GF2: Software

Second Interim Report

Vyas Raina

May 31, 2019

1 Introduction

This section of the project presents the complete Logic Simulator in accordance with the initial client specifications. This report should be read with the software solution available. The report covers the following points:

- Example Definition files and their accompanying circuit diagrams.
- A user guide that informs the user of how the Graphical User Interface (GUI) can be used with the test definition files to assess the system.

2 Example Files and Circuits

2.1 Example 1: Full Adder

2.1.1 Circuit

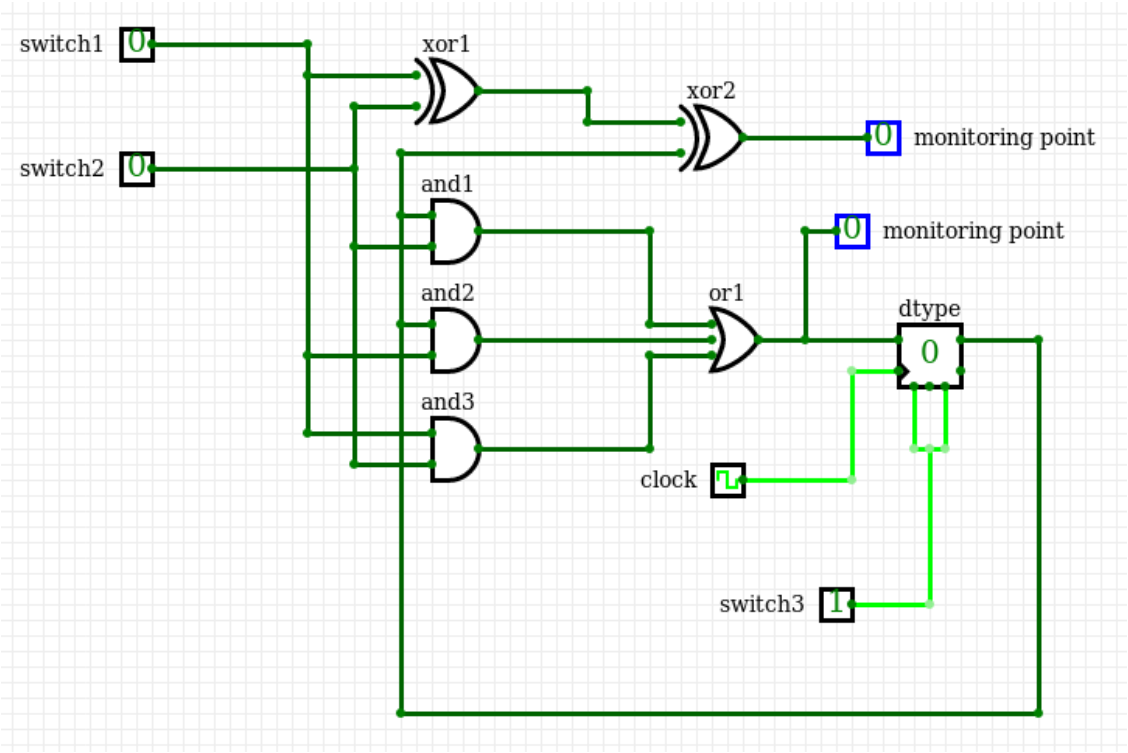


Figure 1: Full Adder Circuit

2.1.2 Definition File

```
DEVICES {
switch1: SWITCH, initial 0;
switch2: SWITCH, initial 0;
switch3: SWITCH, initial 0;
xor1: XOR;
xor2: XOR;
and1: AND, inputs 2;
and2: AND, inputs 2;
and3: AND, inputs 2;
or1: OR, inputs 3;
clock: CLOCK, period 5;
dtype: DTYPE;
}

CONNECT {
switch1 = xor1.I1;
switch1 = and2.I2;
switch1 = and3.I1;
switch2 = and1.I2;
switch2 = xor1.I2;
switch2 = and3.I2;
clock = dtype.CLK;
xor1 = xor2.I1;
and1 = or1.I1;
and2 = or1.I2;
and3 = or1.I3;
or1 = dtype.DATA;
switch3 = dtype.SET;
switch3 = dtype.CLEAR;
dtype.Q = xor2.I2;
dtype.Q = and1.I1;
dtype.Q = and2.I1;
}

MONITOR{
xor2;
or1;
}
END
```

