw x12 4(x9)	sw a2, 0x4(s1)	# 计数器端口：F0000004，送计数常数x12 =F8000000
61	0x0000_00d0	0x0004A583	lw x11 0(x9)	lw a1, 0x0(s1)	# 读GPIO端口F0000000状态:x11={out0，out1，out2, 9'h00, BTN3-BTN0, SW15-SW0}
62	0x0000_00d4	0x00B585B3	**add** x11 x11 x11	**add** a1, a1, a1	# 左移
63	0x0000_00d8	0x00B585B3	**add** x11 x11 x11	**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
64	0x0000_00dc	0x00B4A023	sw x11 0(x9)	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:
65					# {GPIOf0[15:2], LED, GPIOf0[1:0]/counter_set}
66	0x0000_00e0	0x006A8AB3	**add** x21 x21 x6	**add** s5, s5, t1	# x21=x21+1
67	0x0000_00e4	0x01592023	sw x21 0(x18)	sw s5, 0x0(s2)	# x21送s2=E0000000七段码端口
68	0x0000_00e8	0x01402B03	lw x22 20(x0)	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
69	0x0000_00			loop2:	
70	0x0000_00ec	0x0004A583	lw x11 0(x9)	lw a1, 0x0(s1)	# 读GPIO端口F0000000状态：{out0，out1，out2, D28-D21, BTN3-BTN0, SW15-SW0}
71	0x0000_00f0	0x00B585B3	**add** x11 x11 x11	**add** a1, a1, a1	

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72   0x0000_00f4   0x00B585B3   add x11 x11 x11    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
73   0x0000_00f8   0x00B4A023   sw x11 0(x9)       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：
74                                                                            {GPIOf0[15:2], LED, GPIOf0[1:0]/counter_set}
75   0x0000_00fc   0x0004A583   lw x11 0(x9)       lw a1, 0x0(s1)      # 再读GPIO端口F0000000状态
76   0x0000_0100   0x0055FC33   and x24 x11 x5     and s8, a1, t0      # 取最高位=out0，屏蔽其余位送x14
77   0x0000_0104   0x006B0B33   add x22 x22 x6     add s6, s6, t1      # 程序计数延时
78                              #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
79   0x0000_0108   0x040B0E63   beq x22 x0 92      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
80                                           l_next:
81   0x0000_010c   0x0004A583   lw x11 0(x9)       lw a1, 0x0(s1)      # 再读GPIO端口F0000000开关SW状态
82   0x0000_0110   0x00E70BB3   add x23 x14 x14    add s7, a4, a4      # x14=4，x23=00000008
83   0x0000_0114   0x017B8CB3   add x25 x23 x23    add s9, s7, s7      # x25=00000010
84   0x0000_0118   0x019B8BB3   add x23 x23 x25    add s7, s7, s9      # x23=00000018(00011000)：11对应SWO[4:3]
85   0x0000_011c   0x0175FC33   and x24 x11 x23    and s8, a1, s7      # 取SW[4:3]：屏蔽其余位送x24
86   0x0000_0120   0x000C0C63   beq x24 x0 24      beq s8, zero, L00   # SW[4:3]=00，L00：7段显示"点"循环移位，SW0=0
87   0x0000_0124   0x037C0463   beq x24 x23 40     beq s8, s7, L11     # SW[4:3]=11，L11：显示七段图形，SW0=0：Display显示点阵
88   0x0000_0128   0x00E70BB3   add x23 x14 x14    add s7, a4, a4      # x23=8(00001000)
89   0x0000_012c   0x037C0663   beq x24 x23 44     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
90   0x0000_0130   0x01592023   sw x21 0(x18)      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
91   0x0000_0134   0xFB9FF06F   jal x0 -72         j loop2
92                                           L00:
93   0x0000_0138   0x00D78463   beq x15 x13 8      beq a5, a3, L4      # x15=ffffffff，转移L4
94   0x0000_013c   0x0080006F   jal x0 8           j L3
95                                           L4:
96   0x0000_0140   0x00D687B3   add x15 x13 x13    add a5, a3, a3      # x15=fffffffe:a3=FFFFFFFFH
97                                           L3:
98   0x0000_0144   0x00F92023   sw x15 0(x18)      sw a5, 0x0(s2)      # SW[4:3]=00，7段显示点移位后显示
99   0x0000_0148   0xFA5FF06F   jal x0 -92         j loop2
100                                          L11:
101  0x0000_014c   0x0609AA83   lw x21 96(x19)     lw s5, 0x60(s3)     # SW[4:3]=11，从内存取预存七段图形
102  0x0000_0150   0x01592023   sw x21 0(x18)      sw s5, 0x0(s2)      # SW[4:3]=11，显示七段图形
103  0x0000_0154   0xF99FF06F   jal x0 -104        j loop2
104                                          L01:
105  0x0000_0158   0x0209AA83   lw x21 32(x19)     lw s5, 0x20(s3)     # SW[4:3]=01，从内存取预存数字
106  0x0000_015c   0x01592023   sw x21 0(x18)      sw s5, 0x0(s2)      # SW[4:3]=01，七段显示预置数字
107  0x0000_0160   0xF8DFF06F   jal x0 -116        j loop2
108                                          C_init:
109  0x0000_0164   0x01402B03   lw x22 20(x0)      lw s6, 0x14(zero)   # 取程序计数延时初始化常数
110  0x0000_0168   0x00F787B3   add x15 x15 x15    add a5, a5, a5      # X15左移，7段图形点左移
111  0x0000_016c   0x0067E7B3   or x15 x15 x6      or a5, a5, t1       # x15末位置1，对应右上角不显示
112  0x0000_0170   0x00E989B3   add x19 x19 x14    add s3, s3, a4      # x14=00000004，LED图形访存地址+4
113  0x0000_0174   0x0089F9B3   and x19 x19 x8     and s3, s3, s0      # x19=000000XX，屏蔽地址高位，只取6位
114  0x0000_0178   0x006A8AB3   add x21 x21 x6     add s5, s5, t1      # x21+1
115  0x0000_017c   0x00DA8463   beq x21 x13 8      beq s5, a3, L6      # x21=ffffffff，重置x21=5
116  0x0000_0180   0x00C0006F   jal x0 12          j L7
117                                          L6:
118  0x0000_0184   0x00E00AB3   add x21 x0 x14     add s5, zero, a4    # x21=4
119  0x0000_0188   0x006A8AB3   add x21 x21 x6     add s5, s5, t1      # 重置x21=5
120                                          L7:
121  0x0000_018c   0x0004A583   lw x11 0(x9)       lw a1, 0x0(s1)      # 读GPIO端口F0000000状态
122  0x0000_0190   0x00B58C33   add x24 x11 x11    add s8, 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
123  0x0000_0194   0x018C0C33   add x24 x24 x24    add s8, s8, s8
124  0x0000_0198   0x0184A023   sw x24 0(x9)       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：
125                                                                           {GPIOf0[15:2], LED, GPIOf0[1:0]/counter_set}
126  0x0000_019c   0x00C4A223   sw x12 4(x9)       sw a2, 0x4(s1)      # 计数器端口：F0000004，送计数常数x12=F8000000
127  0x0000_01a0   0xF6DFF06F   jal x0 -148        j l_next
128
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