Name: **Lab Section:**

CprE 288 Fall 2012 – Homework 1
Due Thu. Aug. 30 in the class

Notes:

- **Start early on homework**
- Homework answers must be typed using a word editor. Hand in a hard copy in the class.
- Late homework is accepted within three days from the due date. E-mail the word file to your instructor. *Late penalty is 10% per day (counting from 10:45am of the due date).*

Question 1 (20 pts)

Note: The purpose of this question is to refresh your understanding of numeric representation from the prerequisite courses.

Complete the table below. Assume ASCII encoding of characters, and a 2's compliment encoding of negative numbers. Recall what you have learned about 2's compliment encoding from other courses. When representing a number in hexadecimal or binary, use the proper number of digits for the ATmega128 architecture (depends on type). The first row has been completed for you.

	Value of x		
	x (decimal)	**x (hex)**	**x (binary)**
char x = 100;	100	0x64	0b01100100
char x = 'G';	71	0x47	0b01000111
char x = '9';	57	0x39	0b00111001
char x = '7';	55	0x37	0b00110111
char x = '\n';	10	0x0A	0b00001010
int x = 0x288;	648	0x0288	0b0000001010001000
int x = 0xECE;	3790	0x0ECE	0b0000111011001110
char x = 0b11000011;	195	0xC3	0b11000011
unsigned int x = 0x2C00 + 0x2041;	19521	0x4c41	0b0100110001000001
char x = 8 + 0x02;	10	0x0A	0x00001010
char x = 0x18 / 8;	3	0x03	0x00000011
signed int x = -1;	-1 (65535)	0xFFFF	0x1111111111111111
signed int x = -16;	-16 (65520)	0xFFF0	0x1111111111110000
signed char x = 8;	8	0x08	0x00001000
char x = -1;	-1 (255)	0xFF	0x11111111
unsigned char x = -7;	-7 (249)	0xF9	0x11111001

Name: **Lab Section:**

Question 2 (5 pts)

Read the Wikipedia articles on microcontroller. Answer the following questions regarding the history of microprocessor and microcontroller, **based on your own understanding and using your own language.**

a. Which chip is thought to be the first microprocessor? How many transistors roughly did it use?

Intel 4004, about 2,300 transistors.

b. Which chip is thought to be the first microcontroller? Which components did it have?

TMS 1000, with CPU, ROM and RAM on the same chip. (Today's microcontrollers add I/O devices.)

Question 3 (10 pts)

The Cerebot II board used in lab contains an ATmega128 processor. **Answer the following questions about the processor**, using Internet when necessary (give your source, i.e. URL / Slide #).

a. Who is the manufacturer of the ATmega128 processor used in lab?

Atmel

b. What is the clock frequency of the processor?

16MHz

c. What are the types and sizes of memory available, and the uses for each type of memory?

4 KB of EEPROM (for long term storage)
4 KB of SRAM (data memory)
128 KB of Flash (program memory)

d. Name 5 features of the processor, along with a concise description:
   1. Two UARTs – Serial communication over a cable or Bluetooth
   2. PWM – Pulse Width Modulation channels for generating accurate waveforms
   3. ADC – Analog to Digital Conversion to measure analog voltages
   4. Input Capture – Two input capture channels to generate interrupts on changes to the channel (useful for SONAR)

Name: **Lab Section:**

5. SPI – Serial Peripheral Interface; communicates with various devices serially

Question 4 (5 pts)

Read the Wikipedia article on Endianness (little-endian and big-endian**). Briefly summarize the differences in the space below.**

Little endian has the most significant bit on the left, while big endian has the most significant bit on the right. Endianess may also occur at the byte level or larger. Endianess may also be mixed. For example, some systems may store an int with value 0xABCD in memory as 0xCDAB if reading the byte addresses consecutively.