CSE-306

4-Bit ALU Software Implementation

Submitted by:

Group: 1

Section: B-2

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Introduction

In this assignment, our goal is to design and implement a 4-bit ALU. An Arithmetic Logic Unit (ALU) is the part of a computer processor (CPU) that carries out arithmetic and logic operations on the operands in computers. The operation to be done can be selected using the selection bits.

Problem Specification

Our group is tasked with designing and implementing with software, an ALU with the following functional design specification:

CS2	CS1	CS0 (Cin)	Function
0	0	0	Add
0	0	1	Add with carry
0	1	0	Transfer A
0	1	1	Increment A
1	0	X	OR
1	1	X	X-OR

Truth Table

Function Select			Input			Output	
cs2 (mode select)	cs1	cs0 (cin)	Xi	Yi	Zi	F	Function
0	0	0	Ai	Bi	0	A + B	Add
0	0	1	Ai	Bi	1	A + B + 1	Add with carry
0	1	0	Ai	0	0	A	Transfer A
0	1	1	Ai	0	1	A + 1	Increment A
1	0	x	Ai + Bi	0	0	A or B	OR
1	1	x	Ai	Bi	0	A ⊕ B	XOR

K-maps

For X_i

cs2cs1 \ AiBi	00	01	11	10
00	0	0	1	1
01	0	0	1	1
11	0	0	1	1
10	0	1	1	1

$x_i = A_i + B_i.cs2.cs1'$

For Y_i

cs2cs1 \ Bi	0	1
00	0	1
01	0	0
11	0	1
10	0	0

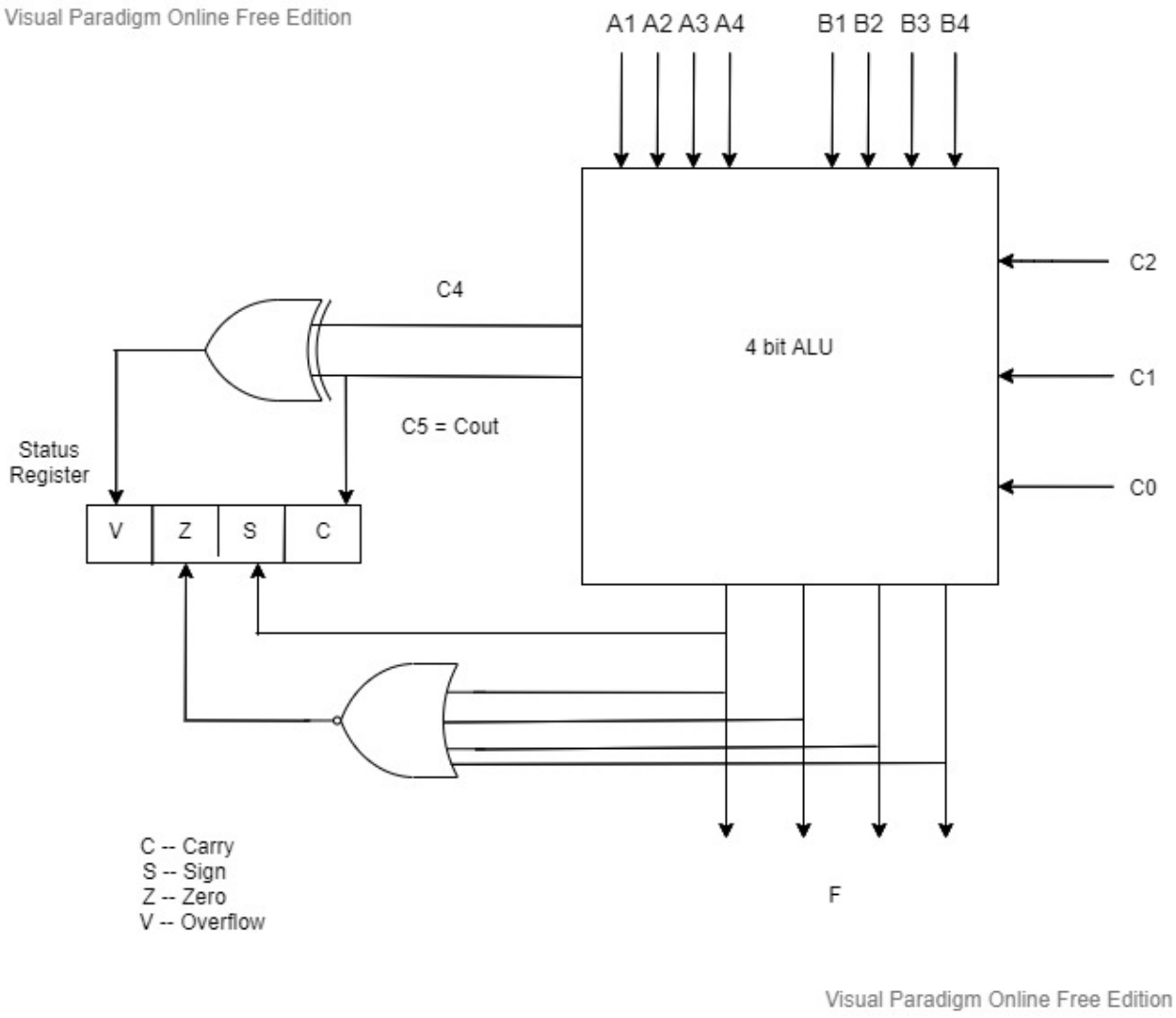
$Y_i = B_i(cs1 \oplus cs2)'$

For Z_i

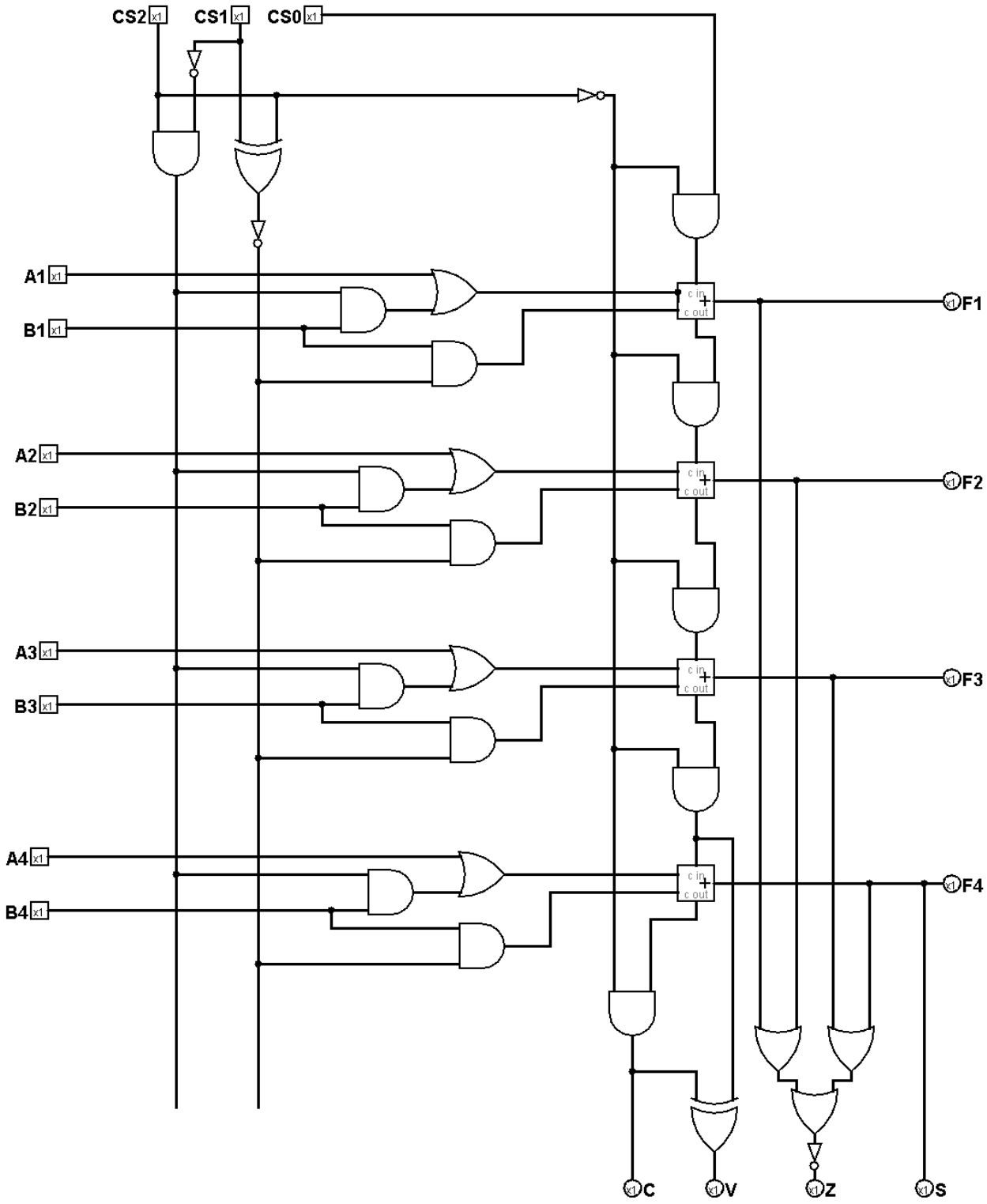
cs2cs1 \ cs0(cin i)	0	1
00	0	1
01	0	1
11	0	0
10	0	0

$Z_i = cs2'.cs_i$

Block Diagram



Complete Circuit Diagram



IC Count

IC	Name	Count
7404	Hex Inverter	1
7408	Quad 2 input AND	4
7432	Quad 2 input OR	2
7483	4-bit binary ADDER	4
7486	Quad 2 input X-OR	1

Simulator Used

We have used “Logisim 2.7.1” to implement and simulate our design of ALU.

Discussion

We have carefully analysed the specification to find the simplest functions for the adder inputs. We have tried to keep the number of ICs minimum and make the design as efficient as possible.