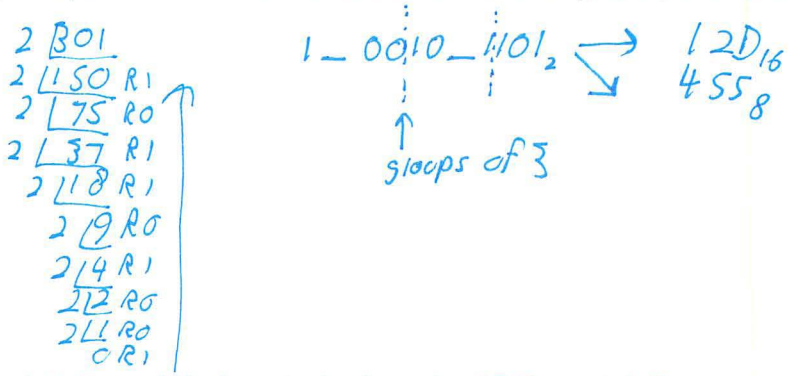
Name Answers

CE-1901-11 – Dr. Durant – Quiz 2
Fall 2016, Week 2

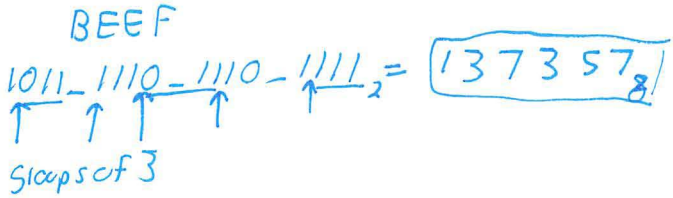
1. (1 point) **List** the powers of 2 from 2^0 to 2^{16} as decimal numbers.

0	1	8	256
1	2	9	512
2	4	10	1024
3	8	11	2048
4	16	12	4096
5	32	13	8192
6	64	14	16384
7	128	15	32768
		16	65536

2. (2 points) **Convert** the base 10 number 301 to binary, octal, and hexadecimal. **Show** your work.



3. (1 point) **Convert** the hexadecimal number BEEF to octal. **Show** your work.



4. (1 point) **Calculate** the minimum number of bits required to encode the decimal number 130 in (unsigned) binary. **Hint:** Although you could convert it to binary, you can determine the answer by finding which powers of 2 it is between. For example, 7 is between 8 and 4, so we don't need an 8's place (2^3) to represent it, but we do need a 4's place (2^2). Don't forget to count the 1's (2^0) bit.

$128 \leq 130 < 256$

$2^7 \leq 130 < 2^8$

∴ need 8 bits, numbered 0..7

5. (3 points) Using exactly 4 bits, **add** the binary numbers 1100 and 1110.

```
  1 1
  1100
+ 1110
------
 1 0 10
```

a. Treat the operation as **unsigned** and **convert** the addends and sum to decimal. **Explain** how you determine whether there was **unsigned** overflow.

1100 → 12
+ 1110 → 14
1010 → 10 off by 16 from desired answer of 26 ∴ there was unsigned overflow (equivalently, carry out bit is on)

b. Treat the operation as **signed** and **convert** the addends and sum to decimal. **Explain** how you determine whether there was **signed** overflow.

2's comp/negative operation: ① flip bits ② +1

	flip	+1
1100	→ 0011	→ 0100
+ 1110	→ 0001	→ 0010
1 1010	→ 0101	→ 0110

all nos ... magnitudes

∴ original was: −4 + −2 = −6

result is correct, did not try to exceed −8 limit ∴ no signed overflow.

6. (2 points) **Draw** the **gate symbols** and **truth tables** for OR2, and XNOR3. The number after the gate name indicates the number of inputs.

check for any input on

a	b	x
0	0	0
0	1	1
1	0	1
1	1	1

check for even # of inputs on

c	d	e	y
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

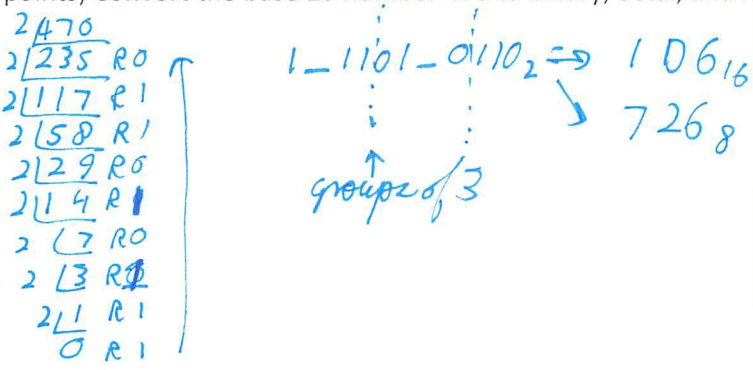
Name Answers

CE-1901-12 – Dr. Durant – Quiz 2
Fall 2016, Week 2

1. (1 point) **List** the powers of 2 from 2^0 to 2^{16} as decimal numbers.

0	1	8	256
1	2	9	512
2	4	10	1024
3	8	11	2048
4	16	12	4096
5	32	13	8192
6	64	14	16384
7	128	15	32768
		16	65536

2. (2 points) **Convert** the base 10 number 470 to binary, octal, and hexadecimal. **Show** your work.



3. (1 point) **Convert** the hexadecimal number 5AFE to octal. **Show** your work.

0:101_1010_1111_1110 ← binary first
0 : 5 : 5 : 3 : 7 : 6₈
↑
or omit

4. (1 point) **Calculate** the minimum number of bits required to encode the decimal number 37 in (unsigned) binary. **Hint:** Although you could convert it to binary, you can determine the answer by finding which powers of 2 it is between. For example, 7 is between 8 and 4, so we don't need an 8's place (2^3) to represent it, but we do need a 4's place (2^2). Don't forget to count the 1's (2^0) bit.

$32 \le 37 < 64$
$2^5 \le 37 < 2^6$
∴ need 6 bits, numbered 0..5

5. (3 points) Using exactly 4 bits, **add** the binary numbers 0111 and 0100.

$$\begin{array}{r} {}^{0}{}^{1}{}^{1}{}^{1} \\ 0111 \\ +\ 0100 \\ \hline 1011 \end{array}$$

a. Treat the operation as **unsigned** and **convert** the addends and sum to decimal. **Explain** how you determine whether there was **unsigned** overflow.

$$\begin{array}{r} 7 \\ +\ 4 \\ \hline 11 \end{array}$$ correct ∴ no unsigned overflow (equivalently, carry out is 0)

b. Treat the operation as **signed** and **convert** the addends and sum to decimal. **Explain** how you determine whether there was **signed** overflow.

The addends start w/ 0 ∴ their values are the same in both systems. Apply 2's complement (negative) operation to negative sum to get magnitude: 1011 $\xrightarrow{\sim}$ 0100 $\xrightarrow{+1}$ 0101 = 5 ∴ input was −5

$$\begin{array}{r} 7 \\ +\ 4 \\ \hline -5 \end{array}$$ error: signed overflow error = −5 − (7+4) = −5 − 11 = −16 distance 16 since $2^4 = 16$ & using 4 bits.

6. (2 points) **Draw** the **gate symbols** and **truth tables** for NAND2, and XOR3. The number after the gate name indicates the number of inputs.

not all

odd ← key test concerning 1 inputs

a	b	x
0	0	1
0	1	1
1	0	1
1	1	0

c	d	e	y
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1