```
1
2  $NOMOD51
3  $INCLUDE (8051.MCU)
4
5  ;====================================================================
6  ; DEFINITIONS
7  ROW1 BIT P1.0
8  ROW2 BIT P1.1
9  ROW3 BIT P1.2
10 ROW4 BIT P1.3
11 COL1 BIT P1.4
12 COL2 BIT P1.5
13 COL3 BIT P1.6
14 COL4 BIT P1.7
15
16 ;====================================================================
17 ; VARIABLES
18 KEY_CODE        EQU 34H
19 COL             EQU 32H
20
21 ;====================================================================
22 ; RESET and INTERRUPT VECTORS
23       ; Reset Vector
24       ORG   0000H
25       JMP   START
26
27 ;====================================================================
28 ; CODE SEGMENT
29       ORG   0100H
30
31 ; KHAI BAO MANG KY TU TRONG KEYPAD
32 CHAR_CODE: DB '7','8','9','%','4','5','6','x','1','2','3','-','C','0','=','+'
33
34 START:
35       MOV TMOD, #20H            ; TIMER1 CHE DO 2
36       MOV TH1, #0FDH            ; NAP TIMER1 TOC DO BAUD 9600
37       MOV SCON, #50H            ; TRUYEN DU LIEU O CHE DO 1, BAT CHO PHEP TRUYEN
38       MOV R0, #38H              ; R0 LUU DIA CHI BAT DAU CUA PHEP TOAN
39
40 LOOP:
41       MOV R1, #0                ; TOAN HANG 1
42       MOV R2, #0                ; TOAN TU
43       MOV R3, #0                ; TOAN HANG 2
44       MOV R4, #0                ; HANG CHUC KQ
45       MOV R5, #0                ; HANG DON VI KQ
46       MOV R6, #0                ; DANH DAU KET QUA AM
47
48       CLR ROW1
49       CLR ROW2
50       CLR ROW3
51       CLR ROW4
52
53       JNB COL1, SCAN            ; KIEM TRA COT 1 = 0 ?, NEU CO NHAY VAO QUET PHIM DE TIM HANG TUONG UNG
   DUOC BAM
54       JNB COL2, SCAN            ; KIEM TRA COT 2 = 0 ?, ...
55       JNB COL3, SCAN            ; KIEM TRA COT 3 = 0 ?, ...
56       JNB COL4, SCAN            ; KIEM TRA COT 4 = 0 ?, ...
57
58       JMP LOOP
59
60    SCAN:
61       CALL SCAN_KEYPAD          ; QUET PHIM
62       JNB COL1, $               ; CHONG DOI PHIM COT 1
63       JNB COL2, $               ; CHONG DOI PHIM COT 2
64       JNB COL3, $               ; CHONG DOI PHIM COT 3
65       JNB COL4, $               ; CHONG DOI PHIM COT 4
```

```
66
67          MOV @R0, KEY_CODE          ; LUU KY TU QUET DUOC VAO PHEP TOAN
68          DEC R0
69
70          CLR C                      ; XU LY BAM NUT 'C'
71          MOV A, KEY_CODE
72          CALL NUM_TO_CHAR
73          SUBB A, #'C'
74          JZ CLEAR_SCREEN            ; XOA TOAN BO MAN HINH LCD
75
76          MOV A, KEY_CODE            ; HIEN THI KY TU BAM LEN MAN HINH LCD
77          CALL DISPLAY_LCD
78
79          CLR C                      ; XU LY BAM NUT '='
80          MOV A, KEY_CODE
81          CALL NUM_TO_CHAR
82          SUBB A, #'='
83          JZ CALCULATE               ; THUC HIEN TINH TOAN
84
85          JMP LOOP
86
87      CALCULATE:
88          MOV A, 38H                 ; TOAN HANG 1
89          CALL NUM_TO_CHAR
90          CLR C
91          SUBB A, #'0'               ; CHUYEN CHAR THANH SO
92          MOV R1, A                  ; LUU TOAN HANG 1
93
94          MOV A, 36H                 ; TOAN HANG 2
95          CALL NUM_TO_CHAR
96          CLR C
97          SUBB A, #'0'               ; CHUYEN CHAR THANH SO
98          MOV R3, A                  ; LUU TOAN HANG 2
99
100         MOV A, 37H                 ; TOAN TU '+'
101         CALL NUM_TO_CHAR
102         MOV R2, A
103         CLR C
104         SUBB A, #'+'               ; NEU LA TOAN TU '+', NHAY DEN NHAN THUC HIEN PHEP '+'
105         JZ CAL_ADD
106
107         MOV A, R2                  ; TOAN TU '-'
108         CLR C
109         SUBB A, #'-'               ; NEU LA TOAN TU '-', NHAY DEN NHAN THUC HIEN PHEP '-'
110         JZ CAL_SUB
111