2.2 Example 2: 4-Bit Shift Register

2.2.1 Circuit

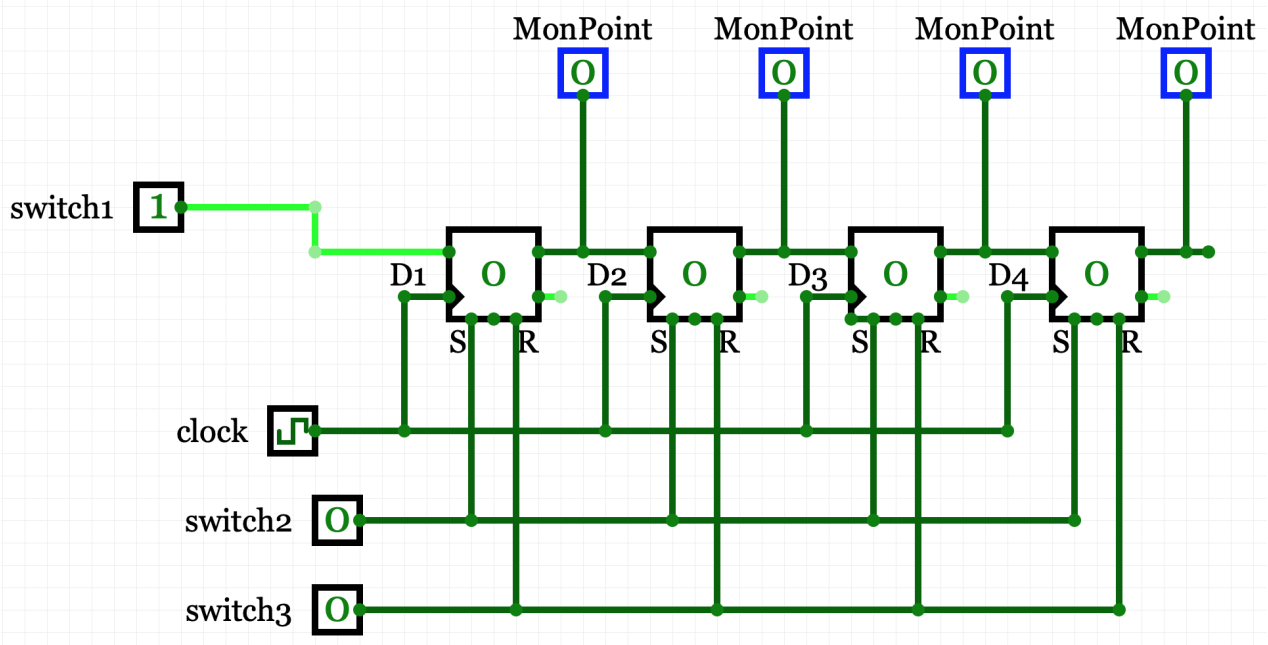


Figure 2: 4-Bit Shift Register

2.2.2 Definition File

```
DEVICES{
switch1: SWITCH, initial 1;
switch2: SWITCH, initial 0;
switch3: SWITCH, initial 0;
D1: DTYPE; D2: DTYPE; D3: DTYPE; D4: DTYPE;
clock: CLOCK, period 5;
}

CONNECT{
switch1 = D1.DATA;
D1.Q = D2.DATA; D2.Q = D3.DATA; D3.Q = D4.DATA;
clock = D1.CLK; clock = D2.CLK; clock = D3.CLK;
clock = D4.CLK;
switch2 = D1.SET; switch2 = D2.SET; switch2 = D3.SET;
switch2 = D4.SET;
switch3 = D1.CLEAR; switch3 = D2.CLEAR;
switch3 = D3.CLEAR; switch3 = D4.CLEAR;
}

MONITOR{
D1.Q; D2.Q; D3.Q; D4.Q;
}

END
```

