Karachi Campus
Discovering Knowledge
Department of Computer Science

Digital Logic Design (LAB)

16 – bit - Adder

Group Members

Haroon Khalid Janjua	02-134192-048
Ammar Anis	02-134192-073
Shaheer Suleman	02-134192-009
Moaaz Rafique	02-134192-064

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Miss Yumnah Hasan

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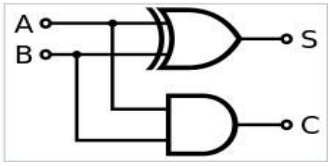
INTRODUCTION

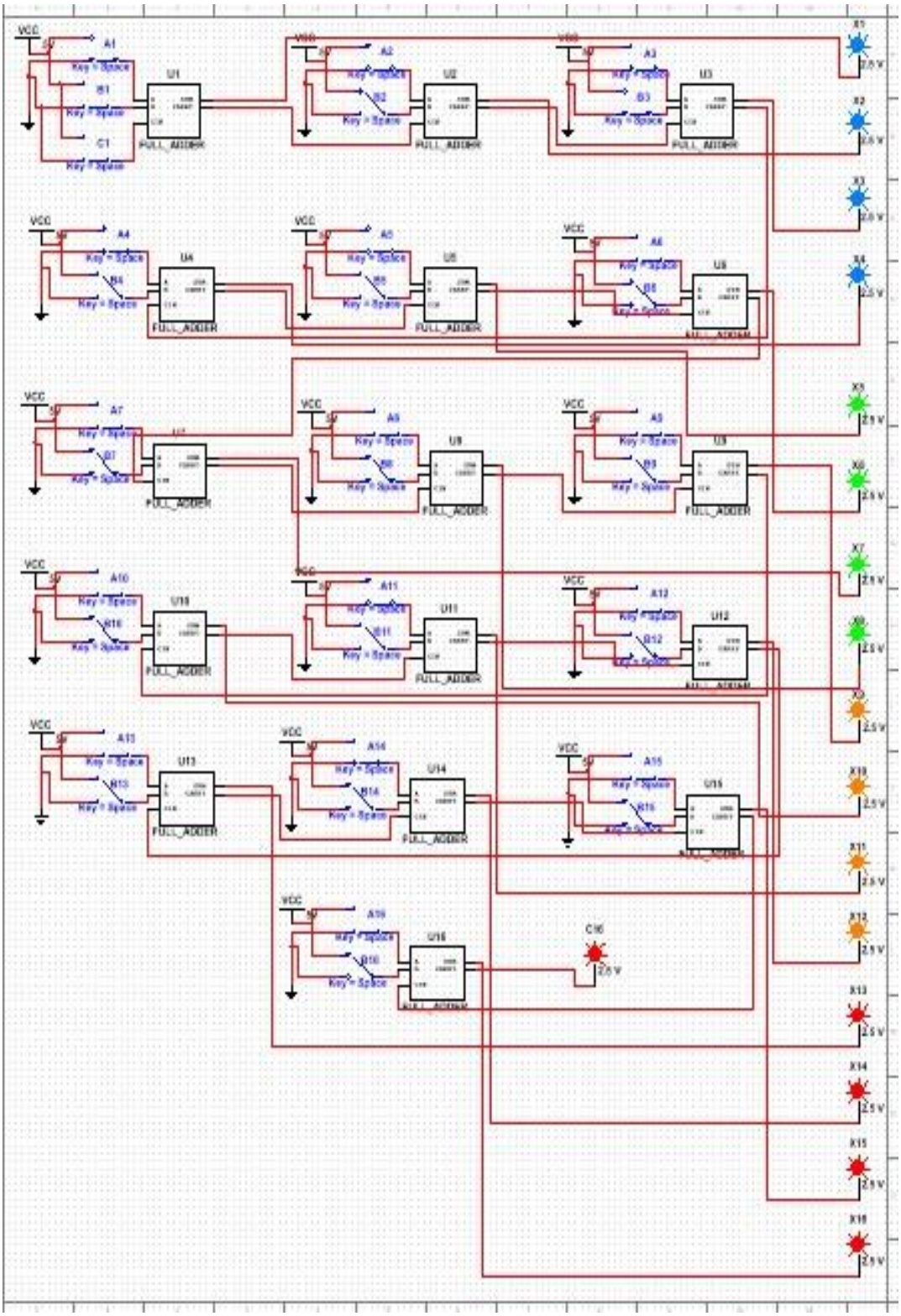
In Electronics, the adder circuit is a digital circuit that performs the addition of a number. Adders are used in arithmetic logic units or ALUs in many computers and other types of processors. They are also used in other parts of the processor where they are used for the calculation of addresses, table indices, increment and decrement operators and similar operations. Although adders can be created for many number representations, such as Binary-coded decimal etc, the most common adders operate on binary numbers.' In cases where two's or one's complements are used to represent negative numbers, it is trivial to modify the adder to the adder-subtractor. Other signed number representations require more logic throughout the basic adder. Well, There are 9 types of adder circuits which can be named as Half adder, Full adder, Ripple-carry adder, Carry-lookahead adder, Brent–Kung adder, Kogge–Stone adder, Carry-save adder, Carry-select adder, Carry-skip adder.

