CPE 323 – Introduction to Embedded Computer Systems
Quiz 1 (09/15/2014)

1 (4)	2 (10)	3 (6)	4 (2)	Total (20+2)

1. (4 points) Fill in the table below by entering the minimum and the maximum in decimal number system for given data types.

Type	MIN	MAX
`unsigned short int a;` // 8-bit unsigned integer	0	255
`int b;` // 16-bit signed integer	-32,768	32,767

2. (10 points) Consider the following sequence of C/C++ declarations?

```
unsigned int a_ui = 19;   ; 16-bit unsigned integer
short int b_si = -6;      ; 8-bit signed integer in 2's complement
char c_ch = 'b';          ; 8-bit ASCII character, ascii('a')=97
```

Fill in the following table (the binary, hex, and octal representations should include all digits).

Variable	# of bits	Decimal representation	Hexadecimal representation	Binary representation	Octal representation
a_ui	16	19	0013	0000_0000_0001_0011	000023
b_si	8	-6	FA	1111_1010	372
c_ch	8	98	62	0110_0010	142

3. (6 points) Consider ADD arithmetic operation P = Q + R, where P, Q, and R are 8-bit signed integers ($Q=127_{10}$ and $R=21_{10}$)? Calculate P (hex and decimal representation) and flags V (Overflow), C (Carry), Z (Zero), and N (Negative)?

Q: 0x7F

R:..+0x15

P:..=$0x94_{16}$ = 1001.0100_2 => negative

=> -P = 0110.1100_2 => $6*16+12 = 108_{10}$

=> P = -108_{10} N = 1, V = 1, Z = 0, C = 0.

4. BONUS (2 points) Consider SUB arithmetic operation D=Q-R, where Q and R are 8-bit signed integers from above. Calculate D (hex and decimal representation).

Q: 0x7F

1cR:.+0xEA

\+ 1

D:..= 0x6A = 0110.1010 => positive => $6*16 + 10 = 106_{10}$

N = 0, V = 0, Z = 0, C = 1