Group -8

Assignment 3

Bratin Mondal (21CS10016)
Somya Kumar (21CS30050)
Submitted on: August 24th, 2023

GCD Calculation

The Algorithm:

1. **The pseudocode:**

```
int A, int B;

while( A != 0 & B != 0 )
{
     if(A == 0)
          return B;
     if(B == 0)
          return A;
     if(A > B)
          A = A - B
     else
          B = B - A
}
```

   The GCD module calculates the Greatest Common Divisor of two positive integers.

2. **The Design:**

   The GCD module has the following parameters:

1. input wire rst: Checks if the module is to be reset from the beginning. rst is set to 1 for the first iteration of the loop and set to 0 for further iterations of the loop.
2. Input wire clk: It is the clock pulse which is sent to the module
3. input [7:0] A: 8 bit number A as input
4. input [7:0] B: 8 bit number B as input
5. output reg [7:0] result: The result of the module

The module contains the following variables:

1. reg_A: It stores the intermediate value of A in the calculation
2. reg_B: It stores the intermediate value of A in the calculation
3. reg_result: It stores the intermediate value of result in the calculation

3. <u>Working:</u>

The workings of the module are as follows:

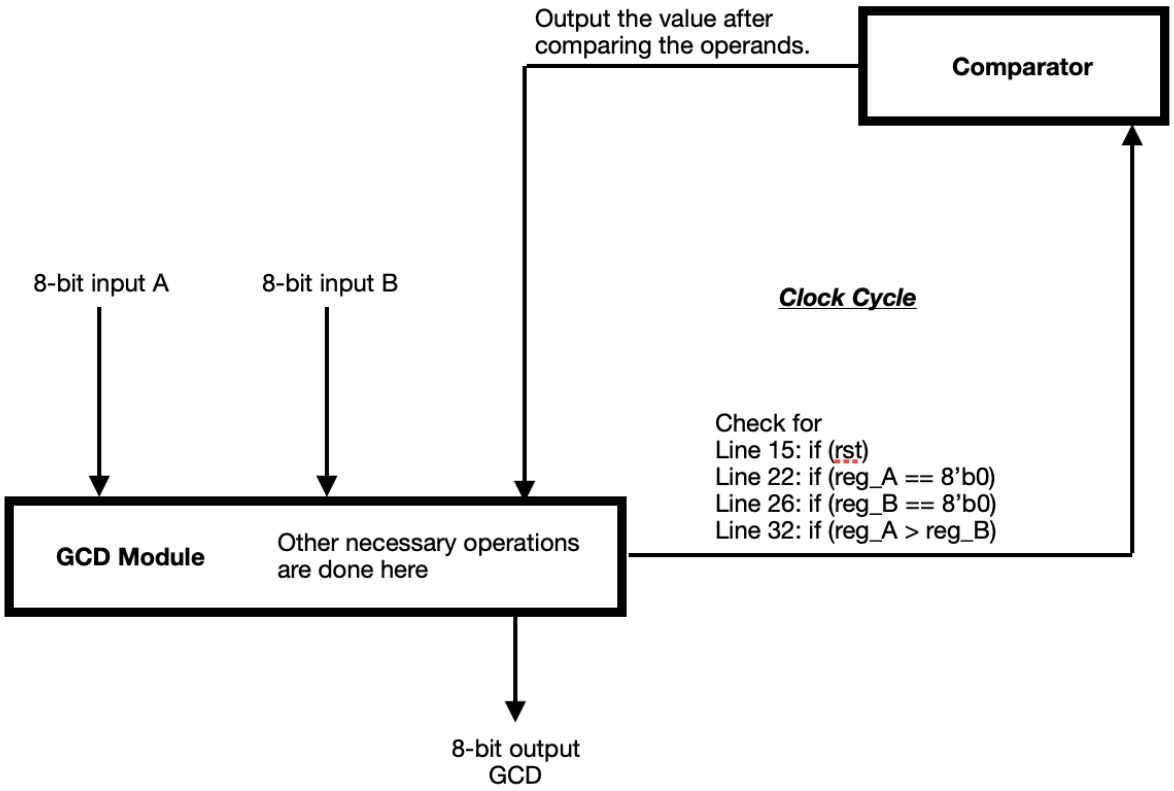
In each clock cycle:

1. If reset mode is on, we do the following. This particular line of the check condition in line 15 will be implemented through a **comparator** in the circuit.
    a. Load A into reg_A
    b. Load B to reg_B
    c. Load 0 to reg_result
    d. Load 0 to result
2. Else if reset mode is off, we do as follows.
    a. If the value in reg_A is 0, then we set the value of result to reg_B. This particular line of the check condition in line 22 will be implemented through a **comparator** in circuit.
    b. Else if the value in reg_B is 0 then we set the value of result to reg_A. This particular line of the check condition in line 26 will be implemented through a **comparator** in circuit.
    c. Else if the value of reg_A is greater than reg_B, we set value of reg_A to reg_A-reg_B.This particular line of

the check condition in line 32 will be implemented through a **comparator** in circuit.

d. Else if the value of reg_B is greater than reg_A, we set value of reg_B to reg_B-reg_A.

4. Structure:



The Test Bench:

The test bench we submitted calculates the GCD for 120 and 165

Working:

We keep toggling the clock after every 5 time units.
The test bench works as follows.

1. Initialize the clock with 0
2. Initialize rst with 1
3. Initalize A with 120
4. Initalize B with 165
5. Wait 15 time units for reset
6. set rst to 0 for further iterations of loop
7. Wait for the gcd calculation to complete
8. Output the GCD value