

CMSC131 Lab

Sections 0108 or 0109

Tim Lin

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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_{10}

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$$592_{10} = 5 \times 10^2 + 9 \times 10^1 + 2 \times 10^0$$

$$645_4 = 6 \times 4^2 + 4 \times 4^1 + 5 \times 4^0$$

$$9AF_{16} = 9 \times 16^2 + 10 \times 16^1 + 15 \times 16^0$$

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

Base 7 to Base 10

241_7

Base 7 to Base 10

$$\begin{aligned}241_7 &= 2 \times 7^2 + 4 \times 7^1 + 1 \times 7^0 \\&= 98_{10} + 28_{10} + 1_{10} \\&= 127_{10}\end{aligned}$$

Base 10 to Base 5

177_{10}

Base 10 to Base 5

$$177_{10} =$$

Base 10				
Integer ÷				
Remainder				

Base 10 to Base 5

$$177_{10} =$$

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

$$= 1202_5$$

Base 10 to Base 2

$$75_{10} =$$

Base 10							
Integer ÷							
Remainder							

Base 10 to Base 2

$$75_{10} =$$

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

$$= 1001011_2$$

Other Examples

$$45_{10} \rightarrow \mathbf{x}_3$$

$$253_6 \rightarrow \mathbf{x}_{10}$$

$$113_{10} \rightarrow \mathbf{x}_7$$

$$132_5 \rightarrow \mathbf{x}_9$$

$$\mathbf{AC3}_{16} \rightarrow \mathbf{x}_{10}$$

$$45_{10} \rightarrow \mathbf{X}_3$$

$$45 / 3 = 15\text{r}0$$

$$15 / 3 = 5\text{r}0$$

$$5 / 3 = 1\text{r}2$$

$$1 / 3 = 0\text{r}1$$

$$\Rightarrow 1200_3$$

$$253_6 \rightarrow \mathbf{X}_{10}$$

$$253_6 = 2 \times 6^2 + 5 \times 6^1 + 3 \times 6^0$$

$$= 105_{10}$$

$$113_{10} \rightarrow X_7$$

$$113 / 7 = 16r1$$

$$16 / 7 = 2r2$$

$$2 / 7 = 0r2$$

$$\Rightarrow 221_7$$

$$132_5 \rightarrow X_9$$

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

$$42 / 9 = 4r6$$

$$4 / 9 = 0r4$$

$$\Rightarrow 46_9$$

$$\text{AC3}_{16} \rightarrow \text{X}_{10}$$

$$\begin{aligned}\text{AC3}_{16} &= 10 \times 16^2 + 12 \times 16^1 + 3 \times 16^0 \\ &= 2755_{10}\end{aligned}$$

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

$$\begin{aligned} 22,235_{10} &= \textcolor{red}{0101} \textcolor{blue}{0110} \textcolor{green}{1101} \textcolor{violet}{1011}_2 \\ &= \textcolor{red}{5} \quad \textcolor{blue}{6} \quad \textcolor{green}{D} \quad \textcolor{violet}{B}_{16} \\ &= 0 \textcolor{green}{101} \textcolor{blue}{011} \textcolor{magenta}{011} \textcolor{brown}{011} \textcolor{orange}{011}_2 \\ &= 0 \quad \textcolor{green}{5} \quad \textcolor{blue}{3} \quad \textcolor{magenta}{3} \quad \textcolor{brown}{3} \quad \textcolor{orange}{3}_8 \end{aligned}$$

Base 2 to Base 8

011101101₂

1₈
010₂ =

2₈
011₂ =

3₈
100₂ =

4₈
101₂ =

5₈
110₂ =

Base 2 to Base 8

011 101 101₂

3 5 5₈

1₈
010₂ =
2₈
011₂ =
3₈
100₂ =
4₈
101₂ =
5₈
110₂ =

Base 2 to Base 16

0010011011101101₂

0000 ₂	=	0 ₁₆
0001 ₂	=	1 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

Base 2 to Base 16

0010 0110 1110 1101₂
2 6 E D₁₆

0000 ₂	=	0 ₁₆
0001 ₂	=	1 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
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1101 ₂	=	D ₁₆
1110 ₂	=	E ₁₆
1111 ₂	=	F ₁₆