# ELEC 8550-1, Fall 2020

# Computer Arithmetic

Dr. H. Wu

Dept of Electrical and Computer Engineering

University of Windsor

# What is Arithmetic?

- **Addition/Subtraction,**
- **Multiplication,**
- **Division,**
- **etc.**
- **all elementary school stuff**

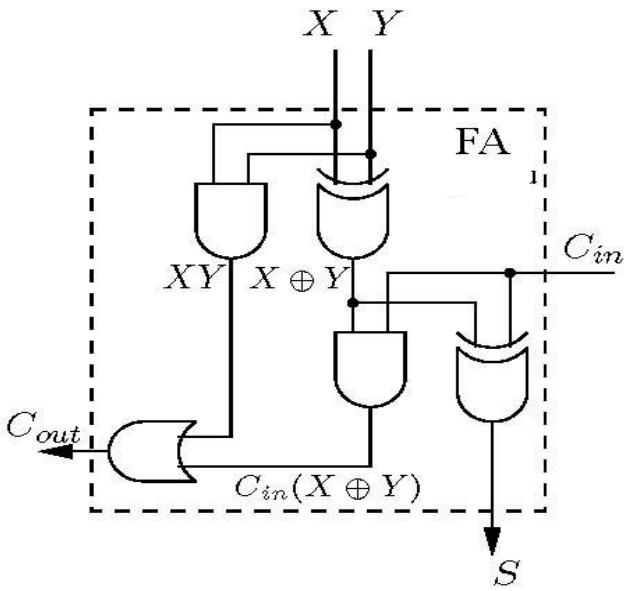
# What is *Computer Arithmetic?*

Three questions:

1. How are numbers represented in a computer?
2. How are the arithmetic operations performed in a computer?
3. How can the operations be performed efficiently?

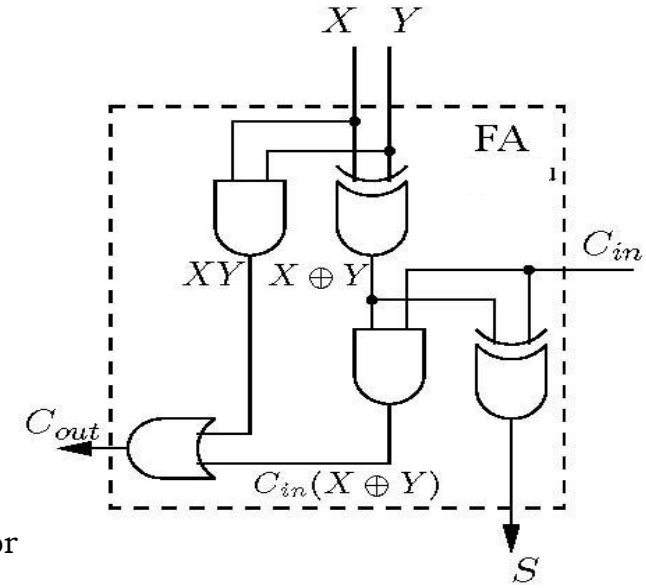
# Simple example: Design a 1-bit adder

1. Representation of the inputs and outputs:
   - Input: X, Y, $C_{in}$ and Output: S, $C_{out}$
   - All are one bit binary number
2. Algorithm for 1-bit addition:
   - $S = X \oplus Y \oplus C_{in}$,
   - $C_{out} = XY + C_{in}(X \oplus Y)$
   - S is the sum bit of X+Y, and $C_{out}$ is the carry-out bit.
3. Circuit for the 1-bit adder:
   - Full Adder: the circuit diagram.



# Simple example: Design a 1-bit adder

4. How to evaluate the efficiency of a circuit?
   - Circuit complexities: √
     - How many logic gates does it use?
     - How much time delay does it have?



# This course is about efficient computation for

- Computer systems
- DSP
- Communications & Networks
- Network Security and Cryptography
- Control & Robotics
- Any computer or computation related applications

# Background requirements

- Arithmetic (from elementary school)
- Digital logic design
- Computer architecture (i.e., CPU)

# Important information

- All lecture notes are posted at course website.
- All assignment solutions are posted at course website after you have submitted the assignments.
- I generally follow the lecture notes in class, although more examples/discussions may be given in class.
- Only the content covered in the lecture notes or in class is tested in the exams (midterm and final).

# A kind reminder (Important):

- Assignments and project reports are submitted electronically via course website,
  - which means no email or hardcopy submission.
- Late assignments will be deducted 10% per day up to 3 days (after which they will receive 0 marks).
- Visit the professor or teaching assistant only during office hours.
- For urgent matters it is recommended to use email to make an appointment.
  - If you cannot make it for the appointment, please send a cancellation email in advance.
- Emailing the professor/GA is welcomed. Please put [8550-1] in the email subject when emailing, otherwise replay could be delayed.