**Name: Mofazzal Hossain**

**Student Number: R00225120**

**Class Group: COMP1D-X**

**Lab 6 – Adders**

1. Complete the following truth table for a binary half adder:

# Truth Table:

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | Sum | Carry |
| 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |

1. Using the truth table above, design a half adder circuit which adds two bits.

## Circuit:

S = A’ B + A B’ or S = A ⊕ B

C = AB

A diagram of a circuit

Description automatically generated

1. Draw the black box representation of a half adder.

A diagram of a square with black lines

Description automatically generated

1. Complete the following truth table for a full adder:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | B | C | Sum | Carry |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 |

1. Using the black box representation of a half adder (from Q.3), design a full adder which is capable of adding two bits and a carry-in bit.

A diagram of a number of objects

Description automatically generated

1. Implement the full adder design in Logisim using XOR, AND and OR gates.

## Circuit:

A diagram of a circuit

Description automatically generated

1. Using the partial circuit given on Canvas, ripple-burst.circ, complete the ripple carry adder which is capable of adding two 4-bit numbers. Test your circuit by adding the following 4-bit numbers (include a screenshot for each sum):
   1. 0011 + 0111 = 1010
   2. 0101 + 0001 = 0110
   3. 0011 + 0010 = 0101
   4. 1000 + 0011 = 1011
   5. 1010 + 0011 = 1101
   6. 1101 + 1000 = 1010 1 # ( Carry output 1 )

## Circuit:

A diagram of a circuit

Description automatically generated

1. Using a black box design (i.e. use black box full adder blocks), draw the 4-bit ripple carry adder below: