Computer Fundamentals

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Lecture 7

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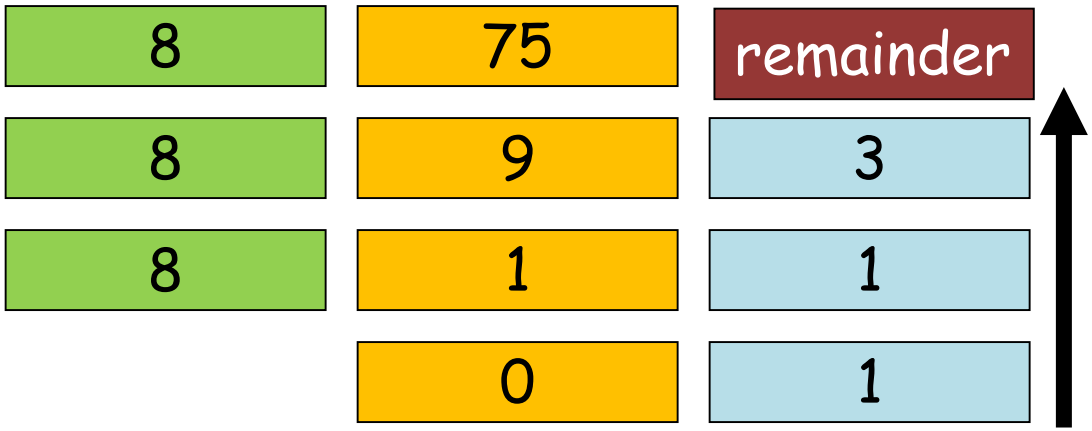
Number System Conversion

- 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



$(113)_8$

Decimal – Octal Conversion (cont.)

- Convert 113 from octal to decimal

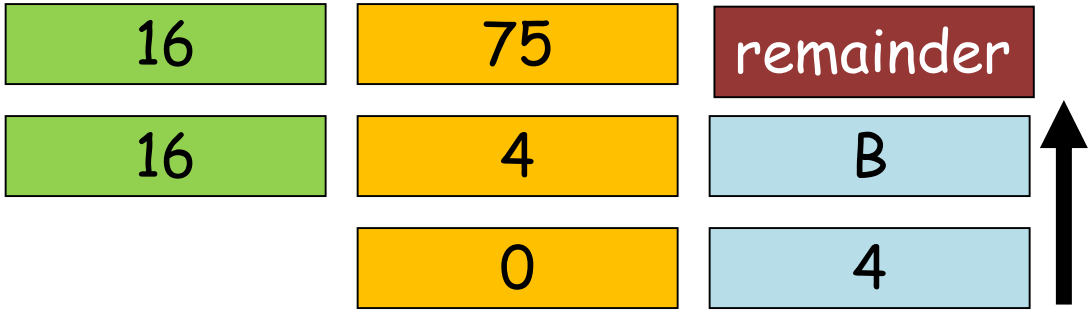
$(113)_8 = 1x8^2 + 1x8^1 + 3x8^0$

$= 64 + 8 + 3$

$= (75)_{10}$

Decimal – Hexadecimal Conversion

- Convert $(75)_{10}$ to hexadecimal



$(4B)_{16}$

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

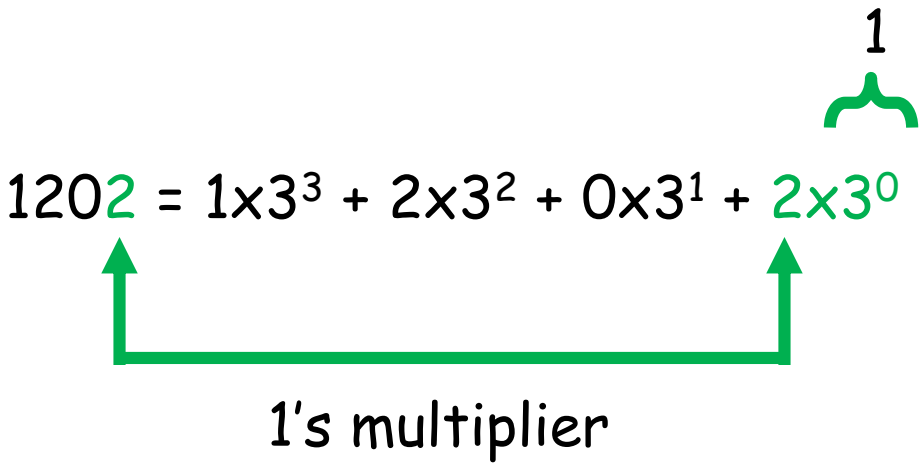
The right-most is the least significant digit

