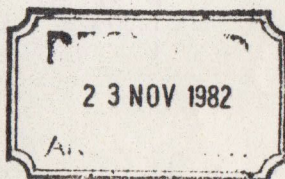


## Micro-Professor Application Note

— DOC. NO. MPF-I-04 -210A —

# PLAYING POKER GAME WITH MPF-I

An Application Example of Z80-PIO.



### MULTITECH INDUSTRIAL CORPORATION

OFFICE : 977, MIN SHEN E. ROAD, TAIPEI, 105, TAIWAN, R.O.C.  
TEL: (02)769-1225 (10 LINES) TELEX: 23756 MULTIIC  
FACTORY: 5, TECHNOLOGY ROAD III  
HSINCHU SCIENCE-BASED INDUSTRIAL PARK.  
HSINCHU, TAIWAN, 300, R.O.C.  
TEL: (035)775102 (3 LINES)

US\$1.00

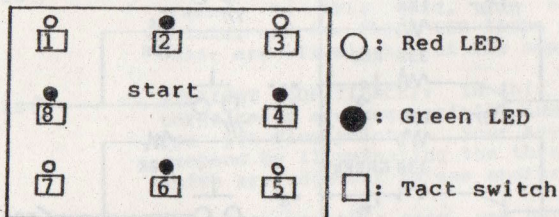
**Purpose:** Simulating poker with PIO in order to familiarize with its functions.

**Required Equipment:** The MPF-I, a PIO, tact switch x 9  
10K ohm 1/4W x 16      2SA 1015 x 8  
330 ohm 1/4W x 8      Green LED x 4  
PCB 100mm x 70mm      Red LED x 4

**Experiment Explanation:**

1. This experiment is similar to poker game. The only difference is that the conventional poker game uses five cards as a suit. However, this experiment deals only three-card suit to players.
2. You are required to make your own keyboard and external circuitry. The keyboard is shown below

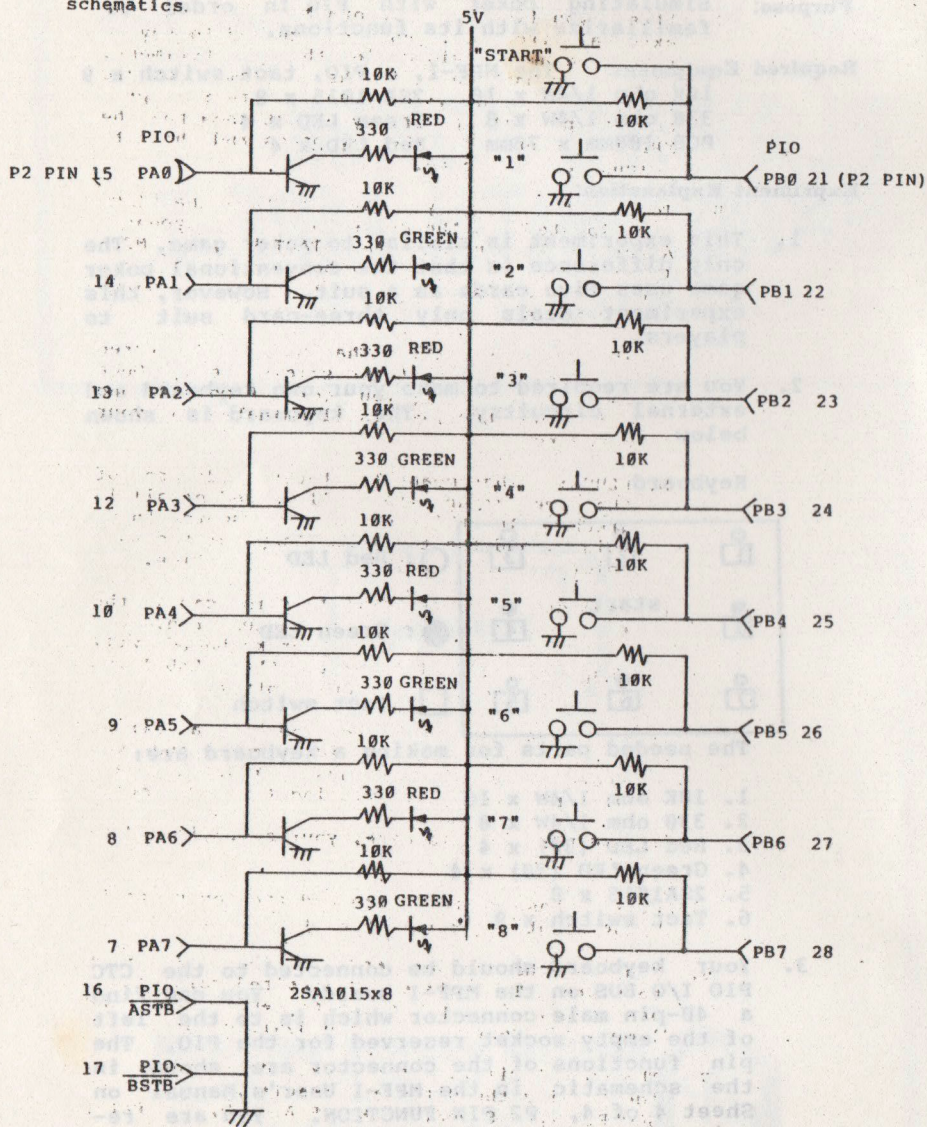
Keyboard



The needed parts for making a keyboard are:

