



Computer Fundamentals

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Lecture 7



Number System Conversion


- Direct conversions possible for
 - ❑ Binary to octal and vice versa
 - ❑ Binary to hexadecimal and vice versa
 - ❑ Decimal to octal and vice versa
 - ❑ Decimal to hexadecimal and vice versa
- Numbers with other bases
 - ❑ ???



Decimal - Octal Conversion

➤ Convert $(75)_{10}$ to octal

8	75	remainder
8	9	3
8	1	1
	0	1



$(113)_8$



Decimal - Octal Conversion (cont.)

➤ Convert 113 from octal to decimal


$$\begin{aligned}(113)_8 &= 1 \times 8^2 + 1 \times 8^1 + 3 \times 8^0 \\ &= 64 + 8 + 3 \\ &= (75)_{10}\end{aligned}$$



Decimal - Hexadecimal Conversion

➤ Convert $(75)_{10}$ to hexadecimal

16	75	remainder
16	4	B
	0	4



$(4B)_{16}$



Decimal - Hexadecimal Conversion (cont.)

- Convert 4B from hexadecimal to decimal

$$(4B)_{16} = 4 \times 16^1 + 11 \times 16^0$$

$$= 64 + 11$$

$$= (75)_{10}$$



Numbers with Other Bases

- Numbering systems possible with other bases
 - ❑ Base 3, 4, 5 etc.
- Conversion to decimal or any other base possible



Base-3 System

- Base 3 numbers expressed in positional notation

The right-most is the least significant digit

$$1202 = 1 \times 3^3 + 2 \times 3^2 + 0 \times 3^1 + 2 \times 3^0$$

The left-most is the most significant digit



Base-3 System (cont.)

➤ Constituents of a decimal number

$$1202 = 1 \times 3^3 + 2 \times 3^2 + 0 \times 3^1 + 2 \times 3^0$$

1's multiplier

1



Base-3 System (cont.)

➤ Constituents of a decimal number

$$1202 = 1 \times 3^3 + 2 \times 3^2 + 0 \times 3^1 + 2 \times 3^0$$

3's multiplier

Diagram illustrating the expansion of the decimal number 1202 into its base-3 components. The number 1202 is shown with the digit 0 highlighted in green. A green bracket above the 0 is labeled with the number 3. A green arrow points from the text "3's multiplier" below to the 0 in the number 1202. Another green arrow points from the text "3's multiplier" below to the 3¹ term in the expansion.



Base-3 System (cont.)

➤ Constituents of a decimal number

$$1202 = 1 \times 3^3 + 2 \times 3^2 + 0 \times 3^1 + 2 \times 3^0$$

9's multiplier

9



Base-3 System (cont.)

- Constituents of a decimal number

$$1202 = 1 \times 3^3 + 2 \times 3^2 + 0 \times 3^1 + 2 \times 3^0$$


27's multiplier



Base 3 - Decimal Conversion

➤ Convert 75 from decimal to base 3

3	75	remainder
3	25	0
3	8	1
3	2	2
	0	2



$(2210)_3$



Base 3 - Decimal Conversion (cont.)

- Convert 2210 from base 3 to decimal

$$\begin{aligned}(2210)_3 &= 2 \times 3^3 + 2 \times 3^2 + 1 \times 3^1 + 0 \times 3^0 \\&= 54 + 18 + 3 + 0 \\&= 75\end{aligned}$$



Exercise

- Convert $(95)_{10}$ to base 2, base 3 and base 16 numbers



Logical Operations Revisited

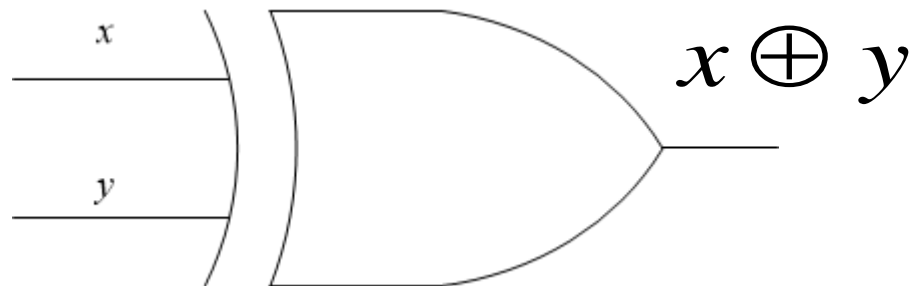
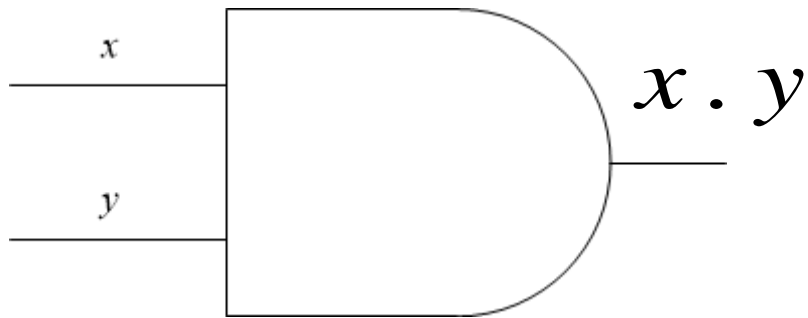
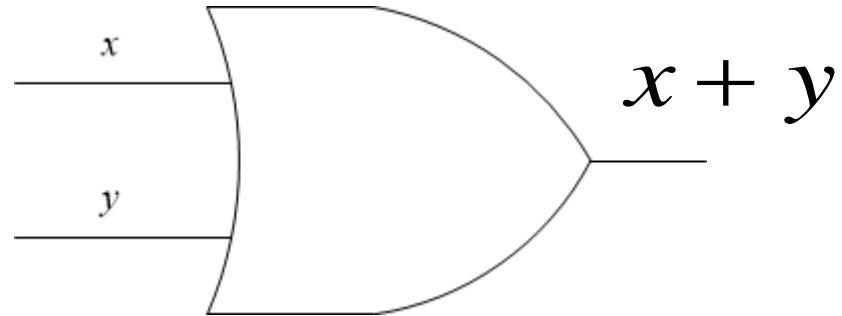
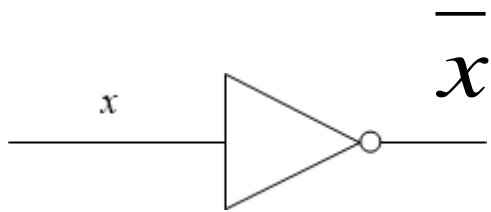
- Truth table for three or more input variables
 - ❑ Follow stepwise approach

