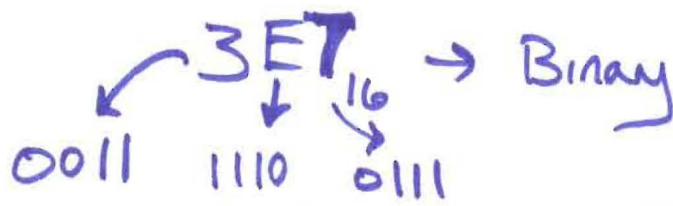


Class Outline 9/1/2009

1. Convert Decimal to Binary
2. Convert Binary to Decimal
3. Convert Decimal to Hexadecimal
4. Convert Hexadecimal to Decimal
Hexadecimal to/from Binary
5. 2's complement
positive + negative
6. Carry in Addition
7. Signed Bit
8. Sign Extension

Hexadecimal → Binary

<u>Decimal</u>	<u>Binary</u>	<u>Hexadecimal</u>
0	0000	0
1	0001	1
→ 2	0010	2
3	0011	3
→ 4	0100	4
5	0101	5
6	0110	6
7	0111	7
→ 8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F
<hr/>		
16	10000	



001111100111₂

Binary to Hexadecimal

<u>1010</u>	<u>1101</u>	<u>0010</u>	<u>1110</u>
A	D	2	E

ADZE₁₆

<u>0101</u>	<u>0010</u>	<u>1101</u>
5	2	D

52D₁₆

$$\frac{1}{2} = 1$$

999₁₀ → Binary

$\frac{999}{2}$	=	1
$\frac{499}{2}$	=	1
$\frac{249}{2}$	=	1
$\frac{124}{2}$	=	0
$\frac{62}{2}$	=	0
$\frac{31}{2}$	=	1
$\frac{15}{2}$	=	1
$\frac{7}{2}$	=	1
$\frac{3}{2}$	=	1
$\frac{1}{2}$	=	1

1111100111₂

$$\begin{array}{r}
 27_{10} \\
 -16 = 1 \cdot 16^1 \\
 \hline
 11 \\
 = 11 = 11 \cdot 16^0 \\
 \hline
 * \emptyset
 \end{array}$$

$$\begin{array}{r}
 1 \\
 16^1 \quad \frac{B}{16^0} \\
 \hline
 \boxed{1B_{16}}
 \end{array}$$

999₁₀ → Hexadecimal

$$\begin{array}{r}
 999 \\
 -256 = 1 \cdot 16^2 \\
 \hline
 743 \\
 -256 = 1 \cdot 16^2 \\
 \hline
 487 \\
 -256 = 1 \cdot 16^2 \\
 \hline
 231 \\
 -224 = 14 \cdot 16^1 \\
 \hline
 7 \\
 -7 = 7 \cdot 16^0 \\
 \hline
 * \emptyset
 \end{array}$$

$\left. \begin{array}{l} 3 \\ 14 \\ 7 \end{array} \right\} \rightarrow \boxed{3E7_{16}}$

$168_{10} \rightarrow$ ~~Hexa~~ Decimal

$$\frac{168}{16} \quad r = 8 \quad \uparrow$$

$$\frac{10}{16} = r = 10$$

* 0

$$\begin{array}{r} A \\ \hline 16^1 \quad 16^0 \end{array}$$

$A8_{16}$

$3E7_{16} \rightarrow \text{Decimal}$

$$\frac{3}{16^2} \frac{\overset{14}{\cancel{E}}}{16^1} \frac{7}{16^0}$$

$$3 \cdot (16^2) + 14(16^1) + 7 \cdot (16^0) = \boxed{999}_{10}$$

- A = 10
- B = 11
- C = 12
- D = 13
- E = 14
- F = 15

$$16_{10} \rightarrow \frac{10}{16^1} \frac{0}{16^0}$$

$3001_{16} \rightarrow \text{Decimal}$

$$3 \cdot (16^3) + 1 \cdot (16^0)$$

$$3 \cdot 4096 + 1$$

~~$$12304$$~~

$$12289$$

Decimal to Binary

$$25_{10} \rightarrow \text{Binary}$$

① Subtraction: Subtract highest Powers of 2 until we reach \emptyset .

$$\begin{array}{r} 25 \\ -16 = 2^4 \\ \hline 9 \\ -8 = 2^3 \\ \hline 1 \\ -1 = 2^0 \\ \hline \emptyset \end{array}$$

$$\begin{array}{l} 2^0 = 1 \\ 2^1 = 2 \\ 2^2 = 4 \\ \vdots \end{array}$$

$$0 \frac{0}{2^5} \quad 1 \frac{1}{2^4} \quad 1 \frac{1}{2^3} \quad 0 \frac{0}{2^2} \quad 0 \frac{0}{2^1} \quad 1 \frac{1}{2^0}$$