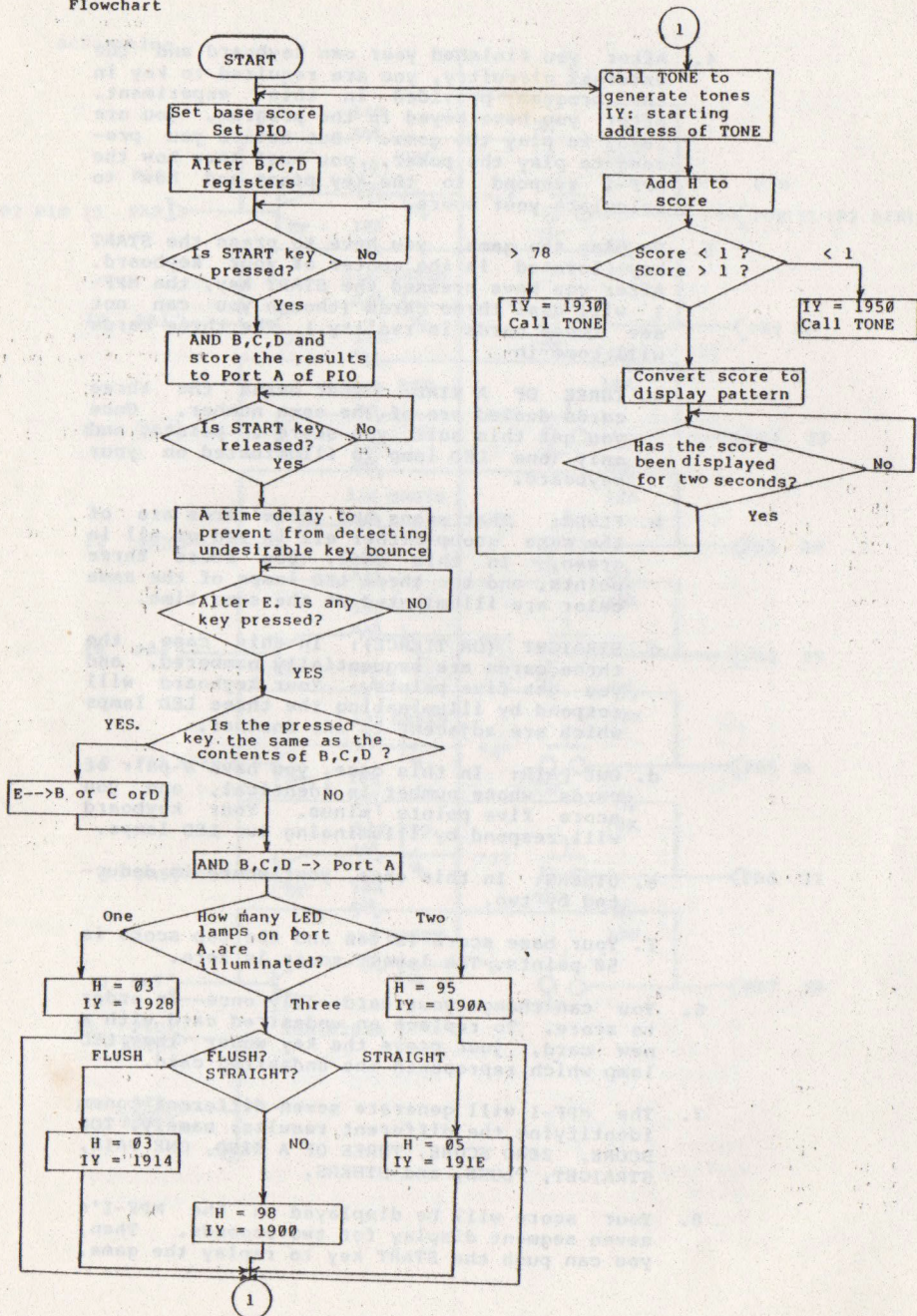
1. 10K ohm 1/4W x 16
  2. 330 ohm 1/4W x 8
  3. Red LED (30) x 4
  4. Green LED (30) x 4
  5. 2SA1015 x 8
  6. Tact switch x 9
3. Your keyboard should be connected to the CTC PIO I/O BUS on the MPF-I board. You can find a 40-pin male connector which is to the left of the empty socket reserved for the PIO. The pin functions of the connector are shown in the schematic in the MPF-I User's Manual on Sheet 4 of 4, P2 PIN FUNCTION. You are required to make the connections in accordance with the schematics provided in this experiment, which is shown below:

schematics.



