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Quiz 9

Answer the following 4 questions.

1. How long is the time delay when we run this C command?

_delay_ms(20000);

> 20 Second

2. Assume that the register PINC = 0xA6. After running this C command, what is the value (<u>Hex format</u>) in the register PINC? <u>Show your work to get the full score; otherwise, some points will be deducted</u>.

PINC |= (1<<3);

> 0b1010 0110
> or 0b0000 1000
> ─────────────
> 0b1010 1110 = 0xAE

3. Consider the following C program.

```
1   #include <avr/io.h>
2
3   int main(void) {
4       DDRD =0x00;
5       PORTD = 0xFF;
6       DDRB = 0xFF;
7       DDRC = 0xFF;
8       if (PIND ^ 0x58) {
9           PORTB = PIND | 0x3C;
10          PORTC = PIND + 0x12;
11      } else {
12          PORTB = PIND & 0xC3;
13          PORTC = PIND + 0x21;
14      }
15      return(0);
16  }
```

> PIND 0b01110010
>   xor 0b01011000
>   0b00101010 = 0x2
>
> → 0b01011000   Port B
>
> Port B   Port C
> 0b01110010   0b01110010
> 0b00111100   0b00010010
> 0b01111110 = 0x7E   0b10000100 = 0x84

If the input to the register PIND is 0x72, what are the values in the registers PORTB and PORTC? <u>Show your work to get the full score; otherwise, some points will be deducted</u>.

PORTB   =   ___0x7E___ (Hex format)

PORTC   =   ___0x84___ (Hex format)

4. Consider the following C program. Answer the following 3 sub-questions.

```
1    #include <avr/io.h>
2    #include <avr/interrupt.h>
3
4    void PIN_SETUP() {
5          PORTB |= (1<<3);
6          PORTD |= (1<<4);
7          DDRC |= 0xFF;
8          PORTC |= 0xFF;
9    }
10
11   int main() {
12          PIN_SETUP();
13          PCICR = (1<<0);
14          PCICR = (1<<2);
15          PCMSK0 = (1<<3);
16          PCMSK2 = (1<<4);
17          sei();
18          while (1);
19          return (0);
20   }
21
22   ISR (PCINT0_vect) {
23          PORTC = 0x54;
24   }
25
26   ISR (PCINT2_vect) {
27          PORTC = 0x8D;
28   }
```

Handwritten annotations beside code:
PB3 = 1
PD4 ~ 1
DDRC = 0xFF
PORTC = 0xFF

a) According to this C program, which pins are the input pins? Show your work to get the full score; otherwise, some points will be deducted.

PC 0 → PC 7 are set to be input pin
DDRC = 0xFF
PORTD = 0x FF

b) Which interrupts are being used? Show your work to get the full score; otherwise, some points will be deducted.

Pin change interrupt via pin 3 and pin 4

```
PCICR = (1<<0);
PCICR = (1<<2);
PCMSK0 = (1<<3);
PCMSK2 = (1<<4);
```

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c) Assume that, right now, the value in the register PORTC is 0x11. If the value in the register PIND changes from 0x97 to 0x5A, what is the value in the register PORTC? <u>Show your work to get the full score; otherwise, some points will be deducted</u>.