# CMSC131 Lab

Sections 0108 or 0109

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OH: Tue. 6-7pm

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#### Intro

- Piazza, Class Website
- Course Questions?
- Eclipse
  - Workspaces & Perspectives
  - Creating/Importing Projects
  - A Basic Program
  - Submitting Projects

# Number Bases

592<sub>10</sub>

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$$592_{10} = 5 \times 10^{2} + 9 \times 10^{1} + 2 \times 10^{0}$$
 $645_{4} = 6 \times 4^{2} + 4 \times 4^{1} + 5 \times 5^{0}$ 
 $9AF_{16} = 9 \times 16^{2} + 10 \times 16^{1} + 15 \times 16^{0}$ 

(All numbers on the right of `=` are in decimal.)

# Base 7 to Base 10

241,

# Base 7 to Base 10

$$241_{7} = 2 \times 7^{2} + 4 \times 7^{1} + 1 \times 7^{0}$$

$$= 98_{10} + 28_{10} + 1_{10}$$

$$= 127_{10}$$

**177**<sub>10</sub>

Base 10		
Integer ÷		
Remainder		

Base 10	177	35	7	1	
Integer ÷	177 // 5 = 35	35 // 5 = 7	7 // 5 = 1	1 // 5 = 0	
Remainder	2	0	2	1	

Base 10				
Integer ÷				
Remainder				

Base 10	75	37	18	9	4	2	1
Integer ÷	37	18	9	4	2	1	0
Remainder	1	1	0	1	0	0	1

# Other Examples

$$egin{array}{llll} {\bf 45}_{10} & 
ightarrow {f X}_3 \ {\bf 253}_6 & 
ightarrow {f X}_{10} \ {\bf 113}_{10} & 
ightarrow {f X}_7 \ {\bf 132}_5 & 
ightarrow {f X}_9 \ {f AC3}_{16} & 
ightarrow {f X}_{10} \end{array}$$

$$45_{10} \rightarrow X_{3}$$
 $45 / 3 = 15r0$ 
 $15 / 3 = 5r0$ 
 $5 / 3 = 1r2$ 
 $1 / 3 = 0r1$ 
 $\Rightarrow 1200_{3}$ 

$$253_6 \rightarrow X_{10}$$

$$253_6 = 2 \times 6^2 + 5 \times 6^1 + 3 \times 6^0$$
  
=  $105_{10}$ 

$$113_{10} \rightarrow X_{7}$$

$$113 / 7 = 16r1$$

$$16 / 7 = 2r2$$

$$2 / 7 = 0r2$$

$$\Rightarrow 221_{7}$$

$$132_5 \rightarrow X_9$$

$$132_5 = 1 \times 5^2 + 3 \times 5^1 + 2 \times 5^0 = 42_{10}$$

$$42 / 9 = 4r6$$
 $4 / 9 = 0r4$ 
 $\Rightarrow 46_{0}$ 

$$AC3_{16} \rightarrow X_{10}$$

$$AC3_{16} = 10 \times 16^{2} + 12 \times 16^{1} + 3 \times 16^{0}$$
  
=  $2755_{10}$ 

# Special Bases

Binary: base 2 (0-1)

Octal: base 8 (0-7)

Hexadecimal: base 16 (0-9, A-F)

It's easier to convert between these.

#### 2-8-16 Conversions

$$22,235_{10} = 0101 \ 0110 \ 1101 \ 1011_{2}$$

$$= 5 \ 6 \ D \ B_{16}$$

$$= 0 \ 101 \ 011 \ 011 \ 011 \ 011_{2}$$

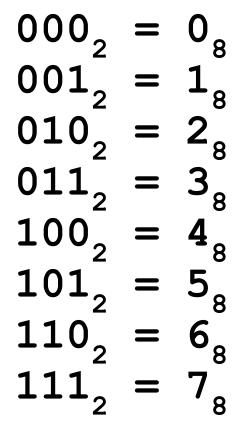
$$= 0 \ 5 \ 3 \ 3 \ 3 \ 3_{8}$$

# Base 2 to Base 8

0111011012

$$000_{2} = 0_{8}$$
 $001_{2} = 1_{8}$ 
 $010_{2} = 2_{8}$ 
 $011_{2} = 3_{8}$ 
 $100_{2} = 4_{8}$ 
 $111_{2} = 6_{8}$ 
 $111_{2} = 7_{8}$ 

## Base 2 to Base 8



# Base 2 to Base 16

```
0000_2 = 0_{16}
0110_2 = 6_{16}
0111_2 = 7_{16}
1000_2 = 8_{16}
1001_2 = 9_{16}
1010_2 = A_{16}
1110_2 = E_{16}
```

```
Base 2 to Base 16
0010 0110 1110 1101<sub>2</sub>
2 6 E D<sub>16</sub>
```

```
0000_2 = 0_{16}
0010_2 = 2_{16}
0011_2 = 3_{16}
0100_2 = 4_{16}
0101_2 = 5_{16}
0110_2 = 6_{16}
0111_2 = 7_{16}
1000_2 = 8_{16}
1001_2 = 9_{16}
1010_2 = A_{16}
1011_2 = B_{16}
1100_2 = C_{16}
1101_2 = D_{16}
1110_2 = E_{16}
1111_2 = F_{16}
```