4. After you finished your own Keyboard and the external circuitry, you are required to key in the program provided in this experiment. After you have keyed in the program, you are ready to play the game. But before you proceed to play the poker, you must know how the MPF-I respond to the key press and how to calculate your score.
5. To play the game, you have to press the START key located in the center of your keyboard. After you have pressed the START key, the MPF-I will deal three cards (though you can not see these cards in reality.) The three cards will come in
  - a. THREE OF A KIND: That means the three cards dealt are of the same number. Once you get this suit, you score 20 points, and only one LED lamp is illuminated on your keyboard.
  - b. FLUSH: That means the three cards are of the same group--either all in red or all in green. In this case, you score three points, and the three LED lamps of the same color are illuminated at the same time.
  - c. STRAIGHT (OR TIERCE): In this case, the three cards are sequentially numbered, and you get five points. Your keyboard will respond by illuminating the three LED lamps which are adjacent to one another.
  - d. ONE PAIR: In this case, you have a pair of cards whose number is identical, and you score five points minus. Your keyboard will respond by illuminating two LED lamps.
  - e. OTHERS: In this case, your score is deducted by two.
  - f. Your base score is ten and the top score is 50 points. The lowest score is zero.
6. You can change your card--only once--in order to score. To replace an undesired card with a new card, just press the key under the LED lamp which represents the undesired card.
7. The MPF-I will generate seven different tones identifying the different results; namely, TOP SCORE, ZERO SCORE, THREE OF A KIND, ONE PAIR, STRAIGHT, FLUSH, and OTHERS.
8. Your score will be displayed on the MPF-I's seven segment display for two seconds. Then, you can push the START key to replay the game.

# Flowchart



```

1800      1      ORG      1800H
          2      PIODA   EQU      80H
          3      PIODB   EQU      81H
          4      PIOCA   EQU      82H
          5      SCAN1   EQU      0624H
          6      HEX7SG  EQU      0678H
1800      7      LD      HL,0
1803      8      LD      (SC0BF+2),HL
1806      9      LD      (SC0BF+4),HL
1809      10     M1:     LD      A,10      ;Set base score
180B      11     LD      (SCORE),A      ;to 10.
180E      12     M2:     LD      IX,SC0BF
1812      13     LD      A,8FH      ;Set PIO's Port A to
1814      14     OUT     (PIOCA),A      ;byte output and port
          15     ;B to byte input mode.
          16     LD      A,0FFH      ;Port A outputs
          17     ;11111111.
1816      18     OUT     (PIODA),A      ;to keep the LED off.
          19     M3      LD      D,0FEH
181A      20     LD      C,D
181D      21     LD      B,D
181E      22     M4      IN      A,(PIODB) ;Check if a key
1820      23     CP      0FEH      ;is pressed? If the
1822      24     JR      M5      ;START key was not
1824      25     RLC      B      ;pressed, then
          26     ;alter the
1826      27     JR      C,M4      ;value of registers
          28     ;B,C,D.
1828      29     RLC      C      ;If the START key was
182A      30     JR      C,M1      ;pressed, then execute
182C      31     RLC      D      ;M5.
182E      32     JR      M4
          33     ;*****
1830      34     M5      LD      A,B      ;AND B,C,D
1831      35     AND      C
1832      36     AND      D
1833      37     OUT     (PIODA),A      ;Store the results of
          38     ;ANDED B,C,D to Port A
          39     ;to illuminate 1 to 3
          40     ;LED lamps.
1835      41     LD      E,0FEH
          42     M6:
          43     ; The next three instructions are to check
          44     ; whether the pressed key is released?
1837      45     IN      A,(PIODB)
1839      46     CP      0FFH
183B      47     JR      NZ,M6
183D      48     LD      H,0FFH      ;A time delay
183F      49     M7      LD      L,0FFH ;to prevent from
1841      50     M8      DEC     L      ;detecting undesirable
1842      51     JR      NZ,M8      ;key bounce.
1844      52     DEC     H
1845      53     JR      NZ,M7
1847      54     IN      A,(PIODB) ;Detect if a key
1849      55     M9      RLC      E      ;is pressed? If not,
184B      56     CP      0FFH      ;alter the value
184D      57     JR      Z,M9      ;of E.
184F      58     CP      B      ;If the key pressed

