Sample Midterm w/ Solutions

Question 1 (6 points)

P0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Write the C-Code necessary to set P0.3 and P0.4 without affecting any other bits of the P0 register.

```
P0 |= (0x01 << 3);
P0 |= (0x01 << 4);
```

Question 2 (4 points)

As a general rule of thumb, how much current can an MCU sink (must include units)?

Don't Source more than 1mA
Don't Sink more than 10mA

Question 3 (2 points)

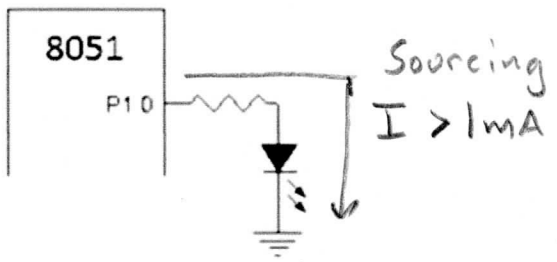
What memory stores the program that is running on an 8051? ROM

Question 4 (2 points)

How many bits comprise the Program Counter? 16 bits

Question 5 (5 points)

A)



For the above image

Is there a problem with this circuit? If there is, describe the issue (first blank)

What would you write to the port pin register to make the LED light up? (last blank)

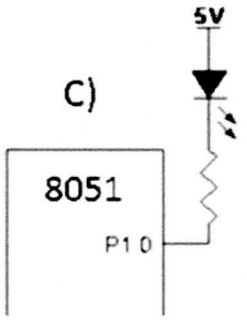
Problem: 8051 Sourcing more than 1mA
Write "1" logic high to turn on the LED
this will still work but would damage the 8051 port pin circuitry

Question 6 (2 points)

Convert Binary 1011|0110 to Hex

0xB6 or $B6_{16}$

Question 7 (5 points)



For the above image

Is there a problem with this circuit? If there is, describe the issue (first blank)
No Issue, this is the proper way
What would you write to the port pin register to make the LED light up? (last blank) "0" logic low Causes I to flow through LED

Question 8 (2 points)

Convert 0xB564 to Binary 1011 0101 0110 0100

Question 9 (6 points)

Given that a 16Mhz crystal is connected to the 8051 and you are using Timer 0 in Mode 1 - 16bit. If TH0 and TL0 were initialized as follows:

TH0 = 0x42, TL0 = 0xA5

How long would it take for the timer to overflow (specify in ms)

$FFFF_{16} - 42A5_{16} = 48474$ ticks
48474 ticks + 1 tick = 48475 ticks to account for Overflow
1 tick = $\frac{1}{16Mhz}(12) = 0.75\mu S$ $0.75\mu S(48475) = 36.35625mS$

Question 10 (4 points)

Another name for a hard coded delay is? (first blank) Busy Wait

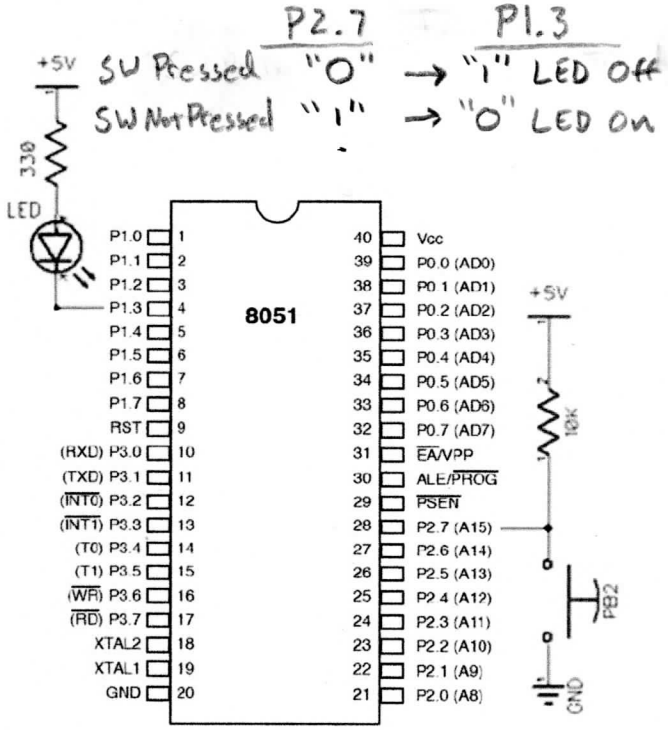
The major drawback of a hard coded delay is? (last blank)

the CPU can't do anything else that is useful during this time

Question 11 (2 points)

Define an Embedded System A system that uses a MCU or CPU to perform one and only one task

Question 12 (16 points)




```
P2 |= (0x01 << 7); // init P2.7 as input
while(1) {
    if(P2 & (0x01 << 7)) // true if not pressed
        P1 &= ~(0x01 << 3); // LED On
    else // sw pressed
        P1 |= (0x01 << 3); // LED off
}
```

Write a piece of code that infinitely loops and checks the state of the Push Button on P2.7 then turns the LED OFF or ON. When the Push Button gets pushed (i.e. closed) the LED will be turned OFF and when the Push Button is not pushed (i.e. open) the LED will be turned ON. The value written to the port must not change the state of any other pins. Include all necessary C code.