2.3 Example 3: Combinational

2.3.1 Circuit

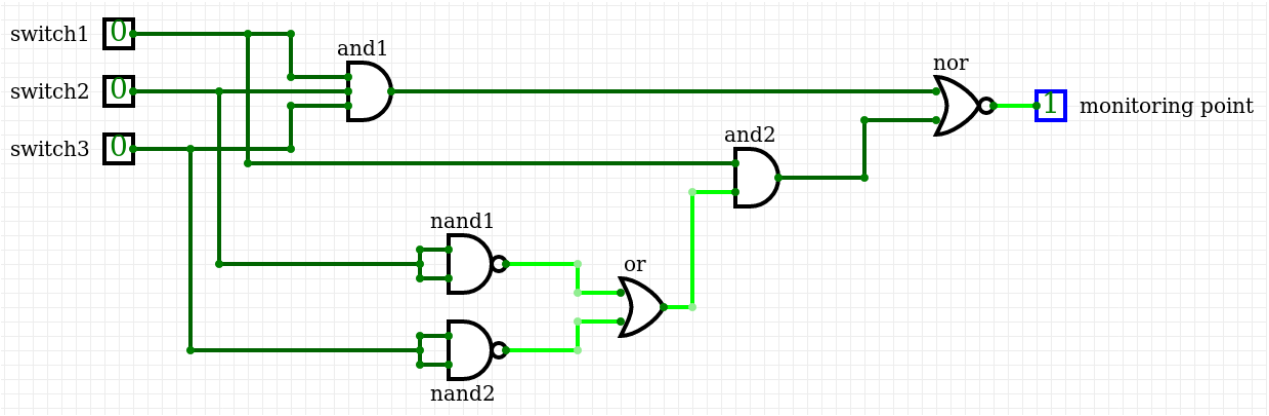


Figure 3: Combinational Circuit

2.3.2 Definition File

```
DEVICES{
switch1: SWITCH, initial 0;
switch2: SWITCH, initial 0;
switch3: SWITCH, initial 0;
and1: AND, inputs 3;
and2: AND, inputs 2;
nand1: NAND, inputs 2;
nand2: NAND, inputs 2;
or: OR, inputs 2;
nor: NOR, inputs 2;
}

CONNECT{
switch1 = and1.I1;
switch1 = and2.I1;
switch2 = and1.I2;
switch2 = nand1.I1;
switch2 = nand1.I2;
switch3 = and1.I3;
switch3 = nand2.I1;
switch3 = nand2.I2;
nand1 = or.I1;
nand2 = or.I2;
or = and2.I2;
and2 = nor.I2;
and1 = nor.I1;
}

MONITOR{
nor;
}

END
```

