2-bit Binary Adder

AIM

- designing a digital circuit that can add two 2-bit binary numbers and produce a 3-bit output (including the carry-out bit).

INTRODUCTION

A binary Adder is a digital circuit that performs arithmetic sum of two binary numbers provide with any length. A binary Adder is constructed using Full-Adder circuits connected in series, with the output carry from one full-adder connected to the input carry of the next full-adder. In many computers and other kinds of processors, others are used in arithmetic logic units (ALUs). They are also used in other parts of the processor, where they are used to calculate addresses, table indices, increment and decrement operators and similar operations.

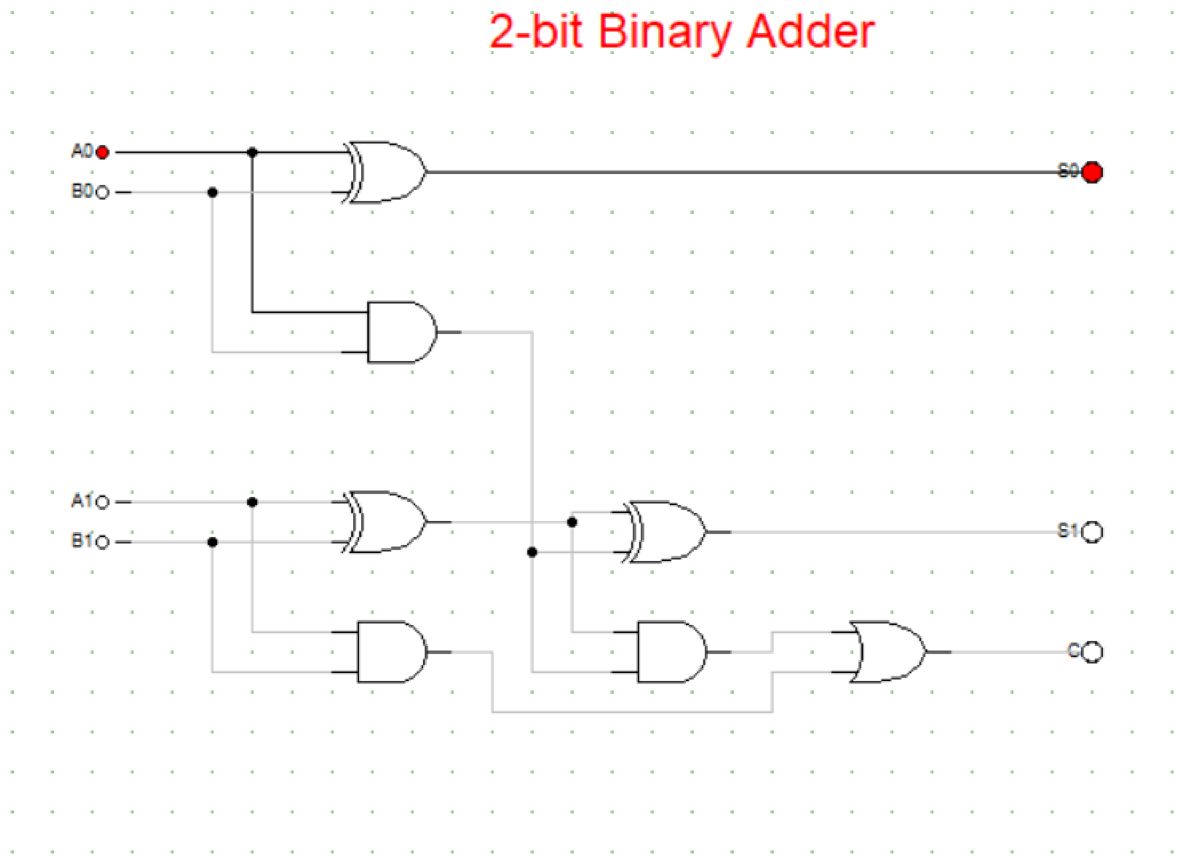
THEORY

Two-Bit binary Adder

A two-bit adder is a circuit the adds together two,2-bitnumbers. The first number, A, can be representing using bits a1 and a0. The second number, B, is similarly represented. The output consists of the sum of A and B, represented as two bits (s1 and s0) and one carry-bit(c). A truth table for a 2-bit adder is as follows:

