Union College
ECE352
Assignment 1 Solution

Due Date: Tuesday April 8th

1. Give block diagrams of two examples of embedded systems that show the inputs and outputs of the microcontroller. Specify whether the inputs and outputs are analog or digital. Site any references that you used.

   Easy to find many examples online.

2. Who designed the first stored program machine?

   There was some confusion about this problem. The first computer was designed by Babbage but the programs were on cards. The first stored program machine was documented by Von Neumann. The first computer actually built and run was the "Manchester Baby" and the engineers were Frederic C. Williams and Tom Kilburn.

3. When was the first microcontroller released?

   The first microcontroller was the 8048 in 1976. The first microprocessor was the 4004 in 1971.

4. What is held in the Program Counter register?

   This holds the address of the next instruction to be executed.

5. What is the address of:
   a. R2 in register bank 3 *1Ah*
   b. R0 in register bank 2 *10h*

6. Explain how data and program memory are treated by the 8051.

   The 8051 is based on the Harvard architecture. ROM/Flash memory is used for program code. The data memory is RAM based and can be extended up to 64K, there can be 4-8K of on board "external" RAM. The internal memory is 256 bytes of RAM along with the SFRs.

7. What is in the SFR area of memory?

This is an area which is used for control and configuration of the different modules on the microcontroller (timers, interrupts, serial IO etc.) as well as many of the important registers such as the accumulator, PSW, SP etc.

8. What is the range of bit-addressable memory locations?

The RAM locations 20h-2Fh are bit-addressable as are all the SFRs which end in 0 or 8.

9. Write a sequence of instructions to put the constant 44h in the following locations:

a) Register 3 (bank 0)

```
mov R3, #044h
```

b) 0x2F

```
mov 0x2F, #044h
```

c) 0x88 (NOT a SFR)

```
mov R0, #088h
mov @R0, #044h
```

d) B register

```
mov B, #044h
```

e) 0x0FF0 in external RAM

```
mov DPTR, #0FF0h
mov A, #044h
movx @DPTR, A
```

10. Write a program to push all of the registers in bank 2 onto the stack. Be sure to initialize the stack pointer.

```
mov SP, #2Fh
push 10h
push 11h
push 12h
push 13h
push 14h
push 15h
push 16h
push 17h
```