Department of Mechanical, Materials and Manufacturing Engineering

Computer Engineering and Mechatronics MMME/3085

Solution Sheet 1: Hexadecimal code and bit manipulation

1. Convert the following binary numbers to hexadecimal:
   a. $10101100_B = AC_H$
   b. $1110101011110101_B = EAF5_H$

2. Convert the following hexadecimal numbers to binary:
   a. $10_H = 00010000_B$
   b. $8D_H = 10001101_B$

3. Evaluate the following expressions in the C language (note that 0xA1 means $A1_H$) expressing your answers in hex and binary. Assume the number is stored in an 8-bit variable so overflows and underflows beyond that capacity will be lost.
   a. 0xA1 << 2; // $10000100_B = 84_H$
   b. 0xF4 >> 3; // $00011110_B = 1E_H$

4. Evaluate the following expressions in the C language:
   a. 0xAA | 0xB1; // $10111011_B = BB_H$
   b. 0xBC & 0x3A; // $00111000_B = 38_H$

5. (You will need to understand 5 and 6 to make sense of Lecture 2!) A control byte on the Atmega2560 is to be set using the following constants which are defined as follows:
   WGM52 =3, CS52 = 2, CS50 = 0. What is the value in TCCR1B after executing this line? (This process is known as "setting" bits).

TCCR1B = (1 << WGM52) | (1 << CS52) | (1 << CS50); // Gives the value $0D_H$

6. DDRB initially contains the value 0xC2. What value does it contain after executing the following line, if DDB1 = 1 and DDB6 = 6? (This process is known as "resetting" or
   "clearing" bits).

   DDRB = DDRB & ~(1 << DDB1) & ~(1 << DDB6); // Gives the value 80_H