```

|      |          |     |     |     |           |                              |
|------|----------|-----|-----|-----|-----------|------------------------------|
| 1850 | 2003     | 59  |     | JR  | NZ,M10    | ;has the same                |
| 1852 | 43       | 60  |     | LD  | B,E       | ;internal code as            |
|      |          | 61  |     |     |           | ;the content of the          |
|      |          | 62  |     |     |           | ;B register,                 |
|      |          | 63  |     |     |           | ;load E to B.                |
| 1853 | 180A     | 64  |     | JR  | M12       |                              |
| 1855 | B9       | 65  | M10 | CP  | C         | ;If the internal code of     |
| 1856 | 2003     | 66  |     | JR  | NZ,M11    | ;the key pressed is the same |
| 1858 | 4B       | 67  |     | LD  | C,E       | ;as the content of C,        |
|      |          | 68  |     |     |           | ;load E to C.                |
| 1859 | 1804     | 69  |     | JR  | M12       |                              |
| 185B | EA       | 70  | M11 | CP  | D         | ;If the internal code of     |
| 185C | 2006     | 71  |     | JR  | NZ,M13    | ;the key pressed is the same |
| 185E | 53       | 72  |     | LD  | D,E       | ;as the content of C,        |
|      |          | 73  |     |     |           | ;load E to D.                |
| 185F | 78       | 74  | M12 | LD  | A,B       | ;Output the ANDed value      |
| 1860 | A1       | 75  |     | AND | C         | ;of B,C,D to Port A          |
| 1861 | A2       | 76  |     | AND | D         | ;to illuminate 1 to 3 LED.   |
| 1862 | D380     | 77  |     | OUT | (PIODA),A |                              |
| 1864 | DB80     | 78  | M13 | IN  | A,(PIODA) | ;Check the illuminated       |
| 1866 | 2609     | 79  |     | LD  | H,09      | ;LED lamps connected to      |
| 1868 | 2E00     | 80  |     | LD  | L,0       | ;Port A                      |
| 186A | 25       | 81  | M14 | DEC | H         |                              |
| 186B | 2807     | 82  |     | JR  | Z,M15     |                              |
| 186D | CB07     | 83  |     | RLC | A         |                              |
| 186F | 38F9     | 84  |     | JR  | C,M14     |                              |
| 1871 | 2C       | 85  |     | INC | L         |                              |
| 1872 | 18F6     | 86  |     | JR  | M14       |                              |
| 1874 | 7D       | 87  | M15 | LD  | A,L       | ;If L = 1, only one          |
| 1875 | FE01     | 88  |     | CP  | 01        | ;LED lamp was illuminated.   |
| 1877 | 2008     | 89  |     | JR  | NZ,M16    |                              |
| 1879 | FD212819 | 90  |     | LD  | IY,TAB5   | ;Load the starting address   |
|      |          | 91  |     |     |           | ;of TONE to IY.              |
| 187D | 2614     | 92  |     | LD  | H,20      | ;Put the score to H.         |
| 187F | 1845     | 93  |     | JR  | M23       |                              |
| 1881 | FE02     | 94  | M16 | CP  | 02        | ;If L = 2, two LED           |
| 1883 | 2008     | 95  |     | JR  | NZ,M17    | ;lamps were illuminated.     |
| 1885 | FD210F19 | 96  |     | LD  | IY,TAB2   | ;Load the stating address    |
|      |          | 97  |     |     |           | ;of TAB2 to IY.              |
| 1889 | 265F     | 98  |     | LD  | H,95      | ;Load score to H.            |
| 188B | 1839     | 99  |     | JR  | M23       |                              |
| 188D | DB80     | 100 | M17 | IN  | A,(PIODA) | ;Check to see how many       |
| 188F | 2E08     | 101 |     | LD  | L,08      | ;LED lamps on Port A         |
| 1891 | 2D       | 102 | M18 | DEC | L         | ;are illuminated?            |
| 1892 | 2810     | 103 |     | JR  | Z,M19     | ;If three adjacent LED       |
| 1894 | CB07     | 104 |     | RLC | A         | ;lamps are illuminated,      |
| 1896 | 38F9     | 105 |     | JR  | C,M18     | ;load 5 to H (which is       |
| 1898 | CB07     | 106 |     | RLC | A         | ;the register used to put    |
| 189A | 38F5     | 107 |     | JR  | C,M18     | ;score.)                     |
| 189C | FD211F19 | 108 |     | LD  | IY,TAB4   | ;Load the starting address   |
|      |          | 109 |     |     |           | ;of TAB4 to IY.              |
| 18A0 | 2605     | 110 |     | LD  | H,05      |                              |
| 18A2 | 1822     | 111 |     | JR  | M23       |                              |
| 18A4 | DB80     | 112 | M19 | IN  | A,(PIODA) | ;Check the illuminated       |
| 18A6 | 2E08     | 113 |     | LD  | L,08      | ;LED lamps on Port A.        |
| 18A8 | 1E03     | 114 | M20 | LD  | E,03      | ;If the three lighted        |
| 18AA | 2D       | 115 |     | DEC | L         | ;LED lamps are of the        |
| 18AB | 2813     | 116 |     | JR  | Z,M22     | ;same color,                 |