$$1202 = 1x3^3 + 2x3^2 + 0x3^1 + 2x3^0$$

The left-most is the most significant digit

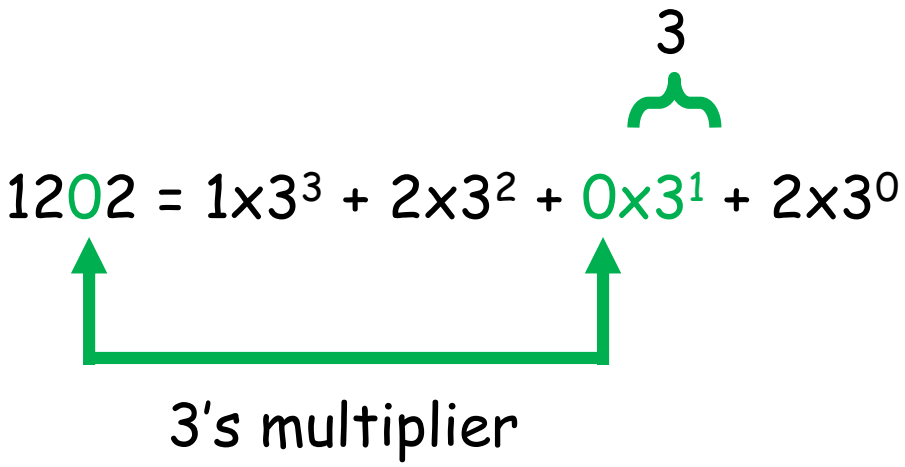
Base-3 System (cont.)

- Constituents of a decimal number



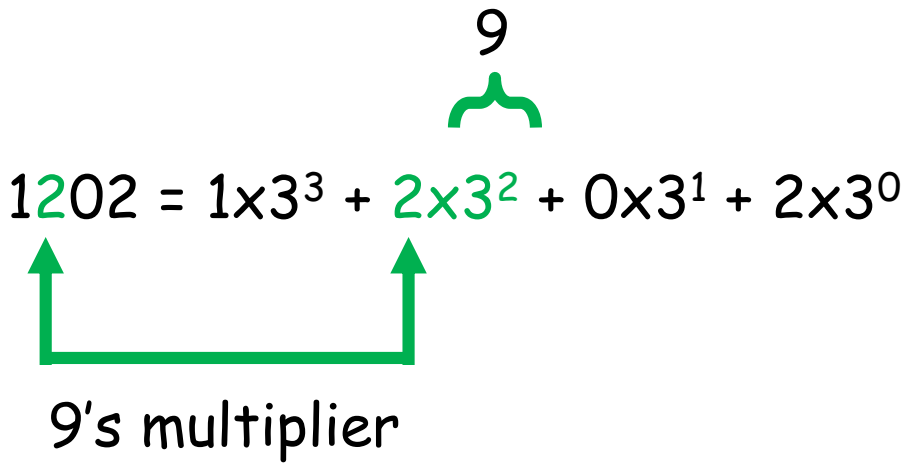
Base-3 System (cont.)

- Constituents of a decimal number



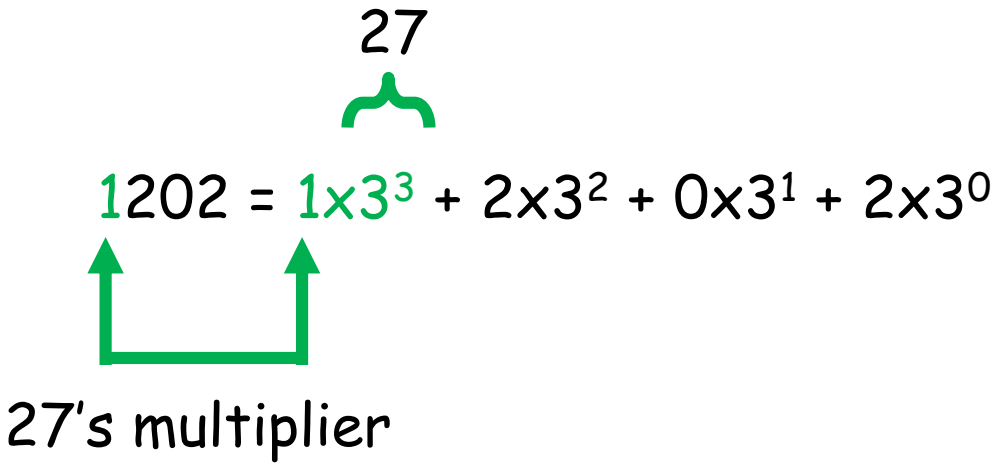
Base-3 System (cont.)

