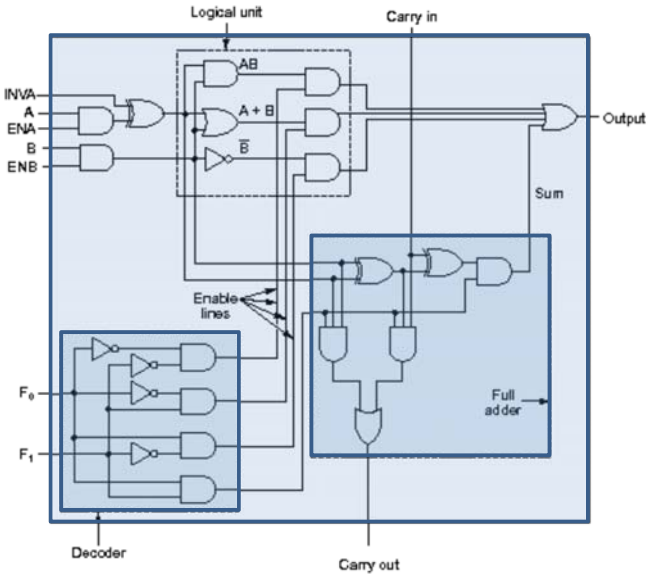
The ALU : Exercises

Using LogiSim ***construct*** the simple **1-bit ALU** shown to the right



Then answer the following questions.

1. What is the purpose of an **ALU**?

2. What are the **three main components** of the ***simple 1-bit ALU*** shown above?

3. **A** and **B** are the inputs for the logical and arithmetic operations that the **ALU** will compute.

   It is possible to force either one to **0** by negating **ENA** or **ENB**.
   It is also possible to produce **A** by setting **INVA**.

   Under normal circumstances **ENA** and **ENB** are both **1** to enable both inputs and **INVA** is **0**.

   Under such conditions the values of **A** and **B** will be fed into the logic unit unmodified.

4. The logical unit computes three different logical operations.

   What are these?

5. Why is the result of only one of these operations passed onto the **OR** gate at the output of the **ALU**?

6. The lower left corner of the **ALU** contains a 2-to-4 decoder.

   What is the purpose of the decoder in the **ALU**

7. The values of **F0** and **F1** control different operations within the **ALU**.

   Experiment with the circuit to deduce the operations that are activated by the different values of **F0** and **F1**, and complete the table below.

F_0	F_1	Operation
0	0	
0	1	
1	0	
1	1	

8. The **ALU** contains a **full adder**. How many bits does a full adder add?

9. Why does the **full adder** have two outputs?

10. List the values of the input switches that will perform the operation **A.B**, assuming that **A = 1** and **B = 1.**

INVA	A	ENA	B	ENB	F_0	F_1	Carry in
	0		1				

11. List the values of the input switches that will perform the operation **A + B**, assuming that **A = 0** and **B = 1**.

INVA	A	ENA	B	ENB	F_0	F_1	Carry in
	0		1				

12. List the values of the input switches that will perform the operation $\overline{B}$,

    assuming that **B = 0**.

INVA	A	ENA	B	ENB	F_0	F_1	Carry in
			0				

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13. List the values of the input switches that will perform the operation **A + B**, assuming that **A = 0** and **B = 0**.

INVA	A	ENA	B	ENB		F_0	F_1	Carry in
	0		0					

14. List the values of the input switches that will add the binary digits **0** and **0**.

INVA	A	ENA	B	ENB	F_0	F_1	Carry in

15. Under those circumstances what will the output value of the **ALU** be and why?

16. List the values of the input switches that will add the binary digits **0** and **1**.

INVA	A	ENA	B	ENB	F_0	F_1	Carry in

17. Under those circumstances what will the output value of the **ALU** be and why?

18. List the values of the input switches that will add the binary digits **1** and **1**.

INVA	A	ENA	B	ENB	F_0	F_1	Carry in

19. Under those circumstances what will the output value of the **ALU** be and why?

20. Why has the **Carry out** output been enabled?

21. List the values of the input switches that will add the binary digits **1** and **1** and **1**.

INVA	A	ENA	B	ENB	F_0	F_1	Carry in

22. Under those circumstances what will the output value of the **ALU** be and why?