# MUSIC OF A SORT

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## IT WORKS!

I received my ALTAIR 8800 in the mail at 10 a.m., and 30 hours later it was up and running with only one bug in the memory! That turned out to be a scratch in a printed circuit that took 6 more hours to find. After that was fixed, everything worked!!

Now, what do you do with a machine that so far has no I/O boards or peripherals? Well, there's always the front panel switches and machine language, so I was soon busy making up programs to test all of the 8080's functions; and getting a good set of calluses on my ten input devices. There's a lot of 8080 instructions!

## ZZZIIIPPP

I had just finished setting in a 'sort' program, and at the same time I was listening to a weather broadcast on a little transistor, low-frequency radio, which was sitting next to the Altair. I hit the 'run' switch on the computer and it took off sorting the same list of numbers over and over again.

At the same time my radio also took off!

The computer was sorting numbers and the radio was going ZZZIIIPP! ZZZIIIPP! ZZZIIIPP!

*Well, what do ya know! My first peripheral device!!!*

The radio was picking up the switching noise of the 8800. I tried some other programs to see what they sounded like, and after about 8 hours of messing around I had myself a program that could produce musical tones and actually make music; of a sort. (Or any other program you have!)

## MUSIC

The closest sheet of music that I could find was *The Fool on the Hill* by the Beatles, so I translated it into OCTAL code, picked up the Altair, and headed down to Menlo Park for the 3rd meeting of the  Bay Area Amateur Computer Users Group-Home Brew Computer Club. I thought everyone there should see just what a computer can do!

## RECITAL

This being the Altair's first recital, it was a bit shy at first, and refused to power up--even though Fred's tape recorder was plugged into the same wall outlet and working just fine. One forty-foot extension cord and half an hour later we were ready. (Fred's tape machine turned out to be running on its own battery power, and all of the wall plugs were dead!)

The recital then proceeded with nary a glitch, much to everyone's delight. (Although during the demanded encore, the machine did break into its own rendition of *Daisy*, apparently genetically inherited.)

| Data For THE FOOL ON THE HILL Beatles | | | | Data for "DAISY" | | | |
|---|---|---|---|---|---|---|---|
| Address | Data | Address | Data | Address | Data | Address | Data |
| 040 | 105 | 120 | 055 | 170 | 034 | 250 | 040 |
| 041 | 105 | 121 | 053 | 171 | 034 | 251 | 042 |
| 042 | 125 | 122 | 071 | 172 | 034 | 252 | 046 |
| 043 | 100 | 123 | 066 | 173 | 042 | 253 | 034 |
| 044 | 071 | 124 | 100 | 174 | 042 | 254 | 034 |
| 045 | 063 | 125 | 071 | 175 | 042 | 255 | 042 |
| 046 | 063 | 126 | 071 | 176 | 053 | 256 | 046 |
| 047 | 063 | 127 | 100 | 177 | 053 | 257 | 053 |
| 050 | 071 | 130 | 071 | 200 | 053 | 260 | 053 |
| 051 | 063 | 131 | 066 | 201 | 071 | 261 | 053 |
| 052 | 055 | 132 | 066 | 202 | 071 | 262 | 053 |
| 053 | 053 | 133 | 071 | 203 | 071 | 263 | 046 |
| 054 | 053 | 134 | 100 | 204 | 063 | 264 | 042 |
| 055 | 055 | 135 | 100 | 205 | 055 | 265 | 042 |
| 056 | 071 | 136 | 100 | 206 | 053 | 266 | 053 |
| 057 | 063 | 137 | 071 | 207 | 063 | 267 | 063 |
| 060 | 046 | 140 | 066 | 210 | 063 | 270 | 063 |
| 061 | 046 | 141 | 060 | 211 | 053 | 271 | 053 |
| 062 | 046 | 142 | 060 | 212 | 071 | 272 | 063 |
| 063 | 071 | 143 | 066 | 213 | 071 | 273 | 071 |
| 064 | 063 | 144 | 071 | 214 | 071 | 274 | 071 |
| 065 | 046 | 145 | 066 | 215 | 071 | 275 | 071 |
| 066 | 046 | 146 | 066 | 216 | 071 | 276 | 071 |
| 067 | 053 | 147 | 060 | 217 | 071 | 277 | 071 |
| 070 | 042 | 150 | 053 | 220 | 046 | 300 | 053 |
| 071 | 046 | 151 | 046 | 221 | 046 | 301 | 053 |
| 072 | 046 | 152 | 046 | 222 | 046 | 302 | 042 |
| 073 | 063 | 153 | 046 | 223 | 034 | 303 | 046 |
| 074 | 071 | 154 | 046 | 224 | 034 | 304 | 046 |
| 075 | 063 | 155 | 044 | 225 | 034 | 305 | 071 |
| 076 | 053 | 156 | 046 | 226 | 042 | 306 | 053 |
| 077 | 053 | 157 | 053 | 227 | 042 | 307 | 053 |
| 100 | 063 | 160 | 053 | 230 | 042 | 310 | 042 |
| 101 | 053 | 161 | 053 | 231 | 053 | 311 | 046 |
| 102 | 071 | 162 | 053 | 232 | 053 | 312 | 042 |
| 103 | 063 | 163 | 053 | 233 | 053 | 313 | 040 |
| 104 | 063 | 164 | 002 | 234 | 063 | 314 | 034 |
| 105 | 071 | 165 | 002 | 235 | 055 | 315 | 042 |
| 106 | 063 | 166 | 002 | 236 | 053 | 316 | 053 |
| 107 | 046 | 167 | 377 | 237 | 046 | 317 | 046 |
| 110 | 046 | | | 240 | 046 | 320 | 046 |
| 111 | 046 | | | 241 | 042 | 321 | 071 |
| 112 | 053 | | | 242 | 046 | 322 | 053 |
| 113 | 042 | | | 243 | 046 | 323 | 053 |
| 114 | 053 | | | 244 | 046 | 324 | 053 |
| 115 | 046 | | | 245 | 046 | 325 | 053 |
| 116 | 046 | | | 246 | 046 | 326 | 002 |
| 117 | 053 | | | 247 | 042 | 327 | 377 |

