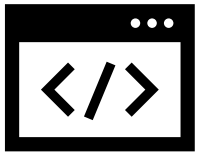
Imperial College London



BIOE40002 – Computer Fundamentals and Programming 1

Part I – Digital Logics, Lab 5

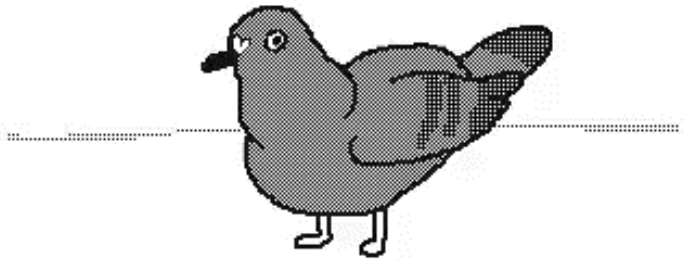
Binghuan Webster Li | *Department of Bioengineering*

binghuan.li19@imperial.ac.uk

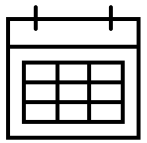
February 17, 2022

Meme of the day…

Imperial College London



When your program is a complete mess, but it does it's job.



Today's Schedule

Imperial College London

- Recap (~ 10 mins)
  - Integration of the 4-bit addition and subtraction machine
  - Selectors and multiplexers
- Lab exercises 11 and 12

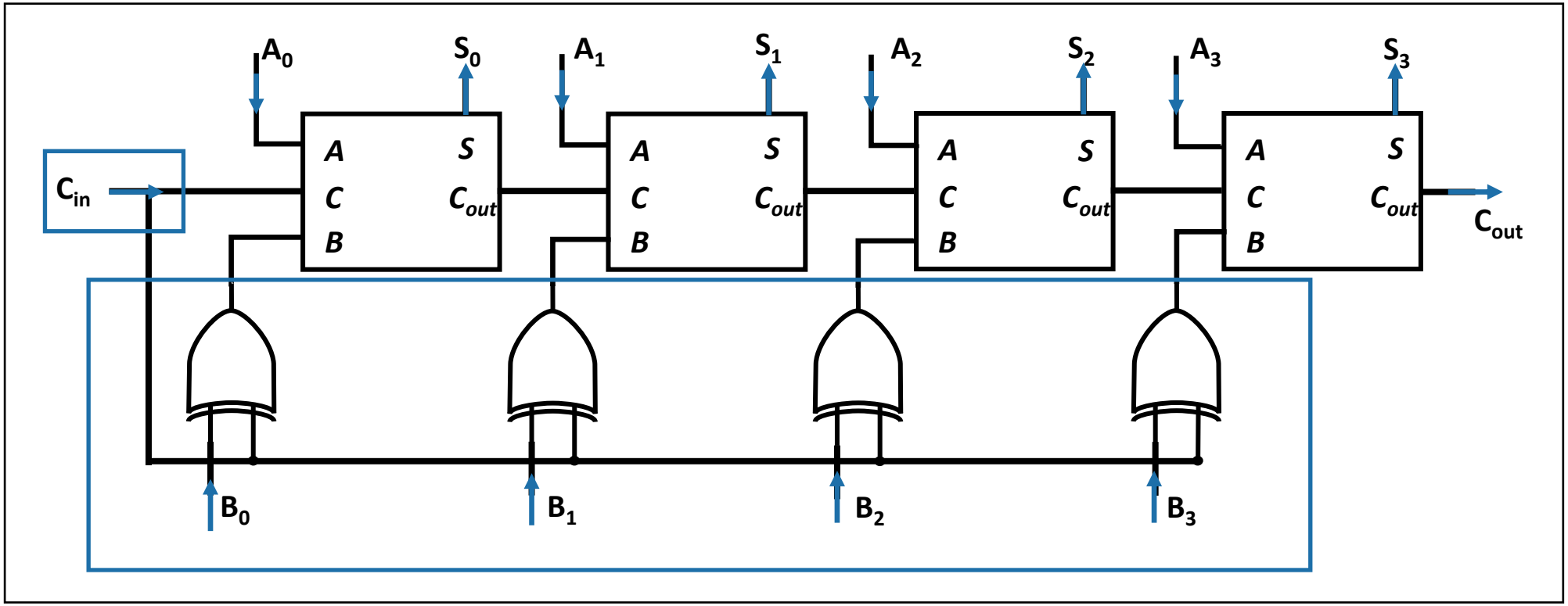
4-bit addition and subtraction machine

Imperial College London

- *Q:* can we integrate addition and subtraction functions into *one* machine?
- ***Rationale:*** a condition to determine whether inverting the input bits is required!