- Constituents of a decimal number



Base-3 System (cont.)

- Constituents of a decimal number



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

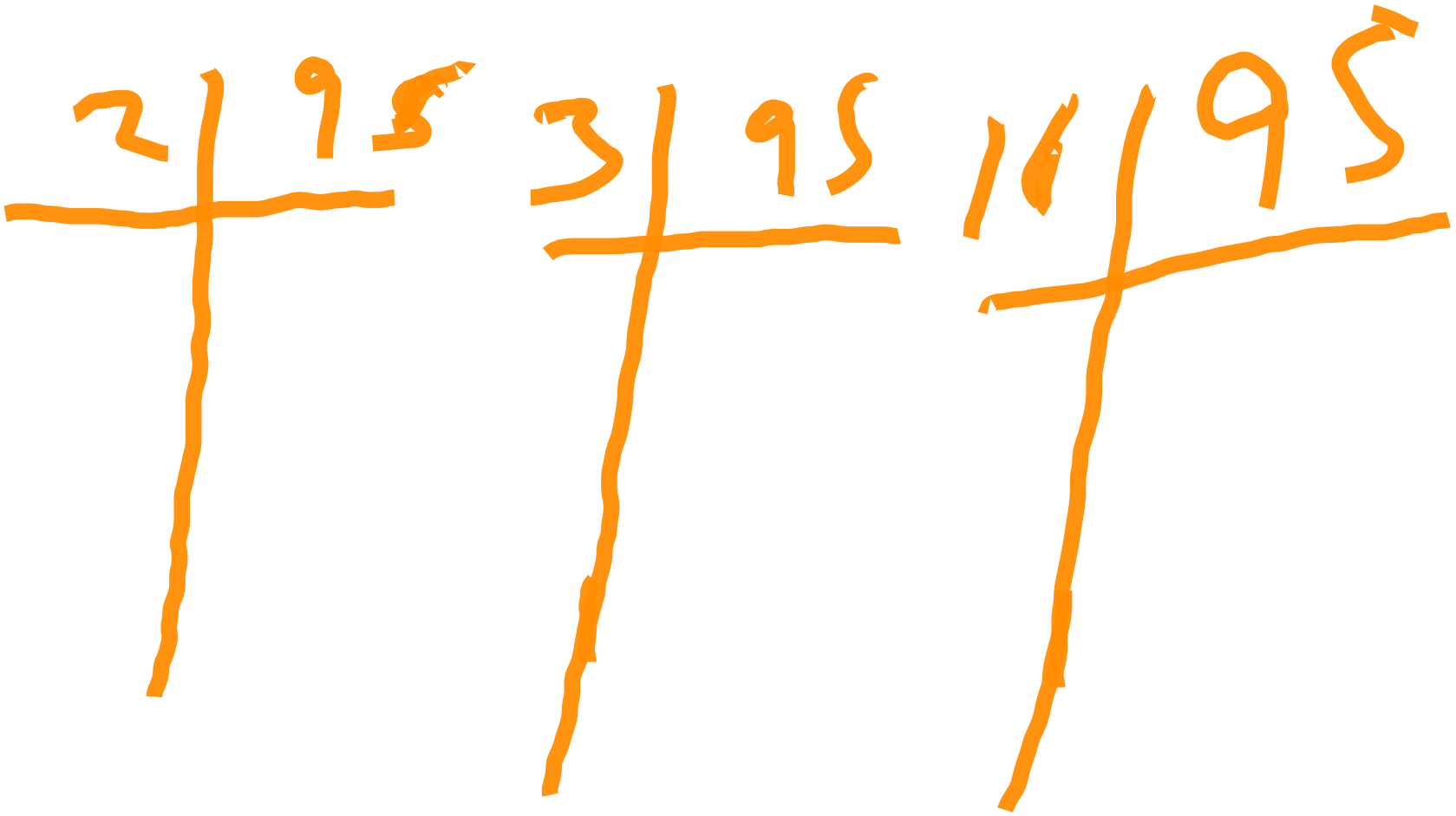
$$(2210)_3 = 2\times3^3 + 2\times3^2 + 1\times3^1 + 0\times3^0$$