|      |          |     |       |      |           |                                |
|------|----------|-----|-------|------|-----------|--------------------------------|
| 18AD | CB07     | 117 | M21   | RLC  | A         |                                |
| 18AF | 38F7     | 118 |       | JR   | C,M20     |                                |
| 18B1 | CB07     | 119 |       | RLC  | A         |                                |
| 18B3 | 30F3     | 120 |       | JR   | NC,M20    |                                |
| 18B5 | 1D       | 121 |       | DEC  | E         |                                |
| 18B6 | 20F5     | 122 |       | JR   | NZ,M21    |                                |
| 18B8 | 2603     | 123 |       | LD   | H,03      | ;then load 3 to H,             |
| 18BA | FD211819 | 124 |       | LD   | IY,TAB3   | ;and load the stating address  |
|      |          | 125 |       |      |           | ;of TAB3 to IY.                |
| 18BE | 1806     | 126 |       | JR   | M23       |                                |
| 18C0 | 2662     | 127 | M22   | LD   | H,98      | ;If none of the above happens, |
|      |          | 128 |       |      |           | ;load 98H (-2 in decimal)      |
|      |          | 129 |       |      |           | ;to H.                         |
| 18C2 | FD210819 | 130 |       | LD   | IY,TAB1   | ;and load TAB1 to IY.          |
| 18C6 | CD5D19   | 131 | M23   | CALL | TONE      | ;Generate a tone.              |
| 18C9 | 3A0019   | 132 |       | LD   | A,(SCORE) | ;Add accumulated score         |
| 18CC | 34       | 133 |       | ADD  | A,H       | ;together.                     |
| 18CD | 27       | 134 |       | DAA  |           |                                |
| 18CE | FE01     | 135 |       | CP   | 01        | ;If the total score < 1,       |
| 18D0 | F2DD18   | 136 |       | JP   | P,M24     |                                |
| 18D3 | FD214C19 | 137 |       | LD   | IY,TAB7   | ;load TAB7 to IY.              |
| 18D7 | CD5D19   | 138 |       | CALL | TONE      | ;After generating a tone,      |
| 18DA | C30918   | 139 |       | JP   | M1        | ;jump to M1 to replay          |
|      |          | 140 |       |      |           | ;the game.                     |
| 18DD | FE32     | 141 | M24   | CP   | 50        | ;If the total score > 50,      |
| 18DF | FAEC18   | 142 |       | JP   | M,M25     |                                |
| 18E2 | FD213D19 | 143 |       | LD   | IY,TAB6   | ;load TAB6 to IY.              |
| 18E6 | CD5D19   | 144 |       | CALL | TONE      | ;After generating a tone,      |
| 18E9 | C30918   | 145 |       | JP   | M1        | ;jump to M1 to replay.         |
| 18EC | 210219   | 146 | M25   | LD   | HL,SC0BF  |                                |
| 18EF | 320019   | 147 |       | LD   | (SCORE),A | ;Load score to SCORE.          |
| 18F2 | CD7806   | 148 |       | CALL | HEX7SG    | ;Convert score to              |
|      |          | 149 |       |      |           | ;display pattern.              |
| 18F5 | 26BB     | 150 |       | LD   | H,0BBH    |                                |
| 18F7 | CD2406   | 151 | M26   | CALL | SCAN1     |                                |
| 18FA | 25       | 152 |       | DEC  | H         | ;Press any key of the MPF-I,   |
| 18FB | 20FA     | 153 |       | JR   | NZ,M26    |                                |
| 18FD | C31A18   | 154 |       | JP   | M3        | ;then jump to M3.              |
| 1900 |          | 155 | SCORE | DEFS | 2         |                                |
| 1902 |          | 156 | SC0BF | DEFS | 6         |                                |
| 1908 | 22BB     | 157 | TAB1: | DEFW | 0BB22H    |                                |
| 190A | 66DD     | 158 |       | DEFW | 0DD66H    |                                |
| 190C | 99FF     | 159 |       | DEFW | 0FF99H    |                                |
| 190E | 00       | 160 |       | DEFB | 0         |                                |
| 190F | 6655     | 161 | TAB2: | DEFW | 5566H     |                                |
| 1911 | 99AA     | 162 |       | DEFW | 0AA99H    |                                |
| 1913 | CCDD     | 163 |       | DEFW | 0DDCCH    |                                |
| 1915 | 99FF     | 164 |       | DEFW | 0FF99H    |                                |
| 1917 | 00       | 165 |       | DEFB | 0         |                                |
| 1918 | 11AA     | 166 | TAB3: | DEFW | 0AA11H    |                                |
| 191A | 2288     | 167 |       | DEFW | 8822H     |                                |
| 191C | 3366     | 168 |       | DEFW | 6633H     |                                |
| 191E | 00       | 169 |       | DEFB | 0         |                                |
| 191F | 11AA     | 170 | TAB4: | DEFW | 0AA11H    |                                |
| 1921 | 3388     | 171 |       | DEFW | 8833H     |                                |
| 1923 | 11AA     | 172 |       | DEFW | 0AA11H    |                                |
| 1925 | 3388     | 173 |       | DEFW | 8833H     |                                |
| 1927 | 00       | 174 |       | DEFB | 0         |                                |