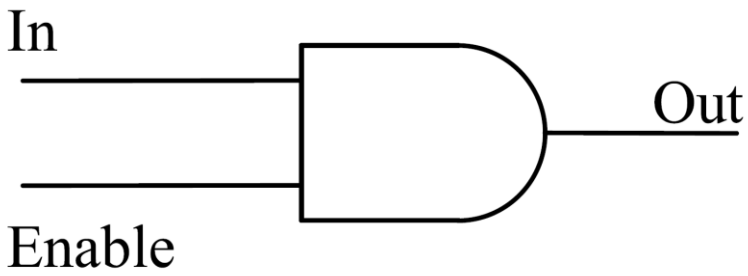
$C_{in} = 0$, addition

$C_{in} = 1$, subtraction



AND gates as selectors

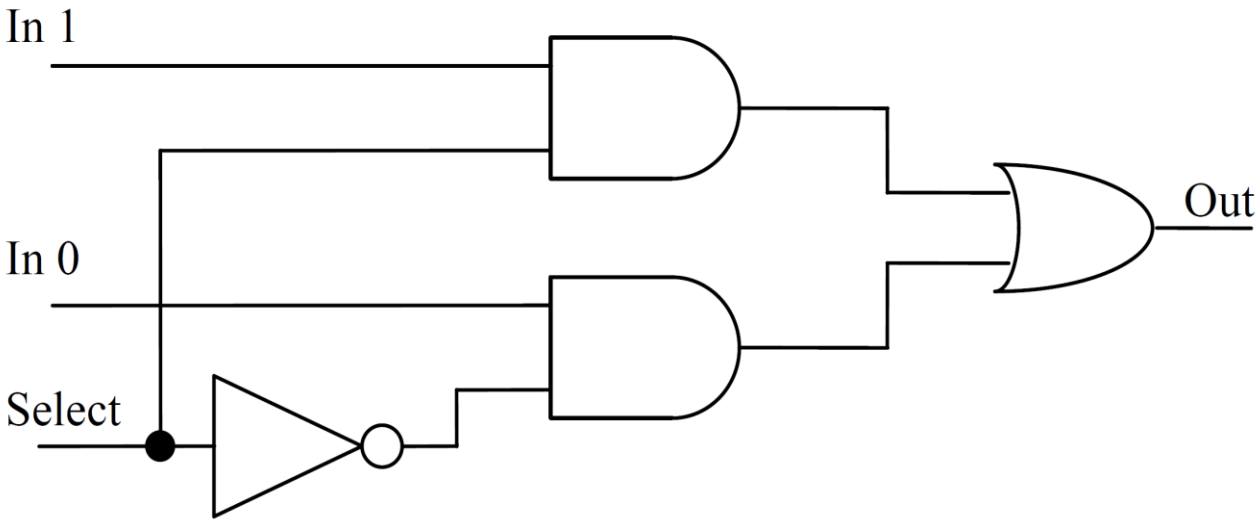
Imperial College London



Enable	*In*	*Out*
0	0	0
0	1	0
1	0	0
1	1	1

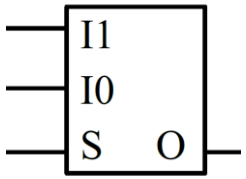
- When *Enable* is set to 1, output follows input
- When *Enable* is set to 0, output would remain 0 regardless of the value of input
- Selector

2 × 1 multiplexer



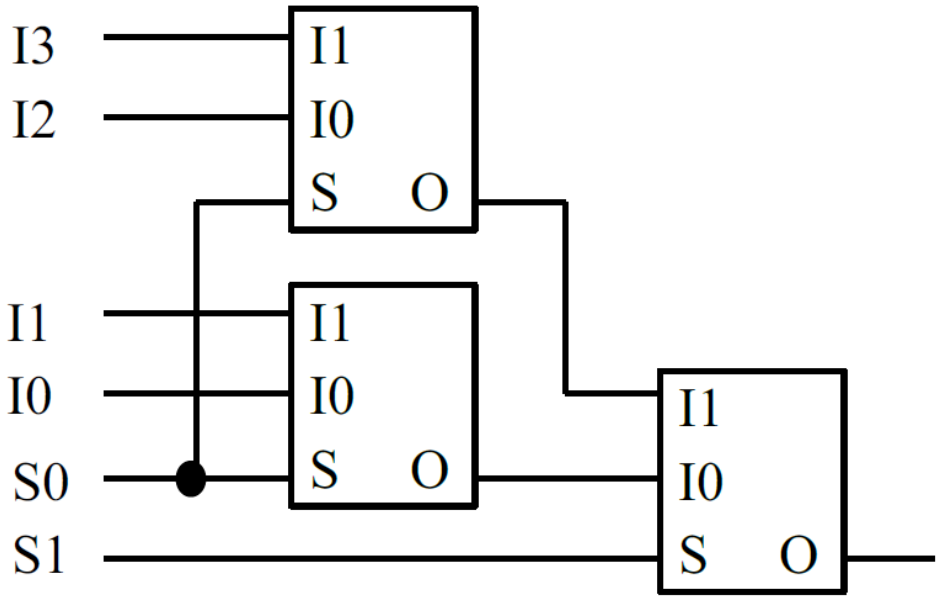
In 0	*In 1*	*Select*	*Out*	
0	0	0	**0**	*In 0*
0	1	0	**0**	
1	0	0	**1**	
1	1	0	**1**	
0	0	1	**0**	*In 1*
0	1	1	**1**	
1	0	1	**0**	
1	1	1	**1**	