Half adder Logic Diagram Circuit And Truth Table



Inputs		Outputs	
A	B	C	S
0	0	0	0
1	0	0	1
0	1	0	1
1	1	1	0

LADDER LOGIC DIAGRAM

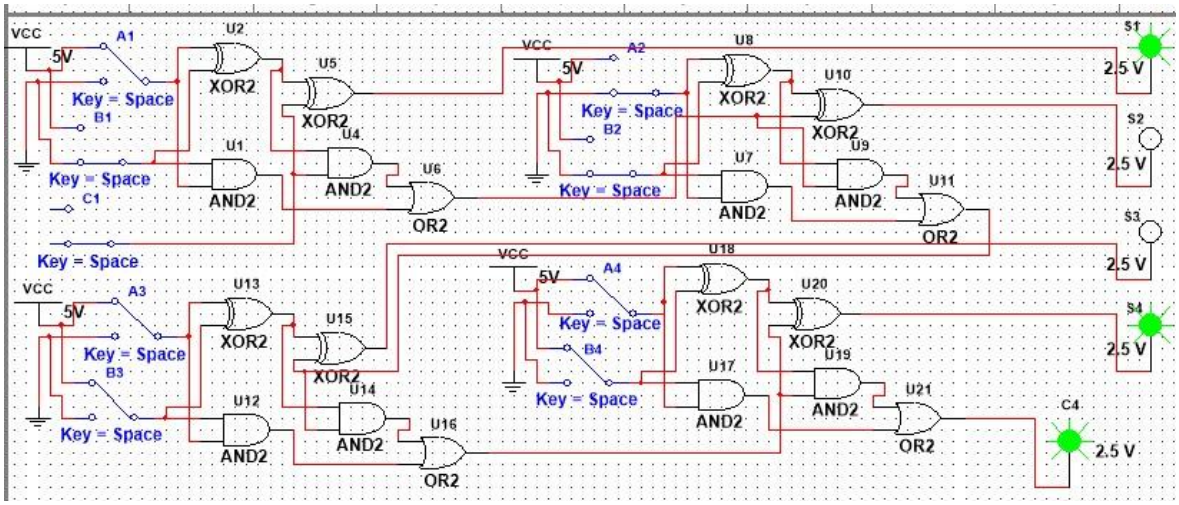


PROJECT DESCRIPTION

16–Bit Adder

In this project, a 16-Bit Adder is being used to perform an addition between two 16-bit binary inputs. Each Adder chip contains a separate VCC, ground for itself. 3 inputs consisting of A, B, Carry-In which delivers two outputs in a form of Sum and Carry-Out. It is necessary to give 16 inputs individually for each variable(A, B). Whereas when it comes to 3rd input C1(Carry-In), the User just has to give input at the start. After that, Result/Output received from Carry-Out will automatically be generated through to next adder chip which will be used as input for Carry-In. Whenever a light probe is turned On/Activated, it's indication is understandable that the output received by the circuit is equal to 1 and When the probe's light is turned Off or doesn't activate, the output received by the circuit is equal to 0.

Now let us discuss how an adder chip circuit is designed and how it works, let's overview its in-depth. Here is a 4-Bit Adder circuit, Which is designed manually on multisim.



Here you can see, that it consists of a Full-Adder circuit. Which is used to take a single input from each variable at a time. A Full-Adder circuit can be made by combining 2 Half-Adder Circuits. A Half-Adder circuit comprises of 1 AND, 1 XOR Gate. This is how a single Adder chip looks like from inside and works in-depth.

