Homework 2 Solutions

Question 1

1. Assume an 8-bit signed number with a bit value of 0x58. What is the decimal equivalent of this number?

$$0x58 = 5 \times 16^1 + 8 \times 16^0 = 80 + 8 = 88$$

2. Assume an 8-bit signed number with a bit value of 0xE3. What is the decimal equivalent of this number

$$0xE3 = 11100011 = -128 + 64 + 32 + 2 + 1 = -29$$

3. Assume an 8-bit signed number with a bit value of 0222. What is the decimal equivalent of this number

$$0222 = 10010010 = -128 + 16 + 2 = -110$$

4. Assume 8-bit signed numbers a = 0x32 and b = 0x41. Compute a − b by first computing the negative of b (in binary) and then adding the two. Show your work.

$$a = 0x32 = 00110010$$
$$b = 0x41 = 01000001$$
(invert b) $$\sim b = 10111110$$
(increment b) $$-b = 10111111$$

$$\begin{array}{r} 00110010 \\ + \quad 10111111 \\ \hline 11110001 \end{array}$$

Question 2

1. Given the following code, what are the final values of variables b and c. Give your answers in hexadecimal.

```
uint8_t a = 0x9C;
uint8_t b = a|0x07;
uint8_t c = a||0x2F;
```

$$a = 0x9C = 10011100$$

$$\begin{array}{rr} & 10011100 \\ | & 00000111 \\ \hline b = & 10011111 \end{array}$$ b=0x9F

Bitwise or; compare each pair of bits

$$\begin{array}{rr} & 10011100 \\ || & 00101111 \\ \hline c = & 00000001 \end{array}$$ c=0x01

Logical or; only one comparison

2. Given the following code, what are the final values of variables b and c. Give your answers in hexadecimal.

```
uint8_t a = 0x3D;
uint8_t b = a|0x62;
uint8_t c = a+0x62;
```

$$a = 0x3D = 00111101$$

$$\begin{array}{rl} & 00111101 \\ | & \underline{01100010} \\ b = & 01111111 \end{array}$$ b=0x7F

$$\begin{array}{rl} & 00111101 \\ + & \underline{01100010} \\ c = & 10011111 \end{array}$$ c=0x9F

3. Given the following code, what are the final values of variables b and c. Give your answers in hexadecimal.

```
uint8_t a = 0x5A;
uint8_t b = a&0x22;
uint8_t c = a&&0x22;
```

$$a = 0x5A = 01011010$$

$$\begin{array}{rl} & 01011010 \\ \& & \underline{00100010} \\ b = & 00000010 \end{array}$$ b=0x02

$$\begin{array}{rl} & 01011010 \\ \&\& & \underline{00100010} \\ c = & 00000001 \end{array}$$ c=0x01

4. Given the following code, what are the final values of variables b and c. Give your answers in hexadecimal.

```
uint8_t a =0x8F;
uint8_t b = a&0x71;
uint8_t c = a-0x71;
```

$$a = 0x8F = 10001111$$

$$\begin{array}{rl} & 10001111 \\ \& & \underline{01110001} \\ b = & 00000001 \end{array}$$ b=0x01

$$\begin{array}{rl} & 10001111 \\ - & \underline{01110001} \\ c = & 00011110 \end{array}$$ c=0x1E

5. Given the following code, what are the final values of variables b and c. Give your answers in hexadecimal.

```
uint8_t a = 0x5A;
uint8_t b = a^0x5A;
uint8_t c = a^0xA5;
```

$$a = 0x5A = 01011010$$

$$\begin{array}{rl} & 01011010 \\ \wedge & \underline{01011010} \quad \text{b=0x00} \\ b = & 00000000 \end{array}$$

$$\begin{array}{rl} & 01011010 \\ \wedge & \underline{10100101} \quad \text{c=0xFF} \\ c = & 11111111 \end{array}$$

6. Given the following code, what are the final values of variables b and c. Give your answers in hexadecimal.

```
uint8_t a =25;
uint8_t b =a<<2;
uint8_t c =a>>2;
```

$$a = 25 = 00011001$$
$$b = 01100100 = 0x64$$
$$c = 00000110 = 0x06$$