QUESTION 8. (10 points)

For the questions below, write the code using the masks that are pre-defined in the header file. (E.g: BIT0:0000 0001, BIT1:0000 0010, …, BIT7:1000 0000).
Perform the operations below on the 8-bit variable (uint_8t data).

Part a) Write code that performs the three operations below. Perform each operation independently of the other

Set bit 6

```
data = BIT6;
```

• Clear bit 6.

```
data &= ~BIT6;
```

• Invert bit 6.

```
data ^= BIT6;
```

Part b) Write code that performs the three operations below. Perform each operation independently of the others.

• Set bits 4 and 5.

```
data = (BIT4 | BIT5);
```

• Clear bits 4 and 5.

```
data &= ~(BIT4 | BIT5);
```

• Invert bits 4 and 5.

```
data ^= (BIT4 | BIT5);
```

• Set bit 4 and clear bit 5.

```
data |= BIT4;
data &= ~BIT5;
```

Part c) Write an if-condition line for each of the cases below. Perform each operation independently of the others.

• Check if bit 2 is 1.

```
If ((data & BIT2) == BIT2){

}
```

• Check if bit 2 is 0.

```
If ((data & BIT2) == 0){
```

```
}
```

• Check if bits 3,4 are 1,1.

```
If ((data & (BIT3|BIT4)) == (BIT3|BIT4)){

}
```

• Check if bit 3 is 0 and bit 4 is 1.

```
If ((data & (BIT3|BIT4)) == BIT4){

}
```

• Check if bits 3, 4 are 0,0.

```
If ((data & (BIT3|BIT4)) == 0){

}
```

QUESTION 9. (10 points)

A module on the microcontroller is configured using a control register called CTL that has the format shown below.

SLP	CLK	CAP	IE
2-	3-	2-	1-

- SLP: selects sleep mode; value between 0 and 3
- CLK: selects clock speed; value between 0 and 7
- CAP: selects built-in capacitor value; choice between 0 and 3
- IE: interrupt enable bit (1: enable/ 0: disable)

To support programming the device, the environment has declared the symbolic constants:

```
SLP_3: 1100 0000
SLP_2: 1000 0000
SLP_1: 0100 0000
SLP_0: 0000 0000

CLK_7: 0011 1000
CLK_6: 0011 0000
…
CLK_0: 0000 0000
```

```
CAP_3: 0000 0110

CAP_0: 0000 0000

IE: 0000 0001
```

Perform all the operations below using the masks defined above.

Part a) Write a line of code that configures the module as the following:

```
(Sleep mode 2)(Clock speed 6)(Capacitor value 1)(Interrupts enabled)
```

```
CTL &= (SLP_2|CLK_6|CAP_1|IE);
```

Part b) For the operation above, show the masks used and the final value of CTL in binary.

SLP_2 = 1000 0000
CLK_6 = 0011 0000
CAP_1 = 0000 0010
IE = 0000 0001

Final Value
CTL = 1011 0011

Part c) Write a piece of code that changes SLP to 1. The current value of SLP is unknown.

We first AND to clear the bits previous in the SLP, then we can OR the bits back onto the variable

```
CTL &= ~SLP_3;
CTL |= SLP_1;
```

Part d) Write a piece of code that changes CLK to 5. The current value of CLK is unknown.

We first AND to clear the bits previous in the CLK, then we can OR the bits back onto the variable

```
CTL &= ~CLK_7;
CTL |= CLK_5;
```

Part e) Write an if-condition line that checks if SLP=1.

```
If ((CTL & SLP_3) == SLP_1)){

}
```

Part f) Write an if-condition line that checks if CLK=5.

```
If ((CTL & CLK_7) == CLK_5)){

}
```

Part g) Write an if-condition that checks if the current value of CLK is either of (0, 2, 4, 6).

```
If ((CTL & CLK_7) == CLK_0 | (CTL & CLK_7) == CLK_2 | (CTL & CLK_7) == CLK_4 |
(CTL & CLK_7) == CLK_6 | ){

}
```