112         MOV A, R2                  ; TOAN TU 'x'
113         CLR C
114         SUBB A, #'x'               ; NEU LA TOAN TU 'x', NHAY DEN NHAN THUC HIEN PHEP 'x'
115         JZ CAL_MUL
116
117         MOV A, R2                  ; TOAN TU '%'
118         CLR C
119         SUBB A, #'%'               ; NEU LA TOAN TU '%', NHAY DEN NHAN THUC HIEN PHEP '%'
120         JZ CAL_DIV
121
122     CAL_ADD:                       ; TINH TOAN PHEP '+'
123         MOV A, R1
124         ADD A, R3                  ; KQ = a + b
125         JMP DONE
126
127     CAL_SUB:                       ; TINH TOAN PHEP '-'
128         MOV A, R1
129         CLR C
130         SUBB A, R3                 ; KQ = a - b
131         JNC SUB_DONE               ; KIEM TRA XEM KET QUA CO AM
```

```
      MOV R6, #1
      MOV A, R3
      CLR C
      SUBB A, R1                ; KQ = b - a
      JZ SUB_DONE
   SUB_DONE:
      JMP DONE

   CAL_MUL:                     ; TINH TOAN PHEP 'x'
      MOV A, R1
      MOV B, R3
      MUL AB                    ; KQ = a x b
      JMP DONE

   CAL_DIV:                     ; TINH TOAN PHEP '%'
      MOV A, R3
      JZ ERROR_DISPLAY          ; HIEN THI MATH ERROR NEU A%B KHI B = 0
      MOV A, R1
      MOV B, R3
      DIV AB                    ; KQ = a % b , CHIA LAY PHAN NGUYEN

   DONE:
      CALL SPLIT_BCD            ; TACH KET QUA RA 2 HANG CHUC, HANG DON VI
      JMP WRITE_RESULT          ; HIEN THI KET QUA RA MAN HINH LCD

   CLEAR_SCREEN:                ; GOI HAM XOA MAN HINH LCD
      CALL CLEAR_LCD

      JMP LOOP

   ERROR_DISPLAY:               ; GOI HAM HIEN THI "MATH ERROR"
      CALL ERROR_DISPLAY_FUNCT

   JMP EXIT_CAL                 ; NHAY TOI KET THUC VIEC TINH TOAN

   WRITE_RESULT:                ; GOI HAM HIEN THI KET QUA LEN MAN HINH LCD
      CALL WRITE_RESULT_FUNCT

   EXIT_CAL:                    ; KET THUC VIEC TINH TOAN

JMP LOOP

;============================SUB-PROGRAM=========================

SCAN_KEYPAD:                    ; HAM QUET PHIM
      CLR ROW1                  ; QUET HANG 1
      SETB ROW2
      SETB ROW3
      SETB ROW4
      CLR C

      CALL CHECK_COL
      MOV A, COL
      JZ CHECK_ROW2
      SUBB A, #1                ; 0, 1, 2, 3
      MOV KEY_CODE, A
      JMP EXIT

CHECK_ROW2:                     ; QUET HANG 2
      SETB ROW1
      CLR ROW2
      SETB ROW3
      SETB ROW4

      CALL CHECK_COL            ; KIEM TRA COT TUONG UNG
      MOV A, COL
```

```
198         JZ CHECK_ROW3
199         ADD A, #3                   ; 4, 5, 6, 7
200         MOV KEY_CODE, A
201         JMP EXIT
202
203   CHECK_ROW3:                       ; QUET HANG 3
204         SETB ROW1
205         SETB ROW2
206         CLR ROW3
207         SETB ROW4
208
209         CALL CHECK_COL              ; KIEM TRA COT TUONG UNG
210         MOV A, COL
211         JZ CHECK_ROW4
212         ADD A, #7                   ; 8, 9, 10, 11
213         MOV KEY_CODE, A
214         JMP EXIT
215
216   CHECK_ROW4:                       ; QUET HANG 4
217         SETB ROW1
218         SETB ROW2
219         SETB ROW3
220         CLR ROW4
221
222         CALL CHECK_COL              ; KIEM TRA COT TUONG UNG
223         MOV A, COL
224         JZ EXIT
225         ADD A, #11                  ; 12, 13, 14, 15
226         MOV KEY_CODE, A
227
228   EXIT:
229   RET
230
231   CHECK_COL:                        ; HAM KIEM TRA COT DUOC BAM
232         JB COL1, CHECK_COL2         ; KIEM TRA COT 1
233         MOV COL, #1
234         JMP FINISH
235
236   CHECK_COL2:                       ; KIEM TRA COT 2
237         JB COL2, CHECK_COL3
238         MOV COL, #2
239         JMP FINISH
240
241   CHECK_COL3:                       ; KIEM TRA COT 3