x	y	z	$x \oplus y$	$(x \oplus y) \cdot z$
0	0	0	0	0
0	0	1	0	0
0	1	0	1	0
0	1	1	1	1
1	0	0	1	0
1	0	1	1	1
1	1	0	0	0
1	1	1	0	0



Diagrammatic Representation

- Graphical depiction of boolean expression

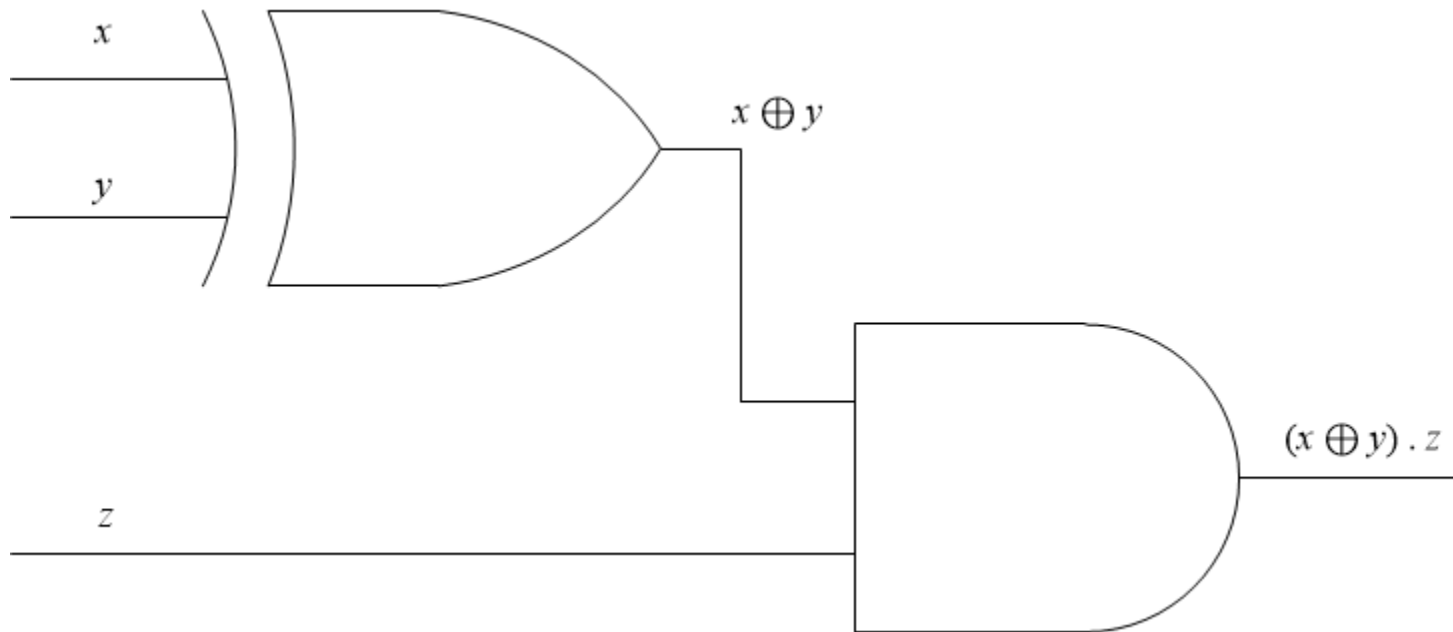




Diagrammatic Representation (cont.)

- Draw diagram for representation of boolean expression

$$(x \oplus y) \cdot z$$





Exercise

➤ Derive truth table for $(x + y) \oplus z$

x	y	z		
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		



Exercise (cont.)

- Draw diagram of boolean expression

$$(x + y) \oplus z$$



Exercise (cont.)

➤ Derive truth table for $\overline{(x + y)} \oplus \bar{z}$

x	y	z				
0	0	0				
0	0	1				
0	1	0				
0	1	1				
1	0	0				
1	0	1				
1	1	0				
1	1	1				



Exercise (cont.)

- Draw diagram for representation of boolean expression

$$\overline{(x + y)} \oplus \bar{z}$$



Exercise (cont.)

- Write the boolean expression for this diagram
- Determine truth table for the following logic diagram

