

# Recursive Adder

Lecture 20  
Section C.5

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1 A Recursive Ripple Adder

2 Levels of Logic

3 Assignment

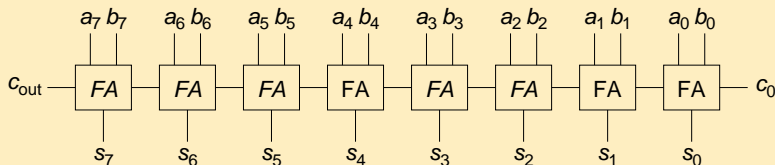
1 A Recursive Ripple Adder

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# The Ripple Adder

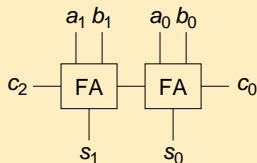
## The Ripple Adder



- An 8-bit ripple adder

# A 2-bit Adder

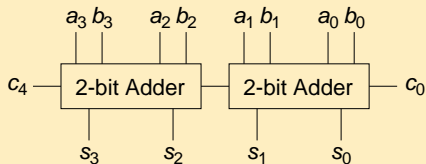
## A 2-bit Adder



- We can combine two 1-bit adders to make a 2-bit adder.

# A 4-bit Adder

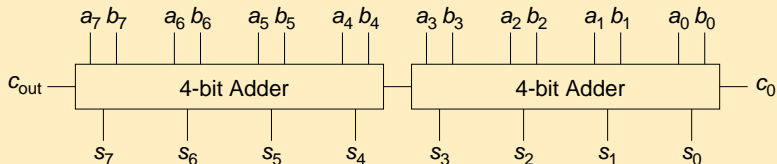
## A 4-bit Adder



- Then we combine two 2-bit adders to make a 4-bit adder.

# An 8-bit Adder

## An 8-bit Adder



- Then we combine two 4-bit adders to make a 8-bit adder, etc.

# Outline

1 A Recursive Ripple Adder

**2 Levels of Logic**

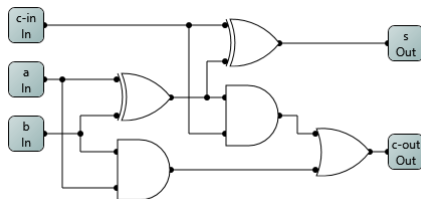
3 Assignment



# Levels of Logic

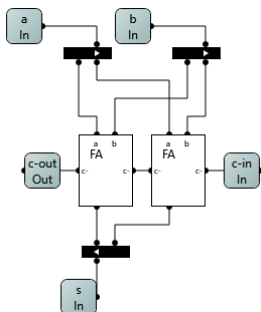
- Two operations are **independent** if the inputs of neither one depend on the outputs of the other.
- If the operations of two logic gates are independent, then they can operate simultaneously.
- To speed up a processor, we want to run as many operations simultaneously as possible.
- Each step is a **level of logic**.

# Logic Levels of Ripple Adders



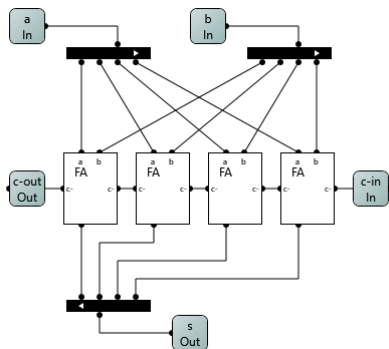
- How many logic levels are required by a full adder?

# Logic Levels of Ripple Adders



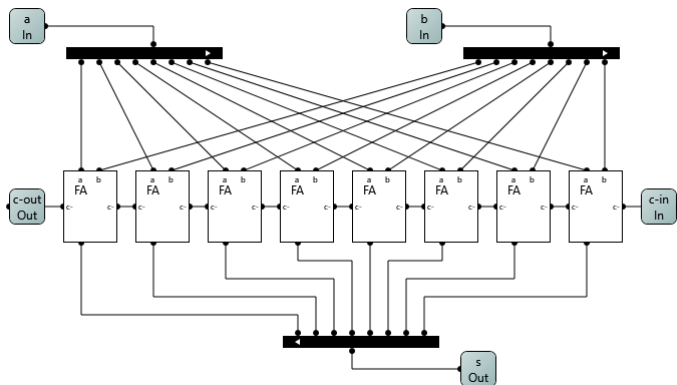
- How many logic levels are required by a 2-bit non-recursive ripple adder?

# Logic Levels of Ripple Adders



- How many logic levels are required by a 4-bit non-recursive ripple adder?

# Logic Levels of Ripple Adders



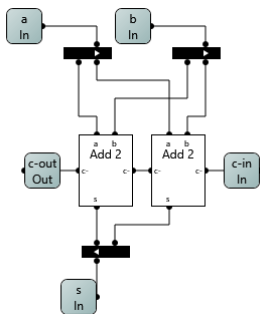
- How many logic levels are required by a 8-bit non-recursive ripple adder?

# Logic Levels of Ripple Adders

- Extrapolate to a 32-bit recursive ripple adder.
- Extrapolate to a 64-bit recursive ripple adder



# Logic Levels of Ripple Adders



- How many logic levels are required by a 4-bit recursive ripple adder?





# Logic Levels of Ripple Adders

- Extrapolate to a 32-bit recursive ripple adder.
- Extrapolate to a 64-bit recursive ripple adder

# Outline

1 A Recursive Ripple Adder

2 Levels of Logic

**3 Assignment**

# Assignment

## Assignment

- Read Section C.5.