## OCTAL CODES FOR NOTES

| Note | Code | | Octave |
|---|---|---|---|
| C | 252 | | |
| C# | 240 | | LOW OCTAVE |
| D | 230 | | |
| D# | 220 | | |
| E | 211 | | |
| F | 200 | | |
| F# | 172 | | |
| G | 162 | | |
| G# | 154 | | |
| A | 146 | | |
| A# | 140 | | |
| B | 132 | | |
| C | 125 | | |
| C# | 120 | | MIDDLE OCTAVE |
| D | 114 | | |
| D# | 110 | | |
| E | 105 | | |
| F | 100 | | |
| F# | 075 | | |
| G | 071 | | |
| G# | 066 | | |
| A | 063 | | |
| A# | 060 | | |
| B | 055 | | |
| C | 053 | | |
| C# | 050 | | HIGH OCTAVE |
| D | 046 | | |
| D# | 044 | | |
| E | 042 | | |
| F | 040 | | |
| F# | 036 | | |
| G | 034 | | |
| G# | 033 | | |
| A | 031 | | |
| A# | 030 | | |
| B | 026 | | |
| C | 025 | | |
| Q | 002 | | |

Note: This is the quietest of the data notes. It can be used for spaces and rests. You may also like to put a number of these quiet 'notes' at the end of the music data, to give a space between playings.

With a little experimentation, you can make all kinds of interesting sounds. ie; sirens, ray-guns, etc.

## PROGRAM TO MAKE AN ALTAIR 8800 PLAY MUSIC

| Addr | Instr | Octal | Comment |
|---|---|---|---|
| 000 | LXI H | 041 | |
| 001 | b2 | xxx | – ADDRESS OF FIRST |
| 002 | b3 | xxx | DATA ENTRY |
| 003 | MOV A,M | 176 | |
| 004 | CPI | 376 | |
| 005 | b2 | 377 | – START OVER DATA |
| 006 | JZ | 312 | |
| 007 | b2 | 000 | |
| 010 | b3 | C00 | |
| 011 | | | |
| 012 | MVI D | 026 | |
| 013 | b2 | xxx | – TEMPO DATA |
| 014 | DCR B | 005 | |
| 015 | JNZ | 302 | |
| 016 | b2 | 020 | |
| 017 | b3 | 000 | |
| 020 | MOV B,M | 106 | |
| 021 | DCR C | 015 | |
| 022 | JNZ | 302 | |
| 023 | b2 | 013 | |
| 024 | b3 | 000 | |
| 025 | DCR D | 025 | |
| 026 | JNZ | 302 | |
| 027 | b2 | 013 | |
| | b3 | 000 | |
| 030 | INR L | 054 | |
| 031 | JMP | 303 | |
| 032 | b2 | 003 | |
| 033 | b3 | 000 | |

**TO RUN THE PROGRAM:**

To run the program, push the 'RESET' switch, then push the 'RUN' switch.

To stop the program, push the 'STOP' switch.

**TO MAKE YOUR OWN MUSIC:**
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Begin loading your music data anyplace after address 034.  Be sure to load the starting address into H&L at address 002, 003.

Each data entry will be one beat of music.

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NOTES

† Tempo-- The tempo is controlled by the value placed in address 012. Start out by trying 040.

† To Play Backwards-- Put 377 in front of all music data (to cause looping). Change address 001 to read the END of the music data. Change address 030 to DCR L (055).

† To Play all of the Memory-- Change address 001 data to a NOP (000). Change address 004, 005, 006 to NOP (000). This will cause program to read all of the memory, including the program instructions themselves.

† Radio Information-- A low-frequency radio around 330 KC works best, but any AM radio will pick up the music at quiet places on the dial.

Set the radio on or very close to the computer, start the program, and turn the dial on the radio until you get good sound. Some places will be much better than others, and some will pick up different sounds from the computer. Also, try moving the radio to different positions on or around the computer. Just rotating the radio 90 degrees can make a lot of difference in the sound you will get.