2.4 Example 4: D-Type Construction

2.4.1 Circuit

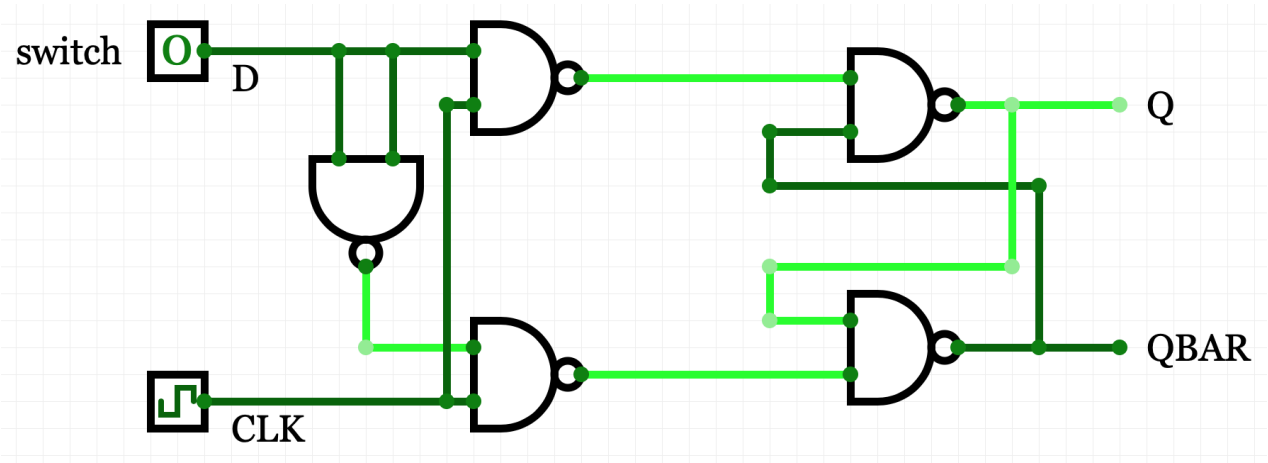


Figure 4: Construction of D-Type Flip Flop

2.4.2 Definition File

```
DEVICES{
switch: SWITCH, initial 0;
clock: CLOCK, period 5;
nand1: NAND, inputs 2;
nand2: NAND, inputs 2;
nand3: NAND, inputs 2;
nand4: NAND, inputs 2;
nand5: NAND, inputs 2;
}

CONNECT{
clock = nand2.I2;
clock = nand1.I2;
switch = nand1.I1;
switch = nand5.I1;
switch = nand5.I2;
nand5 = nand2.I1;
nand1 = nand3.I1;
nand2 = nand4.I2;
nand3 = nand4.I1;
nand4 = nand3.I2;
}

MONITOR{
nand3;
nand4;
}
END
```

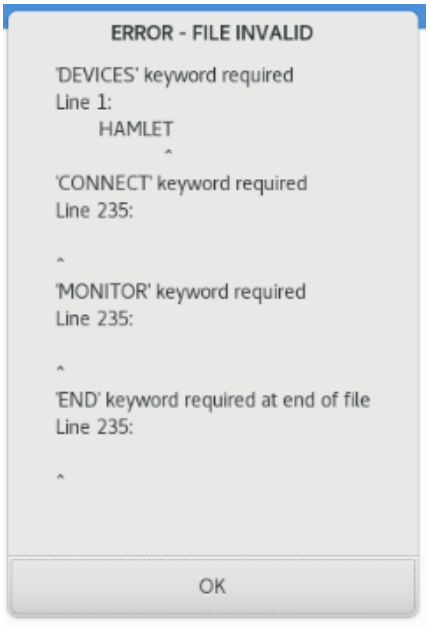
2.5 Example 5: Invalid Circuit (Hamlet Text)

This example demonstrates the response of the system to an input that does not intend to use the system appropriately.

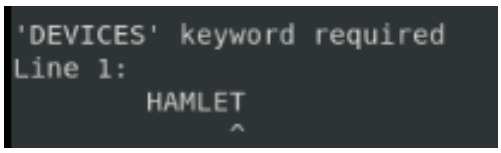
2.5.1 Definition File

```
HAMLET

DRAMATIS PERSONAE

CLAUDIUS        king of Denmark. (KING CLAUDIUS:)

HAMLET  son to the late, and nephew to the present king.

POLONIUS        lord chamberlain. (LORD POLONIUS:)

HORATIO friend to Hamlet.

LAERTES son to Polonius.

LUCIANUS        nephew to the king.

VOLTIMAND       |
|
CORNELIUS       |
|
ROSENCRANTZ     |  courtiers.
|
GUILDENSTERN    |
```

