

1. The following lines of code often appear in C programs that use the serial port. What do they do?

```
TI = 0;
SBUF = 0x0D;
while (TI == 0);
TI = 0;
SBUF = 0x0A;
while (TI == 0);
```

2. The following C-program calls and external assembly function named *AssemFunction* which returns an integer. Explain, specifically, how the assembly code returns the integer since it only has access to registers.

```
extern int AssemFunction();
void main (void)
{unsigned char i;
 int kInt;
 kInt = AssemFunction();
 while(1);
 }
```

3. Timer 0 uses interrupt 1. Given below are two versions of the timer 0 interrupt service routine. Both routines do an identical set of calculations before returning. One of these two routines may run faster than the other. Explain which could run faster and why.

A)

```
void T0Int() interrupt 1
{Do some calculations
 }
```

B)

```
void T0Int() interrupt 1 using 1
{Do some calculations
 }
```

4. If the A/D converter on the AT89C1CC03 has a reference voltage of 2.5 volts what will be the value of the converted number (in decimal) of the input voltage is 2.1 volts?

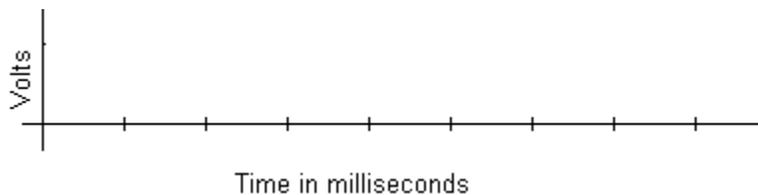
5. A typical UART sends a 7-bit ASCII character as a 10-bit number over a serial line. What are the other three bits used for?

6. Write a function in C which will accept an integer value called x and send bit 3 of the integer to Port 1.2. Name your function *SendBit*.

7. Answer the questions below about the program shown:

```
#include<at89c51cc03.h>
void main(void)
    {CKCON = 0x0;
      TMOD = 0x02;
      TH0 = 0x15;
      TR0 = 1;
      ET0 = 1;
      EA = 1;
      while(1);
    }
//
void SqWave() interrupt 1 using 1
    {P3 = P3 ^ 4;
    }
```

- A) Is this double clocked or single clocked? _____
- B) Which timer is being used? _____
- C) What is the timer mode? 13-bit, 16-bit, or 8-bit? _____
- D) What pin is being used for output? _____
- E) Draw a sketch of the output and label the relevant times.



8. Suppose P3 is an output port and it drives 8 LEDs. Write a program to light each LED in succession using a loop in C with a 0.5 second delay between LEDs going on. Assume that a 0 turns the LED on and a 1 turns the LED off. Your program should loop forever. At any one time only one LED should be on. Begin with the least significant LED. Assume that you have available a delay function called *Delay()* which produces a 0.5 second delay. You need not write this function but your program should call it for the delay time.

9. In the diagram below, Port 1 is used to drive a 3:8 decoder which pulls the cathodes of one row of the LED matrix low and Port 3 is used to drive a line driver to pull the anodes of columns high for the LED matrix. Write a function which will accept a single unsigned char, i and send index i of the data array to the columns and activate row i of the LED matrix. An example calling statement is given below. Note that the data array is global and has been pre-loaded with random data. This example sends 0 to row 0, 1 to row 1, ..., and 7 to row 7.

```
void LedOn(unsigned char i);
unsigned char data[] = {0x0, 0x1, 0x2, 0x3, 0x4, 0x5, 0x6, 0x7};
void main()
{
    unsigned char i;
    for(i=0;i<8;i++)
        LedOn(i);
    ...
}
```