$$= 54 + 18 + 3 + 0$$

$$= 75$$

Exercise

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



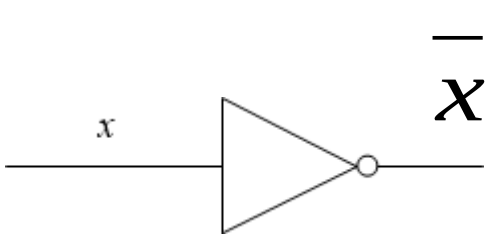
Logical Operations Revisited

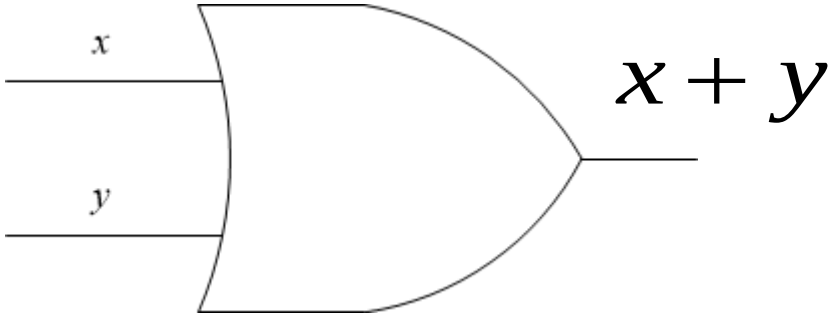
- Truth table for three or more input variables
  - Follow stepwise approach

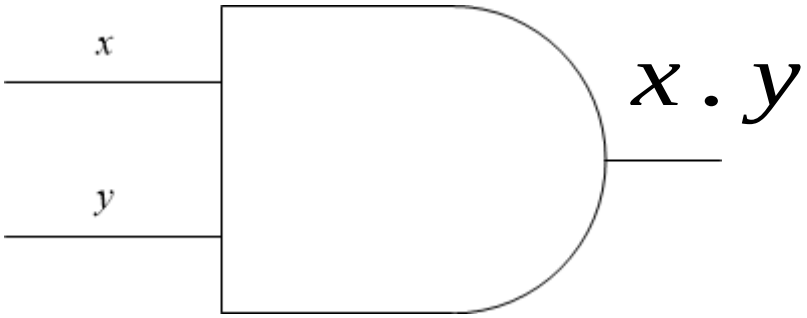
x	y	z	$x \oplus y$	$(x \oplus y).z$
0	0	0	0	0
0	0	1	0	0
0	1	0	1	0
0	1	1	1	1
1	0	0	1	0
1	0	1	1	1
1	1	0	0	0
1	1	1	0	0