2.5.2 System Response



(a) Graphical User Interface



(b) Command Line Interface

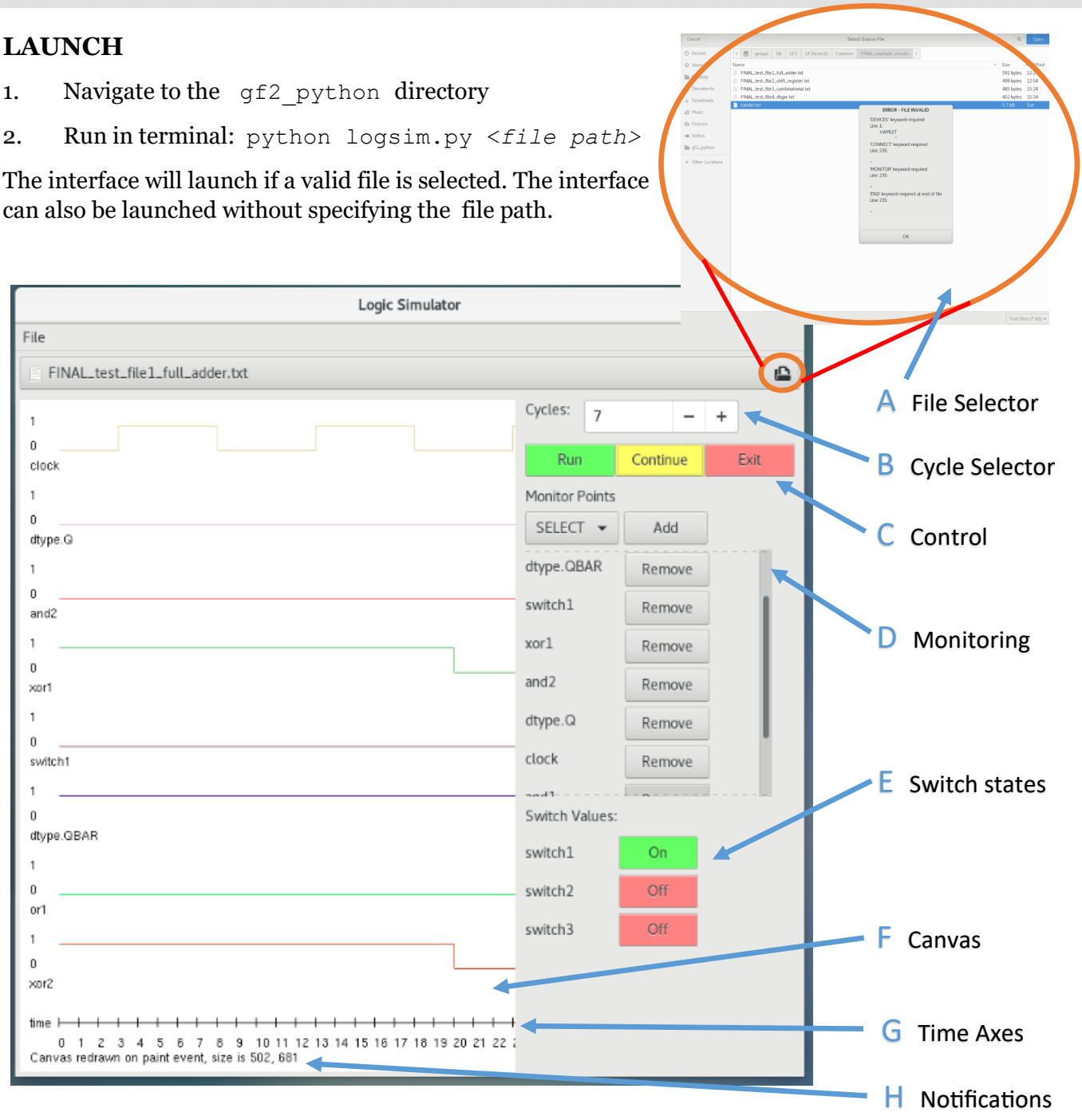
Figure 5: System response to an erroneous file

LOGIC SIMULATOR USER GUIDE

LAUNCH

1. Navigate to the `gf2_python` directory
2. Run in terminal: `python logsim.py <file path>`

The interface will launch if a valid file is selected. The interface can also be launched without specifying the file path.



FEATURES

A. File Selector — only text files available; invalid files will trigger a descriptive error message

B. Cycle Selector — allows selection of number of cycles from *1* to *100*

C. Control Buttons — Run/Continue for `cycles` number of steps

D. Monitoring Tools — Add/Remove output pins to display; scrollbar allows display of any number of output pins

E. Switch Sates — Buttons to change SWITCH states in simulation

F. Canvas — Simulated signal traces of chosen points displayed. Canvas can be panned/zoomed

G. Time Axes - displays cycles elapsed

H. Notifications — Provides user with feedback of action made