|      |          |     |     |     |           |                              |
|------|----------|-----|-----|-----|-----------|------------------------------|
| 1850 | 2003     | 59  |     | JR  | NZ,M10    | ;has the same                |
| 1852 | 43       | 60  |     | LD  | B,E       | ;internal code as            |
|      |          | 61  |     |     |           | ;the content of the          |
|      |          | 62  |     |     |           | ;B register,                 |
|      |          | 63  |     |     |           | ;load E to B.                |
| 1853 | 180A     | 64  |     | JR  | M12       |                              |
| 1855 | B9       | 65  | M10 | CP  | C         | ;If the internal code of     |
| 1856 | 2003     | 66  |     | JR  | NZ,M11    | ;the key pressed is the same |
| 1858 | 4B       | 67  |     | LD  | C,E       | ;as the content of C,        |
|      |          | 68  |     |     |           | ;load E to C.                |
| 1859 | 1804     | 69  |     | JR  | M12       |                              |
| 185B | BA       | 70  | M11 | CP  | D         | ;If the internal code of     |
| 185C | 2006     | 71  |     | JR  | NZ,M13    | ;the key pressed is the same |
| 185E | 53       | 72  |     | LD  | D,E       | ;as the content of C,        |
|      |          | 73  |     |     |           | ;load E to D.                |
| 185F | 78       | 74  | M12 | LD  | A,B       | ;Output the ANDed value      |
| 1860 | A1       | 75  |     | AND | C         | ;of B,C,D to Port A          |
| 1861 | A2       | 76  |     | AND | D         | ;to illuminate 1 to 3 LED.   |
| 1862 | D380     | 77  |     | OUT | (PIODA),A |                              |
| 1864 | DB80     | 78  | M13 | IN  | A,(PIODA) | ;Check the illuminated       |
| 1866 | 2609     | 79  |     | LD  | H,09      | ;LED lamps connected to      |
| 1868 | 2E00     | 80  |     | LD  | L,0       | ;Port A                      |
| 186A | 25       | 81  | M14 | DEC | H         |                              |
| 186B | 2807     | 82  |     | JR  | Z,M15     |                              |
| 186D | CB07     | 83  |     | RLC | A         |                              |
| 186F | 38F9     | 84  |     | JR  | C,M14     |                              |
| 1871 | 2C       | 85  |     | INC | L         |                              |
| 1872 | 18F5     | 86  |     | JR  | M14       |                              |
| 1874 | 7D       | 87  | M15 | LD  | A,L       | ;If L = 1, only one          |
| 1875 | FE01     | 88  |     | CP  | 01        | ;LED lamp was illuminated.   |
| 1877 | 2008     | 89  |     | JR  | NZ,M16    |                              |
| 1879 | FD212819 | 90  |     | LD  | IY,TAB5   | ;Load the starting address   |
|      |          | 91  |     |     |           | ;of TONE to IY.              |
| 187D | 2614     | 92  |     | LD  | H,20      | ;Put the score to H.         |
| 187F | 1845     | 93  |     | JR  | M23       |                              |
| 1881 | FE02     | 94  | M16 | CP  | 02        | ;If L = 2, two LED           |
| 1883 | 2008     | 95  |     | JR  | NZ,M17    | ;lamps were illuminated.     |
| 1885 | FD210F19 | 96  |     | LD  | IY,TAB2   | ;Load the stating address    |
|      |          | 97  |     |     |           | ;of TAB2 to IY.              |
| 1889 | 265F     | 98  |     | LD  | H,95      | ;Load score to H.            |
| 188B | 1839     | 99  |     | JR  | M23       |                              |
| 188D | DB80     | 100 | M17 | IN  | A,(PIODA) | ;Check to see how many       |
| 188F | 2E08     | 101 |     | LD  | L,08      | ;LED lamps on Port A         |
| 1891 | 2D       | 102 | M18 | DEC | L         | ;are illuminated?            |
| 1892 | 2810     | 103 |     | JR  | Z,M19     | ;If three adjacent LED       |
| 1894 | CB07     | 104 |     | RLC | A         | ;lamps are illuminated,      |
| 1896 | 38F9     | 105 |     | JR  | C,M18     | ;load 5 to H (which is       |
| 1898 | CB07     | 106 |     | RLC | A         | ;the register used to put    |
| 189A | 38F5     | 107 |     | JR  | C,M18     | ;score.)                     |
| 189C | FD211F19 | 108 |     | LD  | IY,TAB4   | ;Load the starting address   |
|      |          | 109 |     |     |           | ;of TAB4 to IY.              |
| 18A0 | 2605     | 110 |     | LD  | H,05      |                              |
| 18A2 | 1822     | 111 |     | JR  | M23       |                              |
| 18A4 | DB80     | 112 | M19 | IN  | A,(PIODA) | ;Check the illuminated       |
| 18A6 | 2E08     | 113 |     | LD  | L,08      | ;LED lamps on Port A.        |
| 18A8 | 1E03     | 114 | M20 | LD  | E,03      | ;If the three lighted        |
| 18AA | 2D       | 115 |     | DEC | L         | ;LED lamps are of the        |
| 18AB | 2813     | 116 |     | JR  | Z,M22     | ;same color,                 |