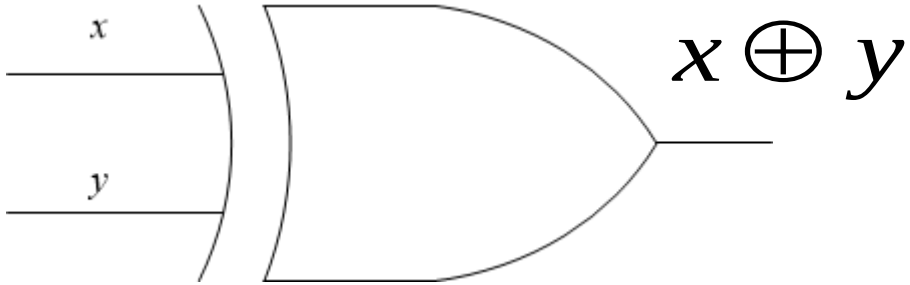
Diagrammatic Representation

- Graphical depiction of boolean expression





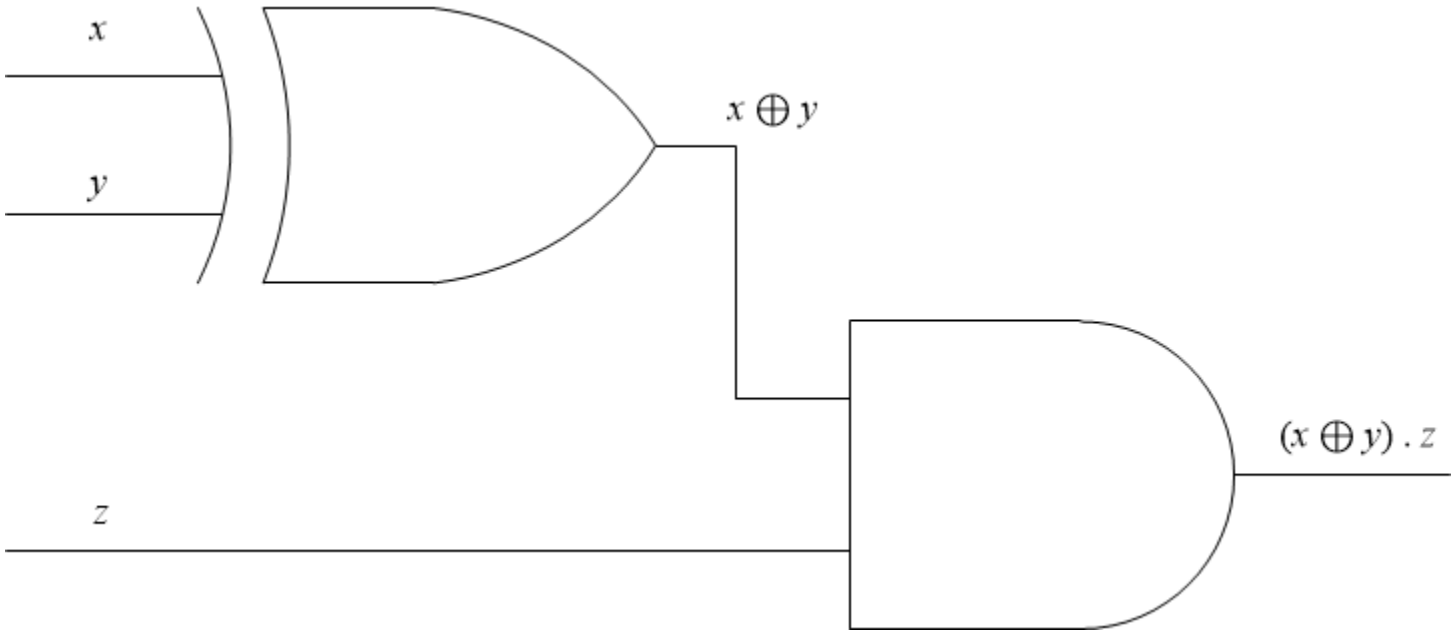




Diagrammatic Representation (cont.)

- Draw diagram for representation of boolean expression

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



Exercise

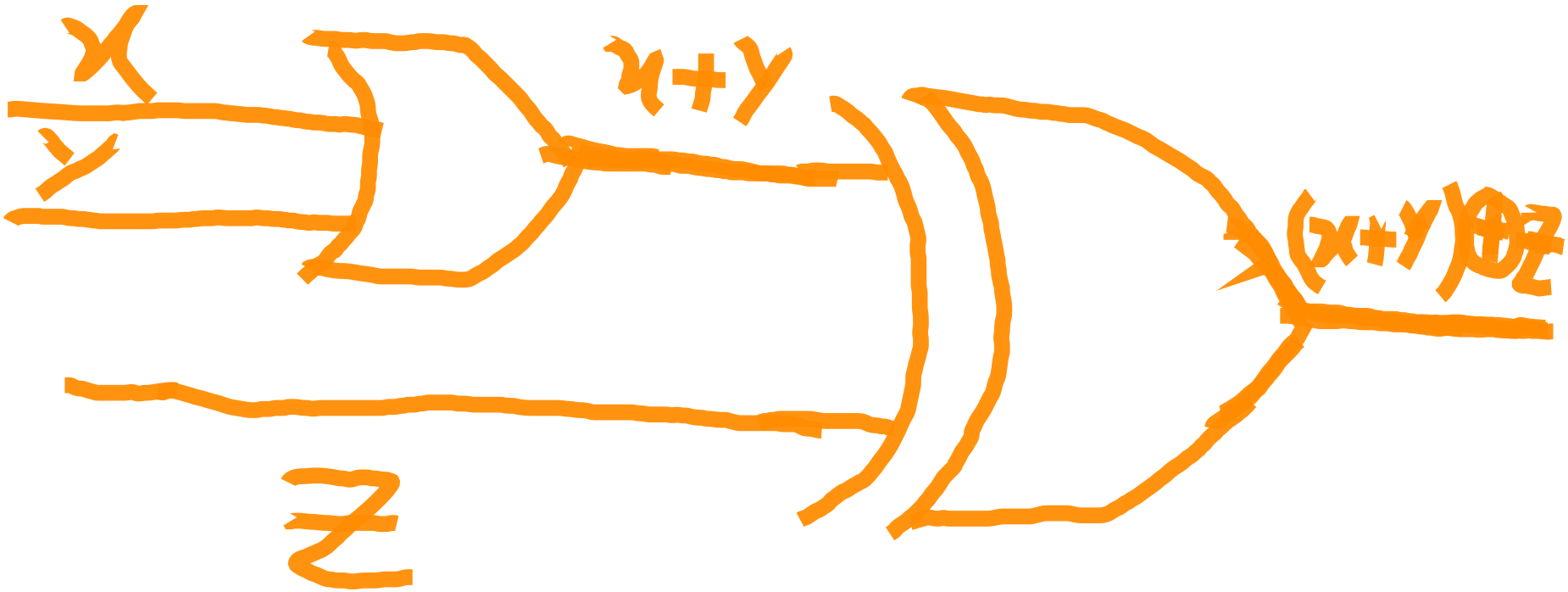
- Derive truth table for $(x + y) \oplus z$