Inputs				**Outputs**		
A_1	**A_0**	**B_1**	**B_0**	**C**	**S_1**	**S_0**
0	0	0	0	0	0	0
0	0	0	1	0	0	1
0	0	1	0	0	1	0
0	0	1	1	0	1	1
0	1	0	0	0	0	1
0	1	0	1	0	1	0
0	1	1	0	0	1	1
0	1	1	1	1	0	0
1	0	0	0	0	1	0
1	0	0	1	0	1	1
1	0	1	0	1	0	0
1	0	1	1	1	0	1
1	1	0	0	0	1	1
1	1	0	1	1	0	0
1	1	1	0	1	0	1
1	1	1	1	1	1	0

CIRCUIT DESIGN

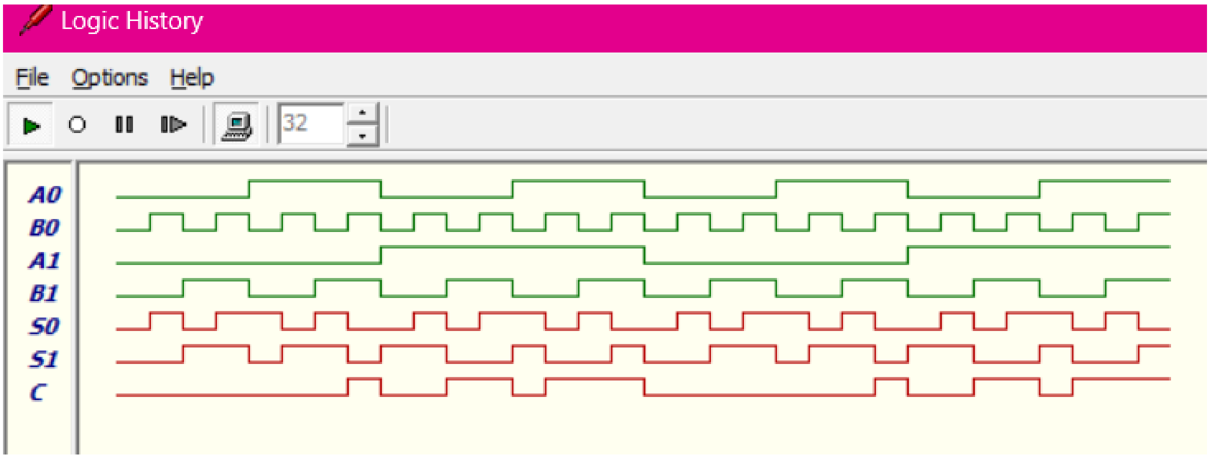


The inputs are generated using sequence generator, and on the outputs, we connected the LEDs. The LED outputs are labelled S0, S1 and C. The S0 LED represents the sum of the input A0 and B0, S1 represents the sum of A1 and B1, while the C represents the carry bit. The LEDs will go on when the output is high and off when the output is low.

TESTING

We took two bits A0 and B0, then we computed the arithmetic manually. From there we compared the answers that are calculated manually to the results from the simulation. We also compared the results using two simulators; digital works which produce waveforms and proteas with LED's. For digital works our inputs are sequence generator and the was the expected waveform. As for proteas we controlled the inputs using a dip switch and on the outputs we connected the LED's of which the expected outcomes were achieved with the corresponding input bits. The problems encountered are that we swapped the bits to the input of the XOR gate and the outcome was not what we expected and also the struggle was with digital works, we were not able to control the bits in the input in order to clearly see if the specific 2 bit input gives the expected results.

!. Waveforms from DigitalWorks Simulation showing expected outcomes.



CHALLENGES

The simulation software was competent, thus; no challenges were identified during running.

CONCLUSION

The circuit was designed, implemented and tested. The simulation for testing was a success.