LOC OBJ CODE M. STMT SOURCE STATEMENT

ASM 5.9

|      |          |     |       |      |           |                                |
|------|----------|-----|-------|------|-----------|--------------------------------|
| 18AD | CB07     | 117 | M21   | RLC  | A         |                                |
| 18AF | 38F7     | 118 |       | JR   | C,M20     |                                |
| 18B1 | CB07     | 119 |       | RLC  | A         |                                |
| 18B3 | 30F3     | 120 |       | JR   | NC,M20    |                                |
| 18B5 | 1D       | 121 |       | DEC  | E         |                                |
| 18B6 | 20F5     | 122 |       | JR   | NZ,M21    |                                |
| 18B8 | 2603     | 123 |       | LD   | H,03      | ;then load 3 to H,             |
| 18BA | FD211819 | 124 |       | LD   | IY,TAB3   | ;and load the stating address  |
|      |          | 125 |       |      |           | ;of TAB3 to IY.                |
| 18BE | 1806     | 126 |       | JR   | M23       |                                |
| 18C0 | 2662     | 127 | M22   | LD   | H,98      | ;If none of the above happens, |
|      |          | 128 |       |      |           | ;load 98H (-2 in decimal)      |
|      |          | 129 |       |      |           | ;to H.                         |
| 18C2 | FD210819 | 130 |       | LD   | IY,TAB1   | ;and load TAB1 to IY.          |
| 18C6 | CD5D19   | 131 | M23   | CALL | TONE      | ;Generate a tone.              |
| 18C9 | 3A0019   | 132 |       | LD   | A,(SCORE) | ;Add accumulated score         |
| 18CC | 34       | 133 |       | ADD  | A,H       | ;together.                     |
| 18CD | 27       | 134 |       | DAA  |           |                                |
| 18CE | FE01     | 135 |       | CP   | 01        | ;If the total score < 1,       |
| 18D0 | F2DD18   | 136 |       | JP   | P,M24     |                                |
| 18D3 | FD214C19 | 137 |       | LD   | IY,TAB7   | ;load TAB7 to IY.              |
| 18D7 | CD5D19   | 138 |       | CALL | TONE      | ;After generating a tone,      |
| 18DA | C30918   | 139 |       | JP   | M1        | ;jump to M1 to replay          |
|      |          | 140 |       |      |           | ;the game.                     |
| 18DD | FE32     | 141 | M24   | CP   | 50        | ;If the total score > 50,      |
| 18DF | FAEC18   | 142 |       | JP   | M,M25     |                                |
| 18E2 | FD213D19 | 143 |       | LD   | IY,TAB6   | ;load TAB6 to IY.              |
| 18E6 | CD5D19   | 144 |       | CALL | TONE      | ;After generating a tone,      |
| 18E9 | C30918   | 145 |       | JP   | M1        | ;jump to M1 to replay.         |
| 18EC | 210219   | 146 | M25   | LD   | HL,SC0BF  |                                |
| 18EF | 320019   | 147 |       | LD   | (SCORE),A | ;Load score to SCORE.          |
| 18F2 | CD7806   | 148 |       | CALL | HEX7SG    | ;Convert score to              |
|      |          | 149 |       |      |           | ;display pattern.              |
| 18F5 | 26BB     | 150 |       | LD   | H,0BBH    |                                |
| 18F7 | CD2406   | 151 | M26   | CALL | SCAN1     |                                |
| 18FA | 25       | 152 |       | DEC  | H         | ;Press any key of the MPP-I,   |
| 18FB | 20FA     | 153 |       | JR   | NZ,M26    |                                |
| 18FD | C31A18   | 154 |       | JP   | M3        | ;then jump to M3.              |
| 1900 |          | 155 | SCORE | DEFS | 2         |                                |
| 1902 |          | 156 | SC0BF | DEFS | 6         |                                |
| 1908 | 22BB     | 157 | TAB1: | DEFW | 0BB22H    |                                |
| 190A | 66DD     | 158 |       | DEFW | 0DD66H    |                                |
| 190C | 99FF     | 159 |       | DEFW | 0FF99H    |                                |
| 190E | 00       | 160 |       | DEFB | 0         |                                |
| 190F | 6655     | 161 | TAB2: | DEFW | 5566H     |                                |
| 1911 | 99AA     | 162 |       | DEFW | 0AA99H    |                                |
| 1913 | CCDD     | 163 |       | DEFW | 0DDCCH    |                                |
| 1915 | 99FF     | 164 |       | DEFW | 0FF99H    |                                |
| 1917 | 00       | 165 |       | DEFB | 0         |                                |
| 1918 | 11AA     | 166 | TAB3: | DEFW | 0AA11H    |                                |
| 191A | 2288     | 167 |       | DEFW | 8822H     |                                |
| 191C | 3366     | 168 |       | DEFW | 6633H     |                                |
| 191E | 00       | 169 |       | DEFB | 0         |                                |
| 191F | 11AA     | 170 | TAB4: | DEFW | 0AA11H    |                                |
| 1921 | 3388     | 171 |       | DEFW | 8833H     |                                |
| 1923 | 11AA     | 172 |       | DEFW | 0AA11H    |                                |
| 1925 | 3388     | 173 |       | DEFW | 8833H     |                                |
| 1927 | 00       | 174 |       | DEFB | 0         |                                |

|      |        |     |       |      |          |
|------|--------|-----|-------|------|----------|
| 1928 | 77FF   | 175 | TAB5: | DEFW | 0FF77H   |
| 192A | 66EE   | 176 |       | DEFW | 0EE66H   |
| 192C | 55DD   | 177 |       | DEFW | 0DD55H   |
| 192E | 44CC   | 178 |       | DEFW | 0CC44H   |
| 1930 | 33BB   | 179 |       | DEFW | 0BB33H   |
| 1932 | 22AA   | 180 |       | DEFW | 0AA22H   |
| 1934 | 1199   | 181 |       | DEFW | 9911H    |
| 1936 | 1188   | 182 |       | DEFW | 8811H    |
| 1938 | 8888   | 183 |       | DEFW | 8888H    |
| 193A | 9977   | 184 |       | DEFW | 7799H    |
| 193C | 00     | 185 |       | DEFB | 0        |
| 193D | 11FF   | 186 | TAB6: | DEFW | 0FF11H   |
| 193F | 22EE   | 187 |       | DEFW | 0EE22H   |
| 1941 | 33DD   | 188 |       | DEFW | 0DD33H   |
| 1943 | 44CC   | 189 |       | DEFW | 0CC44H   |
| 1945 | 55BB   | 190 |       | DEFW | 0BB55H   |
| 1947 | 66AA   | 191 |       | DEFW | 0AA66H   |
| 1949 | 7799   | 192 |       | DEFW | 9977H    |
| 194B | 00     | 193 |       | DEFB | 0        |
| 194C | FF11   | 194 | TAB7: | DEFW | 11FFH    |
| 194E | EE22   | 195 |       | DEFW | 22EEH    |
| 1950 | DD33   | 196 |       | DEFW | 33DDH    |
| 1952 | CC44   | 197 |       | DEFW | 44CCH    |
| 1954 | BB55   | 198 |       | DEFW | 55BBH    |
| 1956 | AA66   | 199 |       | DEFW | 66AAH    |
| 1958 | 9977   | 200 |       | DEFW | 7799H    |
| 195A | FFAA   | 201 |       | DEFW | 0AAFFH   |
| 195C | 00     | 202 |       | DEFB | 0        |
| 195D | D9     | 203 | TONE  | EXX  |          |
| 195E | FD7E00 | 204 | M90   | LD   | A, (IY)  |
| 1961 | 5F     | 205 |       | LD   | E, A     |
| 1962 | FE00   | 206 |       | CP   | 00H      |
| 1964 | 2818   | 207 |       | JR   | Z, M200  |
| 1966 | FD23   | 208 |       | INC  | IY       |
| 1968 | FD4E00 | 209 |       | LD   | C, (IY)  |
| 196B | 3EFF   | 210 |       | LD   | A, 0FFH  |
| 196D | D302   | 211 | M100  | OUT  | (02), A  |
| 196F | 47     | 212 |       | LD   | B, A     |
| 1970 | 00     | 213 | M150  | NOP  |          |
| 1971 | 00     | 214 |       | NOP  |          |
| 1972 | 00     | 215 |       | NOP  |          |
| 1973 | 10FB   | 216 |       | DJNZ | M150     |
| 1975 | EE80   | 217 |       | XOR  | 80H      |
| 1977 | 0D     | 218 |       | DEC  | C        |
| 1978 | 20F3   | 219 |       | JR   | NZ, M100 |
| 197A | FD23   | 220 |       | INC  | IY       |
| 197C | 18E0   | 221 |       | JR   | M90      |
| 197E | D9     | 222 | M200  | EXX  |          |
| 197F | C9     | 223 |       | RET  |          |