Question 13 (8 points)

Write the C code to create a hard coded delay that execute for 2000 iterations using only the unsigned char datatype

```
Unsigned Char X, Y;
for (x = 0, x < 10) {
    for (y = 0, y < 200) {
    }
}
```

← 2000 iterations

Question 14 (6 points)

Given that an 12Mhz crystal is connected to the 8051 and you are using Timer 0 in Mode 1 - 16bit. What value would have to be written to TH0 and TL0 in order to cause an overflow after 5ms from when the timer is started? if the value does not come out to a whole round number, then round to the closest.

$\frac{1}{12Mhz}(12) = 1\mu S$ per Tick

$\frac{5mS}{1mS} = 5000$ Ticks

5000 Ticks $-1 = 4999$ to account for Overflow

$FFFF_{16} - 4999_{10} = EC78_{16}$

Value loaded into TH0? (first blank) 0xEC

Value loaded into TL0? (last blank) 0x78

Question 15 (2 points)

List 2 Memories found in an MCU

Question 16 (2 points) ROM & RAM

Convert 154dec to Hex 0x9A

Question 17 (4 points)

As a general rule of thumb, how much current can an MCU source (must include units)? $\leq 1mA$ Safely

Question 18 (4 points)

What purpose is served by the resistor that we commonly place in series with an LED?

Limit the current through LED

* When an LED is forward biased and the Voltage applied exceeds V_f the resistance approaches Ø

Question 19 (2 points)

What kind of a wave does a Crystal generate? Sine Wave

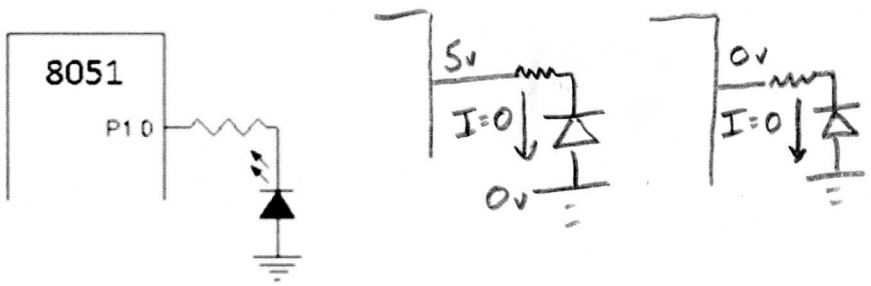
Question 20 (1 point)

List the differences between a CPU and MCU

CPU	MCU
Only CPU no: ROM, RAM, I/O Peripherals	has: CPU ROM RAM Port I/O Peripherals

Question 21 (5 points)

B)



For the above image yes, LED is always Reverse Biased or has 0A of I

Is there a problem with this circuit? If there is, describe the issue (first blank)

What would you write to the port pin register to make the LED light up? (last blank) Can't

Question 22 (4 points)

For the following instruction, list the timer being used, It's mode # and mode name.

TMOD = 0xA0;

TMOD Timer 1 Timer 0

Gate	C/T	M1	M0				
1	0	1	0				

Question 23 (2 points)

M1 : M0

0 0 Timer 1

0 1

1 0 – 8 bit Auto Reload

1 1

Error on my Part

What is the period of a 11Mhz Clock (~~answer must be in Khz and rounded to 4 decimal points~~)? Period is never in Hz

$$\frac{1}{11Mhz} = \boxed{0.0909\,\mu S}$$

Question 24 (6 points)

Write the C-Code necessary to clear P0.3 and P0.4 without affecting any other bits of the P0 register.

```
P0 &= ~(0x01 << 3);
P0 &= ~(0x01 << 4);
```

Question 25 (2 points)

How many bits comprise the only data type of the 8051? 8 bits

Question 26 (2 points)

this one was written correctly

What is the period of a 22Mhz Clock (answer must be in microseconds and rounded to 4 decimal places)?

$$\frac{1}{22Mhz} = 0.0454\,\mu S$$