

EE789 Assignment III

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1 Part I

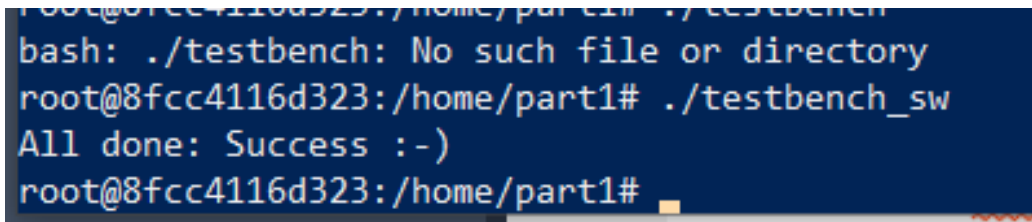
Implementation of floating point divider

(a) Design it and verify it.

The module is defined as:

```
$module [reciprocal]  
$in (a b: $float <8,23>)  
$out (r: $float <8,23>)  
$is
```

The software simulation was verified and all the test cases passed.



```
root@8fcc4116d323:/home/part1# ./testbench  
bash: ./testbench: No such file or directory  
root@8fcc4116d323:/home/part1# ./testbench_sw  
All done: Success :-)  
root@8fcc4116d323:/home/part1#
```

Figure 1: Software simulation

The hardware simulation was verified and all the test cases passed.

```

root@8fcc4116d323: /home/part1
hw
All done: Success :-)
root@8fcc4116d323: /home/part1#
-rxBuf-0-bufPipe requester=0 data= 40a000003e
4cccc
/release/vhdl/ahir.vhdl:17787:41:@116185ns:(a
sassertion note): RPIPE ApFloatMul_group_1-imux
-rxBuf-0-bufPipe requester=0 data= 40a000003e
4cccc
/release/vhdl/ahir.vhdl:17780:41:@116275ns:(a
sassertion note): WPIPE reciprocal_out_buffer-b
ufPipe requester=0 data= ?3f7fffff
/release/vhdl/ahir.vhdl:17787:41:@116285ns:(a
sassertion note): RPIPE reciprocal_out_buffer-b
ufPipe requester=0 data= ?3f7fffff
[0] 0:./ahir_system_test_bench* "8fcc4116d323" 15:14 06-Nov-22

```

Figure 2: Hardware simulation

(b) You should aim for an accuracy of better than 10^{-6} . Yes the required accuracy is achieved and is tested in the testbench

```

if (fabs(r - a/b) > 1e-6)
{
    fprintf(stderr, "Error: %f / %f = %f, expected %f.\n", a, b, r, a/b );
    _err_ = 1;
}

```

(c) How many clock cycles does your divider take to produce the result?

560 cycles

Marker between reciprocal change: $116255 - 110655 = 5600$

Marker between clock cycles: 10

Total clock cycles: $5600 / 10 = 560$

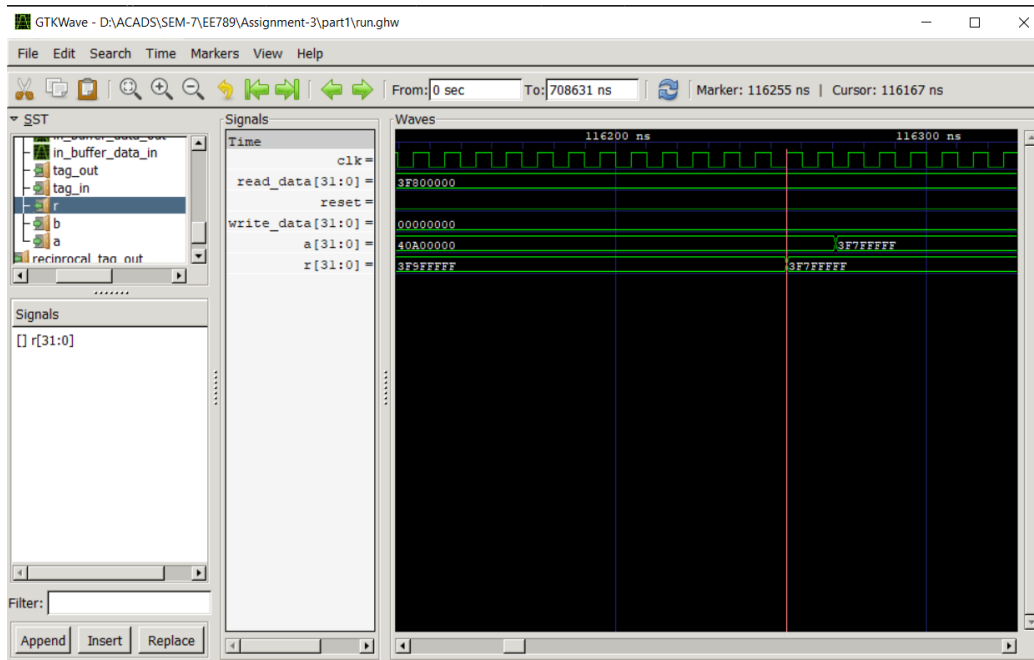


Figure 3: GTK waveform

2 Part II

Linear Equation Solver

Linear equation for $n=16$ is done by Gaussian elimination method. A matrix is transformed into an upper triangular matrix, that is in row echelon form. Once all of the leading coefficients (the leftmost nonzero entry in each row) are 1, and every column containing a leading coefficient has zeros elsewhere, the matrix is said to be in reduced row echelon form. This final form is unique; in other words, it is independent of the sequence of row operations used.

The module is defined as:

```
$module [gaussianelimination] $in () $out () $is
```

The software simulation was verified and all the test cases passed.

```
root@8fcc4116d323:/home/part1# ./testbench
bash: ./testbench: No such file or directory
root@8fcc4116d323:/home/part1# ./testbench_sw
All done: Success :-)
```

Figure 4: Software simulation