

CECS 262 - Midterm 1
Introduction to Embedded System Programming

NAME:

KEY

POSSIBLE POINTS:

STUDENT ID:

1. (2pt) List the two memories found in a microcontroller: ROM and RAM

2. (2pt) What memory stores the program that is running on an 8051: ROM

3. (2pt) How many bits comprise the Program Counter: 16

4. (2pt) How many bits comprise the one data type of the 8051: 8

5. (3pt) Convert 227_{10} to Hex: $E3_{16}$ or $0xE3$ or $E3$

6. (3pt) Convert AB_{16} to Dec: 171

-2 units } 7. (3pt) What is the frequency of a clock with a period of 31.25ms

32Hz

8. (3pt) What is the period of a 16Mhz clock?

0.062 μ s

9. (2pt) A crystal generates what kind of a wave

Sine

10. (2pt) This type of a circuit converts a crystal to a usable clock pierce oscillator

11. (3pt) The recommended Min / Max (circle one) ^{1pt} current that a single MCU I/O Port Pin should Sink is 0.010 A _{2pt or no partial}

12. (3pt) The recommended Min / Max (circle one) ^{1pt} current that a single MCU I/O Port Pin should Source is 0.001 A _{2pt no partial}

13. (3pt) Convert $0x56AF29EC568F$ to Binary

0101 0110 1010 1111 0010 1001 1110 1100 0101 0110 1000 1111

14. (3pt) Convert $1011|0111|1010|1101|0011|0100|1100|1011_2$ to Hex

B7AD34CB

- 1 one char mistake
- 2 2 char mistake
- 3 more

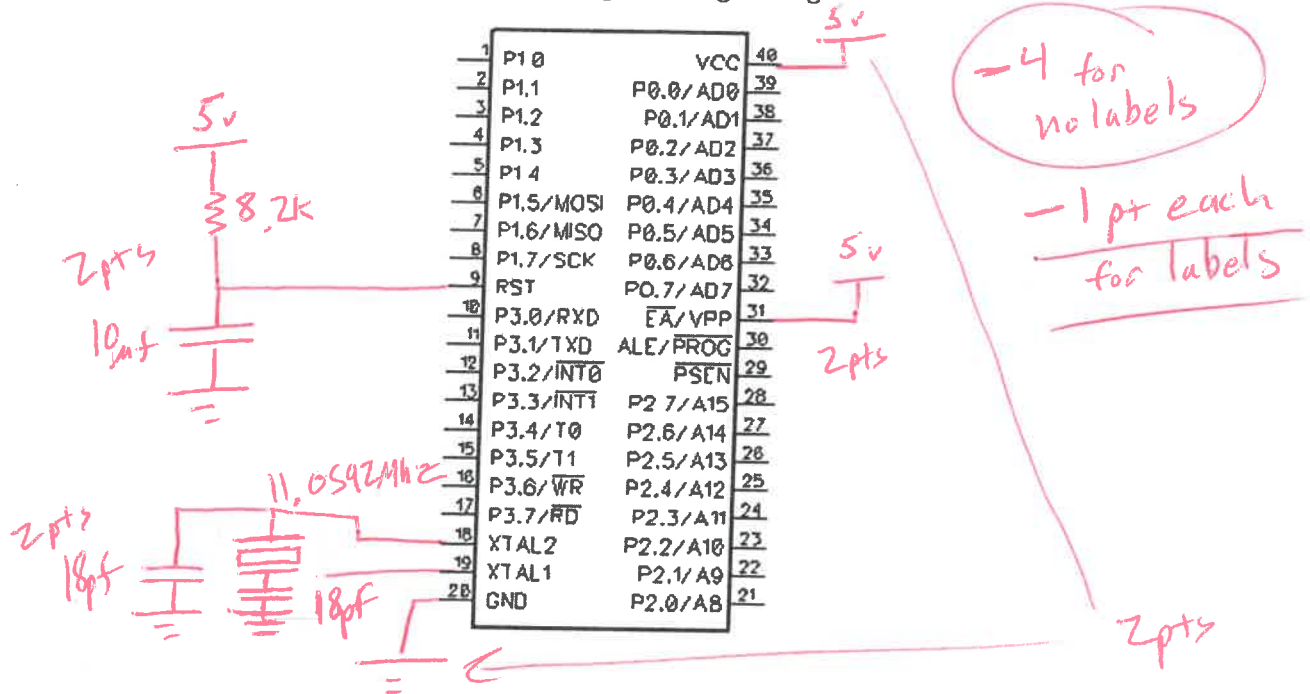
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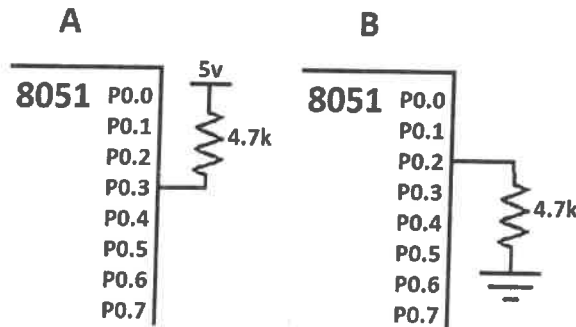
15. (8 pts) Draw the schematic for the following 8051 with the minimum connections and components necessary to start up and run. Please label (give values) for all components.