SIMULATOR SNAPSHOTS

Figure 1

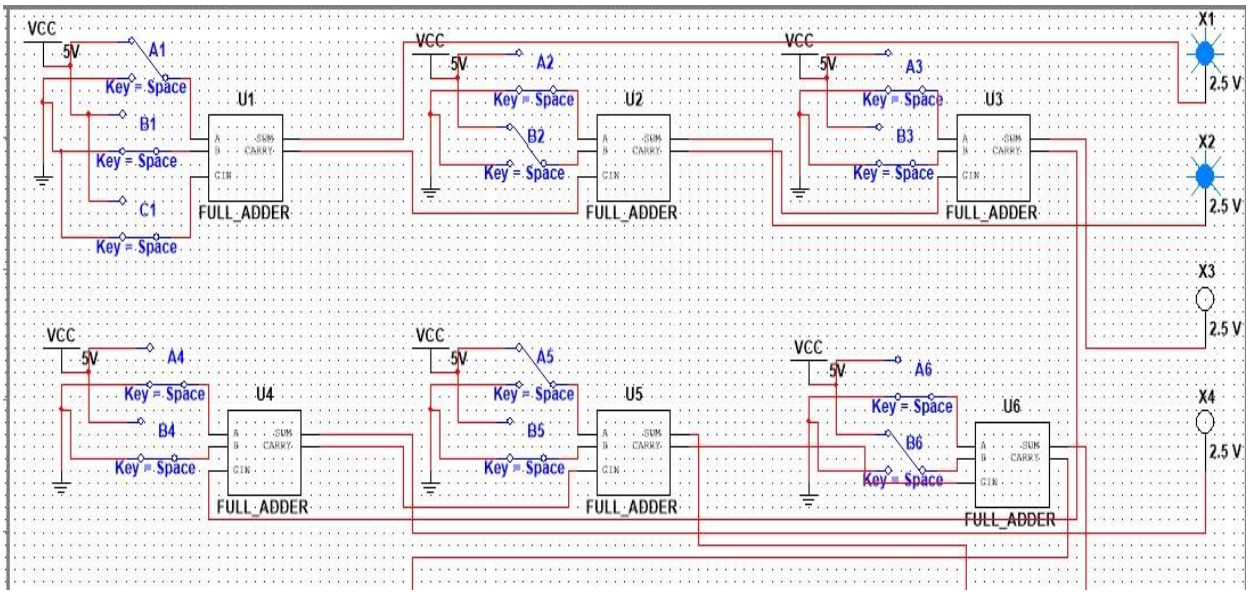


Figure 2

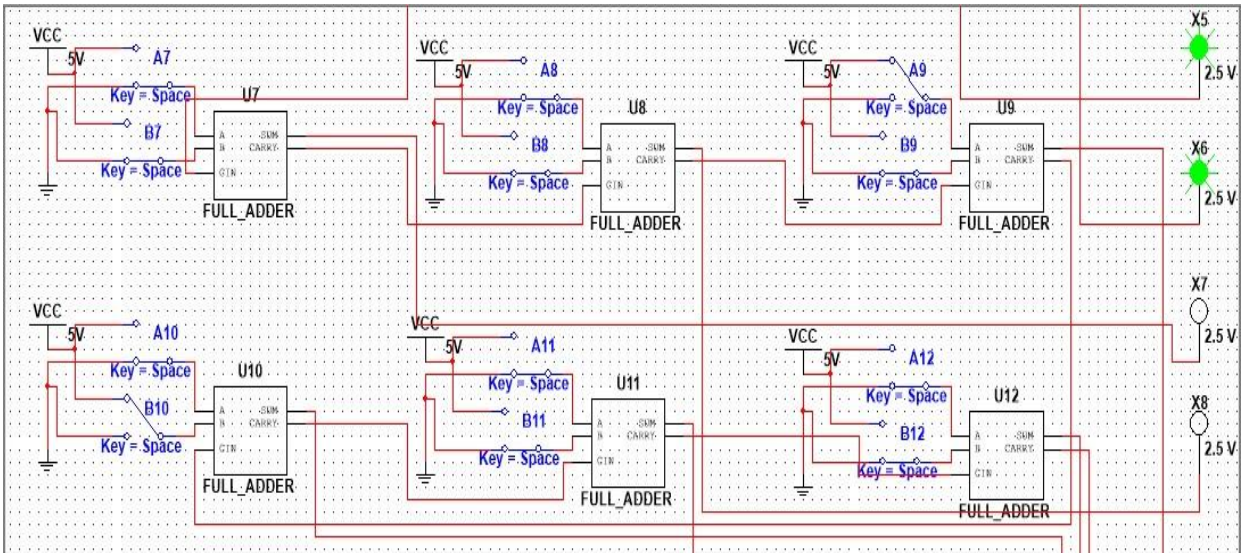


Figure 3

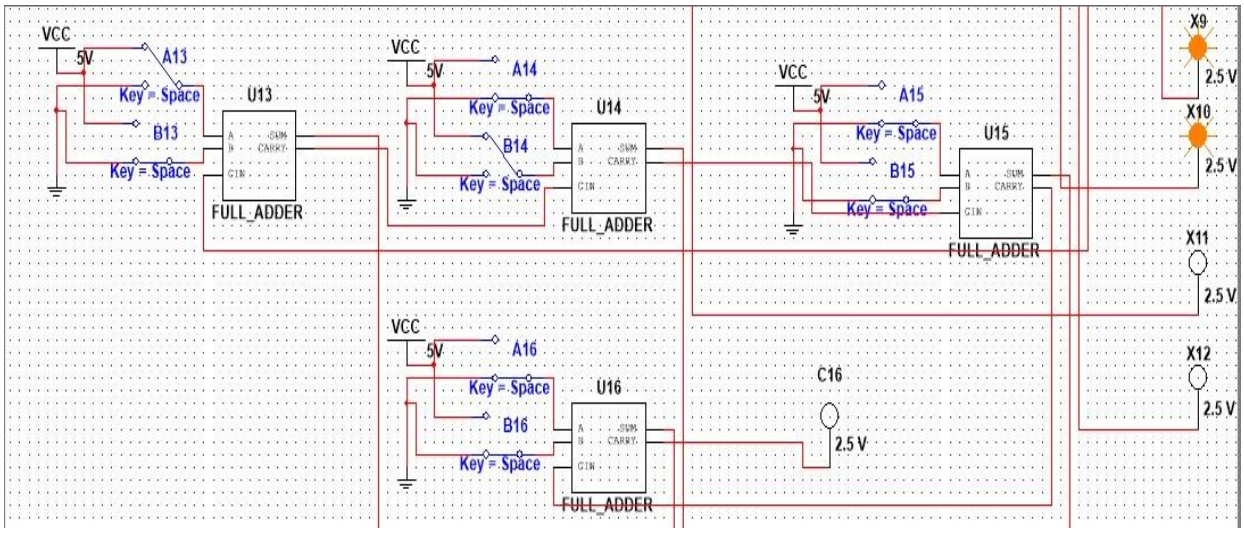
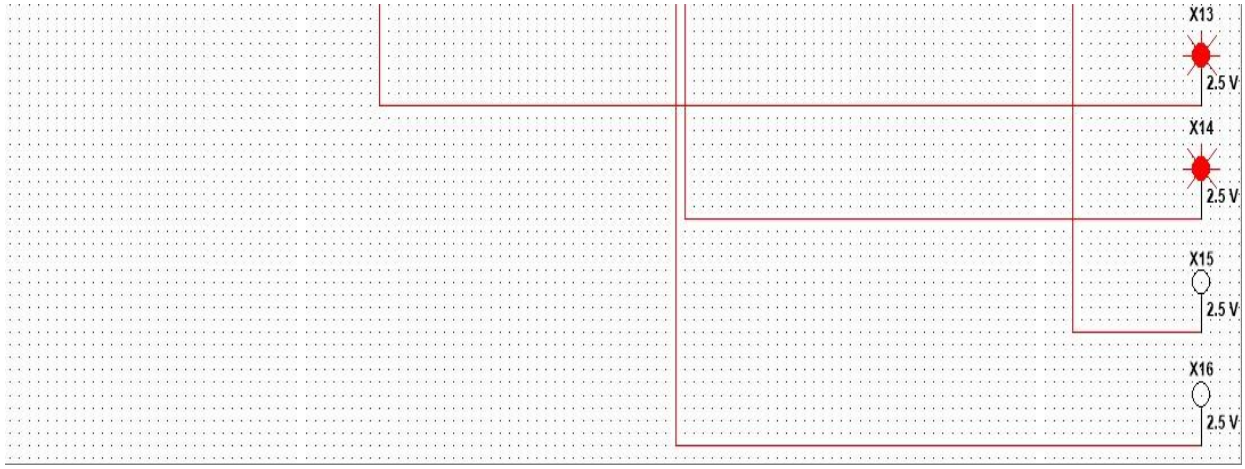


Figure 4



RESULT DISCUSSION

As you can see in Figures 1,2,3,4 input is given and on the other hand, output is successfully delivered. Whole figures join-up to create a 16-Bit Adder. Variable (A) giving an input 0001000100010001 which can be classified as 4369 in denary form. Whereas, Input by variable (B) is 0010001000100010 which can be written as 8738 in denary form. As shown in figure 1, C1(Carry-In) is taken as 0. All Figures show output in the form of a light probe system. Figure 1's output can be classified as 0011, then Figure 2's output is also 0011. Figure 3's output is also 0011 but it also shows C16 which is can also be called Carry-Out, Its Output is 0. In Figure 4 output is 0011. By combining the result shown 4-bit by 4-bit in each figure, It can be written as 0011001100110011(Binary Form) or 13107 In Denary form. Final Result from circuit:(Sum = 0011001100110011, C16(Carry-Out) = 0). Now if we use the denary values and calculate it through the calculator, Answer is still the same which means this circuit operates/works/executes correctly.

CONCLUSION

Adders can be implemented in different methods according to the different requirements. Each kind of adder has different properties in area, propagation delay, and power consumption. There is no absolute advantages or disadvantages for an adder, and usually, one advantage compensates with another disadvantage. For long bit length, a carry look-ahead adder is not practical, but a hierarchical structure one can improve much.

REFERENCES

https://en.wikipedia.org/wiki/Adder_(electronics)