

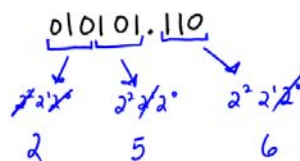
## Number Systems Day 4

### Binary $\rightarrow$ Octal (Shortcut)

- group binary digits by 3's starting at radix point and working way out
- turn each group of 3 bits into an octal digit

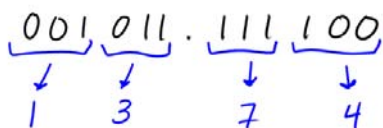
$\overline{2^2} \quad \overline{2^1} \quad \overline{2^0}$   $\rightarrow$  gives a # between 0 and 7 inclusive

EX: convert  $10101.11_2$  to octal.



$$\therefore 10101.11_2 = 25.6_8$$

EX: Convert  $1011.1111_2$  to base 8.



$$\therefore 1011.1111_2 = 13.74_8$$

### Octal $\rightarrow$ Binary

- take octal digit and convert to a series of 3 binary digits

$\overline{2^2} \quad \overline{2^1} \quad \overline{2^0}$

EX: Convert  $14.7_8$  to binary

$$1_8 = 001_2$$

$$7_8 = 111_2$$

$$4_8 = 100_2$$

$$\therefore 14.7_8 = 1100.111_2$$

EX: Convert  $243.6_8$  to binary.



$$243.6_8 = 10100011.11_2$$

## Hexadecimal System (Base 16)

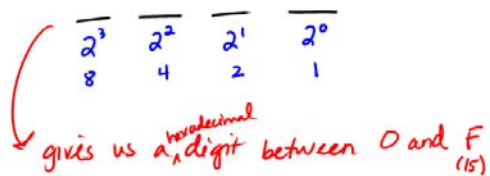
16 symbols:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9,  $A^{10}$ ,  $B^{11}$ ,  $C^{12}$ ,

$D^{13}$ ,  $E^{14}$ ,  $F^{15}$

### Binary $\rightarrow$ Hexadecimal

- \* similar to converting to octal but group digits by 4's instead of 3's



each group of 4 will get converted to a hexadecimal digit

EX: Convert  $10111011_2$  to base 16.

$$\begin{array}{c} \underline{1011} \ \underline{1011}_2 = \textcircled{BB_{16}} \\ \downarrow \qquad \downarrow \\ \begin{array}{c} 2^3 \cancel{2^2} \cancel{2^1} 2^0 \\ // \\ B \end{array} \quad \begin{array}{c} 2^3 \cancel{2^2} \cancel{2^1} 2^0 \\ // \\ B \end{array} \end{array}$$

EX: Convert  $11000.111_2$  to base 16.

$$\begin{array}{c} \underline{0001} \ \underline{1000} . \underline{1110}_2 = \textcircled{18.E_{16}} \\ \downarrow \qquad \downarrow \qquad \downarrow \\ 1 \qquad 8 \qquad \begin{array}{c} 2^3 \cancel{2^2} \cancel{2^1} 2^0 \\ 8 + 4 + 2 \\ 14 \\ E \end{array} \end{array}$$

Hexadecimal  $\rightarrow$  Binary

turn each hexadecimal digit into a series of 4 binary digits

EX: Convert  $8B_{16}$  to binary.

$$\begin{array}{c} 1000 \quad \downarrow \text{"11"} \\ \qquad \qquad 1011 \\ 2^3 \cancel{2^2} \cancel{2^1} 2^0 \qquad \therefore \textcircled{10001011_2} \end{array}$$