The following system requirements are necessary:

- Power, Ground, Power-On Reset (think 8.2kohm and 10uF)
- 11.0592Mhz Crystal Circuit and Programming Voltage



Answer the Following Questions for the 2 Circuits Below



- 16) (2pt) The resistor attached in (A) is referred to as a pull-up resistor
- 17) (2pt) The resistor attached in (B) is referred to as a pull-down resistor
- 18) (3pt) In (B) If you write "1" to P0.2 the Current is said to be? Sourced
- 19) (3pt) In (A) If you Write "1" to P0.3 the Current is said to be? Sinked
- 20) (3pt) In (A) If you read as input from P0.3, the value would be? "1" or High or 1

2pts for 5v

21

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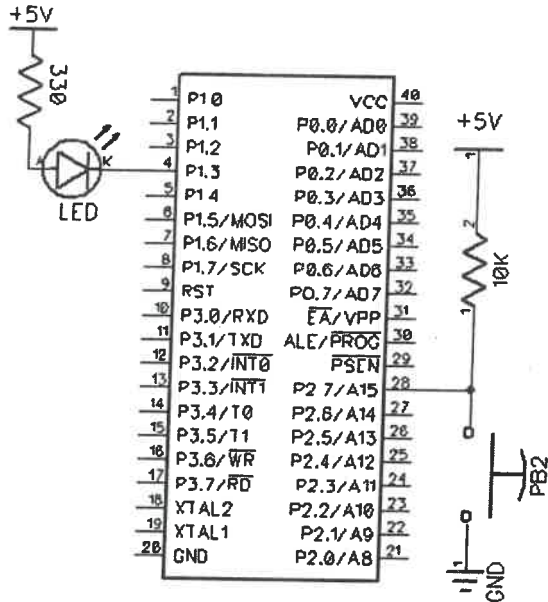
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16.(10pt) For the following 8051 schematic, write a piece of code that infinitely loops and checks the state of the Push Button on P2.7 then turns the LED OFF or ON. When the Push Button gets pushed (i.e. closed) the LED will be turned ON and when the Push Button is not pushed (i.e. open) the LED will be turned OFF. The value written to the port must not change the state of any other pins. Include all necessary C code.

(1pt) What binary value must we Write to the Port Pin to turn the LED "On"? 0

(1pt) What binary value is Read from the Port Pin when the Push Button gets "Pushed"? 0