242         JB COL3, CHECK_COL4
243         MOV COL, #3
244         JMP FINISH
245
246   CHECK_COL4:                       ; KIEM TRA COT 4
247         JB COL4, NO_COL
248         MOV COL, #4
249         JMP FINISH
250
251   NO_COL:
252         MOV COL, #0                 ; KHONG CO COT NAO DUOC BAM
253
254   FINISH:
255   RET
256
257   DISPLAY_LCD:                      ; HAM HIEN THI PHIM BAM LEN MAN HINH LCD
258         CALL NUM_TO_CHAR            ; CHUYEN KY TU BAM TUONG UNG TU BAN PHIM THANH CHAR
259         CALL WRITE_LCD              ; HIEN THI KY TU LEN MAN HINH LCD
260   RET
261
262   WRITE_LCD:                        ; HAM HIEN THI KY TU LEN MAN HINH LCD
263         SETB TR1
```

```
264         MOV SBUF, A                 ; GHI DU LIEU CAN TRUYEN LEN THANH GHI SBUF
265         JNB TI, $                   ; DOI TRUYEN XONG
266         CLR TI
267         CLR TR1
268 RET
269
270 NUM_TO_CHAR:                        ; HAM CHUYEN KY TU BAM TUONG UNG TU BAN PHIM THANH CHAR
271         MOV DPTR, #CHAR_CODE
272         MOVC A, @A+DPTR
273 RET
274
275 RESET_DATA:                         ; HAM RESET LAI DU LIEU VUNG LUU PHEP TINH
276     MOV 38H, #0
277     MOV 37H, #0
278     MOV 36H, #0
279     MOV R0, #38H                    ; GAN LAI R0 O DAU PHEP TINH
280
281 RET
282
283 SPLIT_BCD:                          ; HAM TACH KET QUA THANH HANG CHUC, HANG DON VI
284         MOV B, #10
285         DIV AB
286         MOV R4, A
287         MOV R5, B
288
289 RET
290
291 CLEAR_LCD:                         ; HAM XOA TOAN BO MAN HINH LCD
292         MOV A, #0FEH
293         CALL WRITE_LCD
294         MOV A, #01H
295         CALL WRITE_LCD
296         CALL RESET_DATA
297 RET
298
299 DELAY:                              ; HAM DELAY TRONG KHOANG 5MS
300         MOV R0, #10
301     LOOP_DELAY1:
302         MOV R1, #250
303     LOOP_DELAY2:
304         DJNZ R1, LOOP_DELAY2
305         DJNZ R0, LOOP_DELAY1
306 RET
307
308 ERROR_DISPLAY_FUNCT:                ; HAM HIEN THI 'MATH ERROR' LEN MAN HINH LCD
309         CALL CLEAR_LCD              ; XOA MAN HINH LCD TRUOC KHI HIEN THI 'MATH ERROR'
310         CALL DELAY                  ; DELAY 5MS
311         MOV A, #'M'                 ; HIEN THI KY TU 'M'
312         CALL WRITE_LCD
313         MOV A, #'A'                 ; ...               'A'
314         CALL WRITE_LCD
315         MOV A, #'T'                 ; ...               'T'
316         CALL WRITE_LCD
317         MOV A, #'H'                 ; ...               'H'
318         CALL WRITE_LCD
319         MOV A, #' '                 ; ...               ' '
320         CALL WRITE_LCD
321         MOV A, #'E'                 ; ...               'E'
322         CALL WRITE_LCD
323         MOV A, #'R'                 ; ...               'R'
324         CALL WRITE_LCD
325         MOV A, #'R'                 ; ...               'R'
326         CALL WRITE_LCD
327         MOV A, #'O'                 ; ...               'O'
328         CALL WRITE_LCD
329         MOV A, #'R'                 ; ...               'R'
```

```
330         CALL WRITE_LCD
331  RET
332
333  WRITE_RESULT_FUNCT:             ; HAM HIEN THI KET QUA LEN MAN HINH LCD
334         MOV A, R6                ; KIEM TRA DAU '-' TRONG KET QUA VA HIEN THI NEU CO
335         JZ NOT_NEG
336         MOV A, #'-'
337         CALL WRITE_LCD
338      NOT_NEG:
339         MOV A, R4                ; NEU KET QUA LA '0N' THI CHI HIEN THI 'N'
340         JZ HC_ZERO
341         ADD A, #'0'
342         CALL WRITE_LCD           ; HIEN THI HANG CHUC
343      HC_ZERO:
344         MOV A, R5
345         ADD A, #'0'
346         CALL WRITE_LCD           ; HIEN THI HANG DON VI
347  RET
348
349  END
350
```