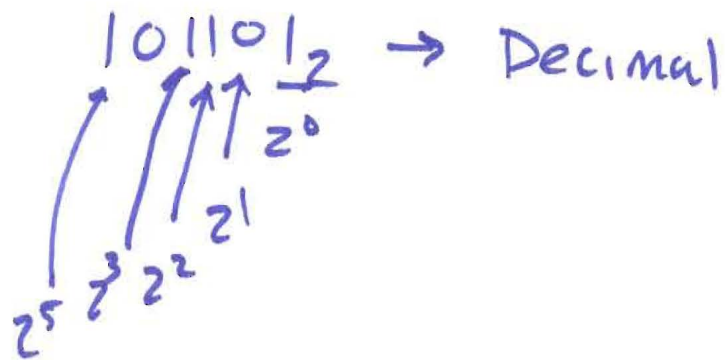
$$= \boxed{11001_2}$$

② Division - Divide by 2

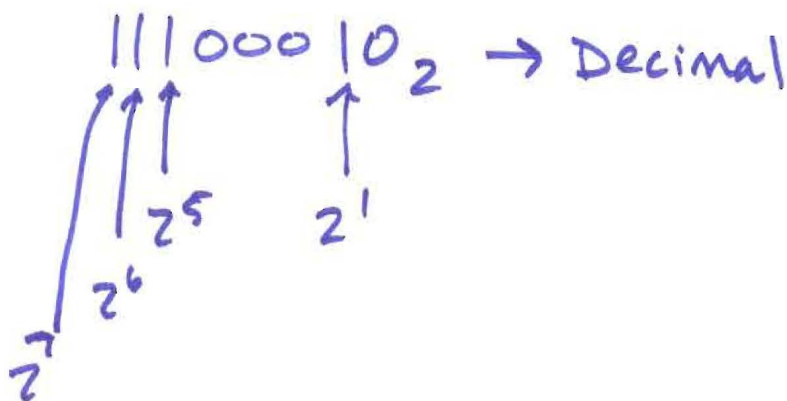
$$\begin{array}{r} 25 \\ \hline 2 \\ 12 \\ \hline 2 \\ 6 \\ \hline 2 \\ 3 \\ \hline 2 \\ 1 \end{array} \begin{array}{l} = 1 \\ = 0 \\ = 0 \\ = 1 \end{array}$$

11001_2

Binary to Decimal



$$1 \cdot (2^5) + 1 \cdot (2^3) + 1 \cdot (2^2) + 1 \cdot (2^0)$$
$$32 + 8 + 4 + 1 = \boxed{45_{10}}$$



$$\dots \frac{1}{2} \frac{0}{2^0}$$

$$128 + 64 + 32 + 2 = \boxed{226_{10}}$$

Hexadecimal (16)

0, 1, 2, 3, ..., 9, A, B, C, D, E, F

$$16^0 = 1 \quad \begin{array}{c} \uparrow \\ 10 \end{array} \quad \begin{array}{c} \uparrow \\ 15 \end{array}$$

$$16^1 = 16$$

$$16^2 = 256$$

$$16^3 = 4096$$

$$16^4 = 65536$$

Decimal \rightarrow Hexadecimal

$25_{10} \rightarrow$ Hexadecimal

$$\begin{array}{r} -16 = 1 \cdot 16^1 \\ \hline \end{array}$$

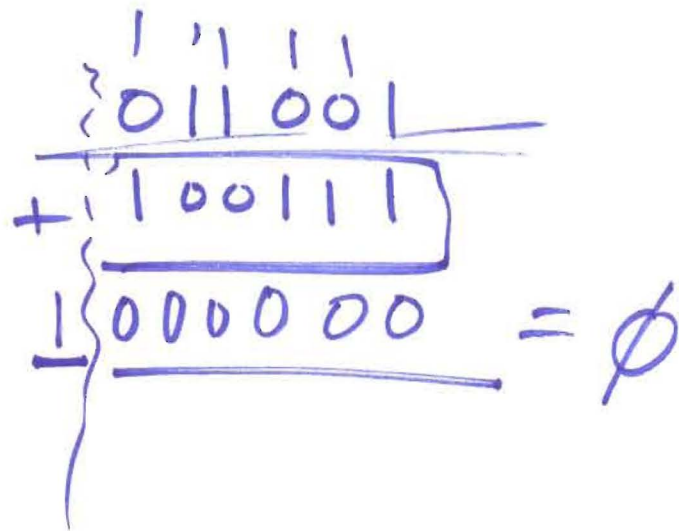
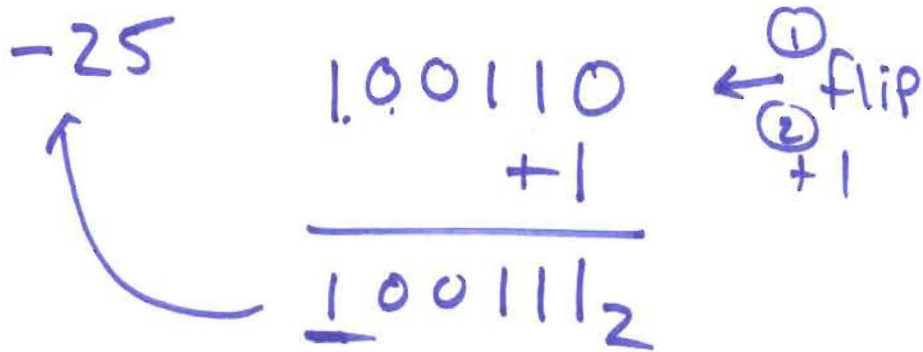
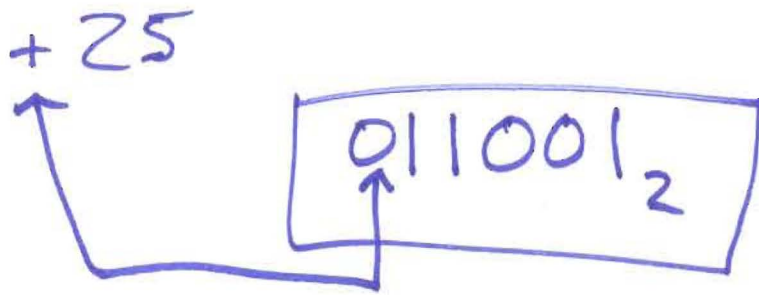
9

$$\begin{array}{r} -9 = 9 \cdot 16^0 \\ \hline \end{array}$$

* \emptyset

$$\frac{1}{16^1} \quad \frac{9}{16^0}$$

$$\boxed{19_{16}}$$



~~-32 + 4 + 1 =~~

-32 + 4 + 2 + 1 = -25