Lab 3
Logic Circuits (EET 241)
Total Points: 100

Objective: Software simulation of binary addition, binary subtraction, even parity and odd parity.

Materials Needed: Logisim (you only need to do software simulation for this lab)

Theory: Binary arithmetic is essential in all digital computers and in many other types of digital systems. To understand digital systems, you must know the basics of binary addition and subtraction.

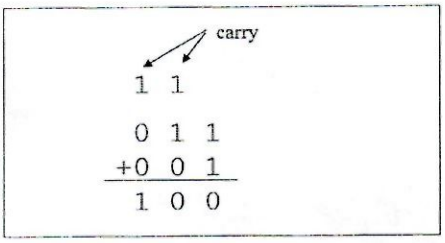
Binary Addition:

Four Basic Rules of Binary Addition:

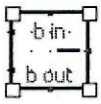
$0 + 0 = 0$ sum = 0, carry = 0
$0 + 1 = 1$ sum = 1, carry = 0
$1 + 0 = 0$ sum = 1, carry = 0
$1 + 1 = 10$ sum = 0, carry = 1

Notice that $1 + 1 = 10$, when binary numbers are added, it creates a sum of 0 in a given column and a carry of 1 over to the next column to the left.

$011 + 001 = ?$



Binary Subtraction



Four Basic Rules of Binary Subtraction:

$0 - 0 = 0$
$1 - 1 = 0$

1 - 0 = 1

0 - 1 = 1 with a borrow of 1; 10 – 1 = 1

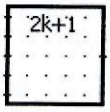
Notice that, a borrow is required in binary only when you try to subtract a 1 from a 0. In this case, when a 1 is borrowed from the next column to the left, a 10 is created in the column being subtracted.

11 - 01 = ?

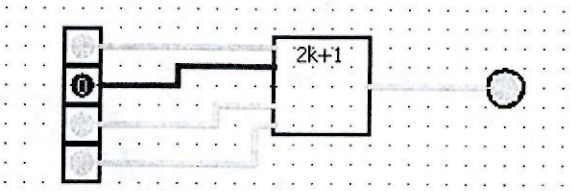
```
  1 1
- 0 1
-----
  1 0
```

No borrow is required

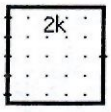
Odd parity Gate:



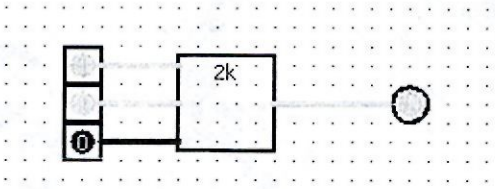
Odd Parity gate will emit 1 if there are an odd number of 1 input.



Even parity gate:



Even Parity gate will emit 1 if there are an even number of 1 input.



Procedure:

1. You should watch the lectures posted on the mediasite where I discussed lab 3 in detail.

2. Connect **Adder** with input and output. Test the output for different combination of inputs. Tabulate the results on 1-1 (for the given input).

3. Connect **Subtractor** with input and output. Test the output for different combination of inputs. Tabulate the results on 1-2 (for the given input).

4. Connect **odd parity gate** with input and output. Test the output for different combination of inputs. Tabulate the results on 1-3 (for the given input).

5. Connect **even parity gate** with input and output. Test the output for different combination of inputs. Tabulate the results on 1-4 (for the given input).

Lab 3 report

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Data and Observations:

Table 1-1 Binary Addition

1000 + 1111	10111
1001 + 1111	11000

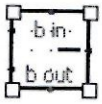

Table 1-2 Binary Subtraction

1111 - 1000	0111
1000 - 0100	0100

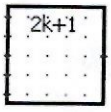

Table 1-3 Odd parity Gate

110101	0
100001	0

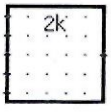

Table 1-4 Even parity Gate

110101	1
100001	1

Submission Process

You should name Logisim file as lab3.circ. You just need to submit lab report and Logisim file (lab3.circ). You do not need to submit tutorial or procedure. I would suggest you create a folder and name it as Lab3 and copy your lab3 report and lab3.circ. Then you will zip the Lab3 folder. Finally, upload the zipped Lab3 file on the Canvas.