CROSS REFERENCE  
SYMBOL VAL M DEFN REFS

PGM3

PAGE 5

|        |      |     |     |     |     |     |     |     |  |
|--------|------|-----|-----|-----|-----|-----|-----|-----|--|
| HEX7SG | 0678 | 6   | 148 |     |     |     |     |     |  |
| M1     | 1809 | 10  | 30  | 139 | 145 |     |     |     |  |
| M10    | 1855 | 65  | 59  |     |     |     |     |     |  |
| M100   | 196D | 211 | 219 |     |     |     |     |     |  |
| M11    | 185B | 70  | 66  |     |     |     |     |     |  |
| M12    | 185F | 74  | 64  | 69  |     |     |     |     |  |
| M13    | 1864 | 78  | 71  |     |     |     |     |     |  |
| M14    | 186A | 81  | 84  | 86  |     |     |     |     |  |
| M15    | 1874 | 87  | 82  |     |     |     |     |     |  |
| M150   | 1970 | 213 | 216 |     |     |     |     |     |  |
| M16    | 1881 | 94  | 89  |     |     |     |     |     |  |
| M17    | 188D | 100 | 95  |     |     |     |     |     |  |
| M18    | 1891 | 102 | 105 | 107 |     |     |     |     |  |
| M19    | 18A4 | 112 | 103 |     |     |     |     |     |  |
| M2     | 180E | 12  |     |     |     |     |     |     |  |
| M20    | 18A8 | 114 | 118 | 120 |     |     |     |     |  |
| M200   | 197E | 222 | 207 |     |     |     |     |     |  |
| M21    | 18AD | 117 | 122 |     |     |     |     |     |  |
| M22    | 18C0 | 127 | 116 |     |     |     |     |     |  |
| M23    | 18C6 | 131 | 93  | 99  | 111 | 126 |     |     |  |
| M24    | 18DD | 141 | 136 |     |     |     |     |     |  |
| M25    | 18EC | 146 | 142 |     |     |     |     |     |  |
| M26    | 18F7 | 151 | 153 |     |     |     |     |     |  |
| M3     | 181A | 19  | 154 |     |     |     |     |     |  |
| M4     | 181E | 22  | 27  | 32  |     |     |     |     |  |
| M5     | 1830 | 34  | 24  |     |     |     |     |     |  |
| M6     | 1837 | 42  | 47  |     |     |     |     |     |  |
| M7     | 183F | 49  | 53  |     |     |     |     |     |  |
| M8     | 1841 | 50  | 51  |     |     |     |     |     |  |
| M9     | 1849 | 55  | 57  |     |     |     |     |     |  |
| M90    | 195E | 204 | 221 |     |     |     |     |     |  |
| PIOCA  | 0082 | 4   | 14  |     |     |     |     |     |  |
| PIODA  | 0080 | 2   | 18  | 37  | 77  | 78  | 100 | 112 |  |
| PIODB  | 0081 | 3   | 22  | 45  | 54  |     |     |     |  |
| SCAN1  | 0624 | 5   | 151 |     |     |     |     |     |  |
| SC0BF  | 1902 | 156 | 8   | 9   | 12  | 146 |     |     |  |
| SCORE  | 1900 | 155 | 11  | 132 | 147 |     |     |     |  |
| TAB1   | 1908 | 157 | 130 |     |     |     |     |     |  |
| TAB2   | 190F | 161 | 96  |     |     |     |     |     |  |
| TAB3   | 1918 | 166 | 124 |     |     |     |     |     |  |
| TAB4   | 191F | 170 | 108 |     |     |     |     |     |  |
| TAB5   | 1928 | 175 | 90  |     |     |     |     |     |  |
| TAB6   | 193D | 186 | 143 |     |     |     |     |     |  |
| TAB7   | 194C | 194 | 137 |     |     |     |     |     |  |
| TONE   | 195D | 203 | 131 | 138 | 144 |     |     |     |  |