Comp Arch Lab Sec 1

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Lab 1

1.1)

Decimal = 255

255/2	=	127	1
127/2	=	63	1
63/2	=	31	1
31/2	=	15	1
15/2	=	7	1
7/2	=	3	1
3/2	=	1	1
1/2	=	0	1

$$255_{10} = 11111111_2$$

255/16	=	15	15
15/16	=	0	15

$$255_{16} = FF_{16}$$

Decimal = 65535

65535	/ 2 =	32767	1
32767	/ 2 =	16383	1
16383	/ 2 =	8171	1
8171	/ 2 =	4095	1
4095	/ 2 =	2047	1
2047	/ 2 =	1023	1
1023	/ 2 =	511	1
511	/ 2 =	255	1
255	/ 2 =	127	1
127	/ 2 =	63	1
63	/ 2 =	31	1
31	/ 2 =	15	1
15	/ 2 =	7	1
7	/ 2 =	3	1
3	/ 2 =	1	1
1	/ 2 =	0	1

$65535_{10} = 1111111111111111_{2}$

65535/16 = 4095 15
4095/16 = 255 15
255/16 = 15 15
15/16 = D 15

$65535_{10} = FFFF_{16}$

Decimal = 4294967295

4294967295/2 = 2147483647 | 1
2147483647/2 = 1073741823 | 1
1073741823/2 = 536870911 | 1
536870911/2 = 268435455 | 1
268435455/2 = 134217727 | 1
134217727/2 = 67108863 | 1
67108863/2 = 33554431 | 1
33554431/2 = 16777215 | 1
16777215/2 = 8388607 | 1
8388607/2 = 4194303 | 1
4194303/2 = 2097151 | 1
2097151/2 = 1048575 | 1
1048575/2 = 524287 | 1
524287/2 = 262143 | 1
262143/2 = 131071 | 1
131071/2 = 65535 | 1
65535/2 = 32767 | 1
32767/2 = 16383 | 1
16383/2 = 8191 | 1
8191/2 = 4095 | 1
4095/2 = 2047 | 1
2047/2 = 1023 | 1
1023/2 = 511 | 1
511/2 = 255 | 1
255/2 = 127 | 1
127/2 = 63 | 1
63/2 = 31 | 1

31/2	=	15	1
15/2	=	7	1
7/2	=	3	1
3/2	=	1	1
1/2	=	0	1

$4294967295_{10} = 11111111111111111111111111111111_{2}$

4294967295/16	=	268435455	15
268435455/16	=	16777215	15
16777215/16	=	1048575	15
1048575/16	=	65535	15
65535/16	=	4095	15
4095/16	=	255	15
255/16	=	15	15
15/16	=	0	15

$4294967295_{10} = FFFFFFFF_{16}$

1.2)

a) $2^{10} =$ Ki

b) $2^{12} = (2^{10})(2^2) =$ 4 Ki

c) $2^{20} =$ Mi

d) $2^{31} = (2^{30})(2) =$ 2 Gi

e) $2^{32} = (2^{30})(2^2) =$ 4 Gi

2.1)

a) 01111111 = 127

↑ Sign representation

b) 11111111 = 255

↑ unsigned representation

2.2)

-2^{15} (-32768) to $2^{15}-1$ (32767)

2.3)

a) 5

5/2 2 1
2/2 1 0
1/2 0 1

5 = 00000101

-5

11111010 (switched to neg bits)
00000001 add 1
11111011

-5 = 1111011

2.4)

5+5 = ?

```
  00000101
+ 00000101
  00001010
```

$$\boxed{5+5 = 00001010}$$

5+(-3) = ?

```
  00000101
+ 11111101
 (1)00000010
```

Overflow of 1

$$\boxed{5+(-3) = 00000010}$$

5+(-5) = ?

```
  00000101     overflow of 1
+ 11111011
 (1)00000000
```

$$\boxed{5+(-3) = 00000000}$$

$3 + (-5) = ?$

$$\begin{array}{r} 00000011 \\ +\ 11111011 \\ \hline 11111110 \end{array}$$

$\boxed{3+(-5) = 11111110}$

$126 + 5 = ?$

$$\begin{array}{r} 01111110 \\ +\ 00000101 \\ \hline 10000011 \end{array}$$

$\boxed{126+5 = 10000011}$

3.1)

$$2^n = 4$$

$$2^n = 2^2$$

$$n = 2$$

$$\boxed{n = 2 \text{ bits}}$$

3.2)

$$2^n = 6$$

$$\ln(2^n) = \ln(6)$$

$$n \ln(2) = \ln(6)$$

$$n = \frac{\ln(6)}{\ln(2)}$$

$$n = 2.58$$

$$n = 3 \text{ bits}$$

3 bits are needed to represent them when decoding the instructions