- When *Select* is set to 1, output follows input channel 1 (*In1*)
- When *Select* is set to 0, output follows input channel 0 (*In0*)
- 2 × 1 multiplexer



4 × 1 multiplexer

Imperial College London



- 2 selector terminals – *S0*, *S1*
- Select the signal from *I0*, *I1*, *I2*, *I3*
- E.g., *S0=1*, *S1=1*; *O=I3*

It is your turn to design a 8 × 1 multiplexer with two 4 × 1 multiplexers and one 2 × 1 multiplexer!

Imperial College London

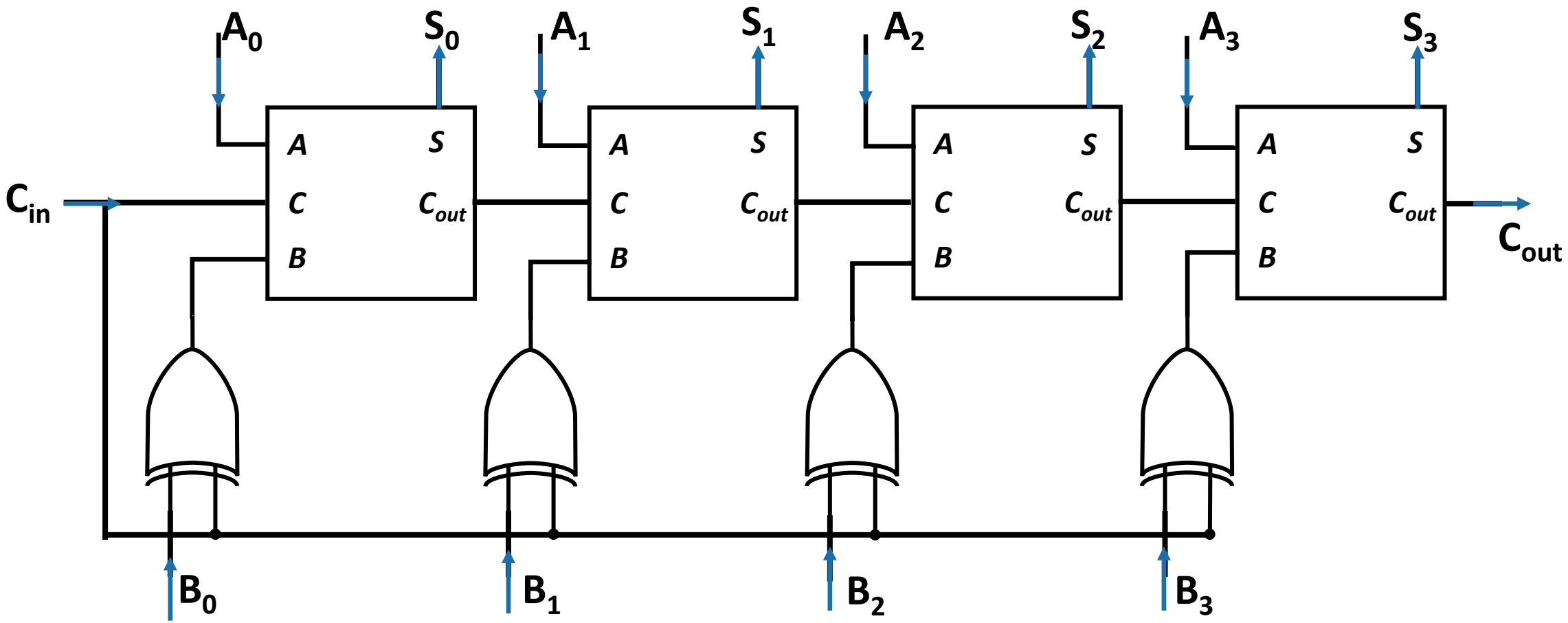
Questions?

That's it for now.

You can now proceed to the Exercise 10 and 11.

Task 11 – design a 4-bit add-subtraction circuit

Imperial College London



- By setting $C_{in} = 0$, the circuit performs addition
- By setting $C_{in} = 1$, the circuit performs subtraction

Task 12 – Design an 8x1 multiplexer

Imperial College London