P2.7 PB LED P1.3
 Pushed 0 On 0
 Not Pushed 1 off 1



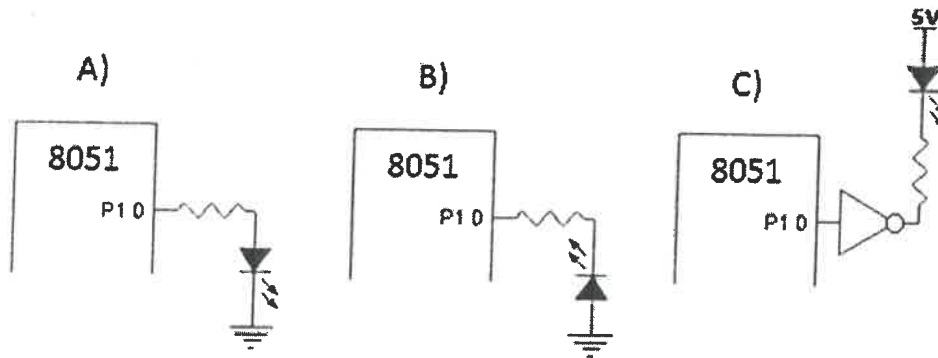
(8pt) CODE:

```

P2 |= 0x01 << 7; 2pt
while(1) { 2pt
    if (P2 & 0x01 << 7) 2pt
        P1 |= 0x01 << 3; 1pt
    else
        P1 &= ~0x01 << 3; 1pt
}
    
```

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13. (9pts – 3pts each)



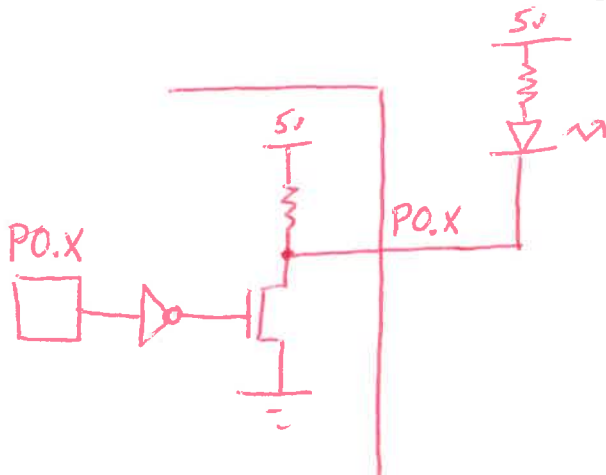
For each of the above LED interface circuits, answer the following questions:

- A) 1) Is there a problem with the circuit? If there is, describe the issue.
Digital circuits like the 8051 MCU shouldn't source more than ~~1mA~~ 1mA
- 2) What would you write to the port pin register to make the LED light up? 1

- B) 1) Is there a problem with the circuit? If there is, describe the issue.
There is no value that would cause the led to turn on
- 2) What would you write to the port pin register to make the LED light up? NA or X

- C) 1) Is there a problem with the circuit? If there is, describe the issue.
no problem
- 2) What would you write to the port pin register to make the LED light up? 1

14. (5pts) Draw the Internal Circuit of a Port 0 Pin. Also draw the circuit necessary to correctly connect that pin to an LED in such a way that writing a 0 to the Port Pin would turn the LED "On".



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15. (3 pts) Write 1 line of C code to set P0.3 without affecting any other bits without using a logical shift.

7 6 5 4 3 2 1 0
 x x x x 1 x x x
 P0 |= 0x08;

16. (3 pts) Write 1 line of C code to clear P0.5 without affecting any other bits and it must use a logical shift.

P0 &= ~(0x01 << 5);

17. (3 pts) Write the C code necessary to clear P0.6 without affecting any other bits.

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

P0 &= ~(0x01 << 6); or P0 &= 0xBF;

18. (3 pts) Write the C code to clear P1.2 and P1.4 in one line/instruction, without affecting any other bits.

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

P1 &= 0xEB;

19. (3 pts) Write the C code to clear P1.2 and set P1.4 in one line/instruction, without affecting any other bits.

P1 = (P1 | (0x01 << 4)) & ~(0x01 << 2);

20. (5 pts) Write a for loop that executes a piece of code 65537 iterations. Label where the instruction would execute 65537 times with a comment that says "critical section".

```
for(x=0; x<256; x++){
  // exec. 256 times
  3 // this is max for 8bit
    // unsigned char
    ↓
```

```
for(x=0; x<256; x++){
  for(y=0; y<256; y++){
    // exec. 65536 times
  }
}
```

★ Need 1 more iteration!!!
 & one more nested loop

if you notice, this is a multiplication problem, so I need to find a factor of 65537. But I accidentally chose a prime number for this problem.

therefore this problem cannot be done with 8bit unsigned chars & nested for loops, you would have to use a larger datatype that I didn't teach

★ I apologize and I graded accordingly, giving partial credit for attempted work.