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

Exercise (cont.)

- Draw diagram of boolean expression

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



Exercise (cont.)

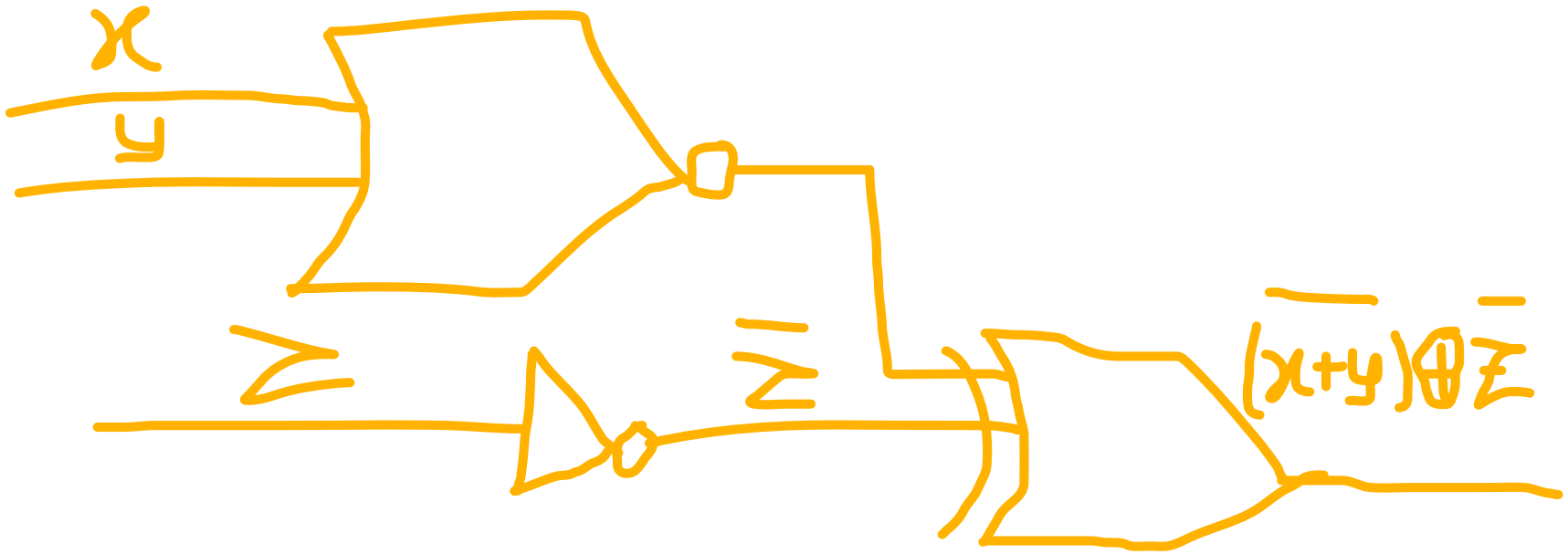
- Derive truth table for $\overline{(x+y)} \oplus \bar{z}$

x	y	z	$x+y$	$\overline{x+y}$	$\bar{z}$	$x+y \oplus \bar{z}$
0	0	0	0	1	1	0
0	0	1	0	1	0	1
0	1	0	1	0	1	1
0	1	1	1	0	0	0
1	0	0	1	0	1	1
1	0	1	1	0	0	0
1	1	0	1	0	1	1
1	1	1	1	0	0	0

Exercise (cont.)

- Draw diagram for representation of boolean expression

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



Exercise (cont.)

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

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