1. The result of a floating point calculation produces a number $x$ in the range $-3.5 \leq x \leq 4.6$. Write the scaling equation so that this number can be sent out to the D to A converter on the AT89C51AC3 and produce voltage values between 0 volts and 3.3 volts.

2. For problem 20 above, what will be the binary number and the corresponding voltage at the D to A converter output if the number $x = 0$.

3. Given three unsigned char variables called $msb$, $lsb$, and $frb$ which represent the most significant byte, least significant byte, and fractional portion of a floating point number. Show how to assemble these three bytes into a single float variable called $f$. Note that the $frb$ byte is 8-bits representing the fractional part of the number.

4. Is the I²C synchronous or asynchronous. Explain your answer.

5. If you are given a 12-bit integer named $x$ representing numbers from 0 to 4095, show how to output the 8 most significant bits of this integer to the D/A converter on the AT89C51CC03 board.

6. Explain the difference between the following three array declarations for the variable $x$ in C for the AT89C51CC03.
   A) code int x[12];
   B) xdata int x[12];
   C) int x[12];
7. If Timer 1 is initialized to 0 and is set up as a 16-bit timer what is the maximum time before time out that we can get using the AT89C51CC03 with a 24 MHz clock crystal? Show your calculations and give an answer in microseconds.

8. When we create a C program using Keil we include the Startup file which does, among other things, initialize the stack pointer. If our program is very simple, uses no interrupts, one register bank, and has only one call to a function, what is the lowest possible address that can be loaded into the stack pointer register by the compiler?

9. For the Keil compiler, the first three parameters are passed to functions in registers except when the function is declared reentrant. Why can't reentrant functions have parameters that are passed in registers?

10. Write a subprogram in C which is called Delay. Your subprogram should use timer 0 to create a delay of 3 msec assuming a 24 MHz crystal.

11. Sketch a circuit which shows how to attach a single pole push button switch to port 1 bit 2 on the AT89C51CC03.
12. What data gets sent to port 0 as a result of the following C code? Put your result in hex.

```c
char code myData[] = "ABCDEF";
char code yourData[] = "FEDCBA";
P0 = myData[yourData[2] - 'A']
```

13. The program below runs in the simulator on the Keil development system. The logic analyzer is open and in the setup port 3 has been selected for viewing. The crystal has been set to 24 MHz. The program runs forever and the signal produced is periodic.

1. What is the shape of the periodic waveform in the logic analyzer window. (Draw a sketch).

2. What is the frequency in Hz of the periodic signal? Show your calculations.

```c
#include<at89c51cc03.h>
#include<at89cc03.h>
 void MyFunction();
 void main(void)
 {CLKCON = 0x01;
    TMOD = 0x10;
    TH1 = 0xD8;  //D8F0 = 55,536
    TL1 = 0xF0;
    TR1 = 1;
    ET1 = 1;
    EA = 1;
    while(1);
 }

 //
 void MyFunction() interrupt 3 using 1
 {P3++;
 }