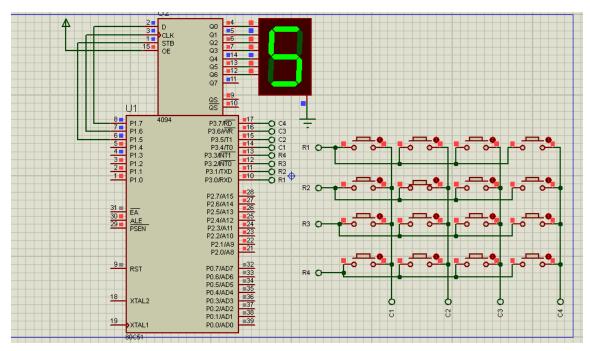
Problem 12

It is the same as problem 11 except that the display is driven by a serial to parallel register 4094



Section 1 initialization

```
16
17
   ; VARIABLES
18
   KEY EQU 30H
   ROW1 EQU P3.0
19
20
   ROW2 EQU P3.1
   ROW3 EQU P3.2
21
   ROW4 EQU P3.3
22
23
   COL1 EQU P3.4
   COL2 EQU P3.5
24
25
   COL3 EQU P3.6
   COL4 EQU P3.7
27
   DAT EQU P1.7
28
29
   CLK EQU P1.6
   STB EQU P1.5
```

Same as problem 11 with the addition of the definitions of 4094 pins (dat,clk,stb)

Section 2 Main code

```
49 Start:
50
51
      MOV A,#10
      MOV DPTR, #DIGIT_CODE
52
      MOVC A,@A + DPTR
53
54
      MOV P1,A
55 LOOP:
      CALL READ KEY
56
      JNC LOOP
57
      MOV A, KEY
      MOV DPTR, #DIGIT_CODE
59
      MOVC A ,@A + DPTR
60
      CALL DISP_KEY
61
      JMP LOOP
```

Same as problem 11 except that we call a function to send the required key value to the 7-segment through converting it to serial data to the 4094 register (line 61 "CALL DISP_KEY")

Function DISP_KEY

```
DISP KEY:
153
154
        CLR STB
155
       MOV R7,#8
156 ALL BITS:
        RLC A
157
       MOV DAT, C
158
        SETB CLK
159
160
       CLR CLK
161
        DJNZ R7, ALL_BITS
        SETB STB
162
163 RET
```

The shift register accepts serial data bit by bit. With each bit, a clock pulse must be sent.

To convert the key value "8-bits parallel" into serial bit stream, we use the rotate left with carry instruction "RLC" (157). This instruction will make internal bit left shift

$C \leftarrow A7 \leftarrow A6 \leftarrow A5 \leftarrow A4 \leftarrow A3 \leftarrow A2 \leftarrow A1 \leftarrow A0 \leftarrow C$

So after executing it the first time, C will contain the value of A7, and we move it to the "DAT" line of the 4094 (158), then we send clock pulse (159-160). We repeat this process for 8 bits (161).

To make the 4094 send this value to the 7-segment, we finally activate the strobe signal "STB".