

Final Project: Gate Simulator

1. Description

Given a gate-level netlist and cell library, calculate the critical path of circuits and simulate the outputs of each pattern.

There are 3 steps to follow:

Step 1 -> Build the graph according to the given netlist.

Step 2 -> Calculate the max delay of the given netlist.

Step 3 -> Calculate the logic value of the given input patterns

2. Input Format

a. Netlist and Pattern (.txt)

The input file is composed of two parts. The first part contains the netlist of the circuit. Build the circuit according to the input format shown below.

```
module M1(n12, n13, n14, n1, n2, n3)
  output n12, n13, n14;
  input n1, n2, n3;
  wire n4, n5, n6, n7, n8, n9, n10, n11;

  INV g1 (.I(n1), .ZN(n4));
  INV g2 (.I(n2), .ZN(n5));
  NAND g3 (.A1(n4), .A2(n5), .ZN(n6));
  INV g4 (.I(n5), .ZN(n7));
  NOR g5 (.A1(n4), .A2(n3), .ZN(n8));
  INV g6 (.I(n6), .ZN(n9));
  NOR g7 (.A1(n6), .A2(n7), .ZN(n10));
  NOR g10 (.A1(n9), .A2(n10), .ZN(n11));
  INV g8 (.I(n11), .ZN(n12));
  NAND g9 (.A1(n7), .A2(n8), .ZN(n13));
  NOR g11 (.A1(n10), .A2(n8), .ZN(n14));
endmodule
```

The second part contains the input patterns for the circuit above. Simulate the outputs of each pattern with the given module in the netlist file.

```
input n1, n2, n3
0 1 0
1 1 0
1 1 1
.end
```

b. Simplified library

There is information on different gates, including delay and truth table.

Gate	Delay	Gate	Delay
NAND	2	USD03	3
AND	3	USD04	4
NOR	2	USD05	5
OR	3	USD06	2
XOR	4	USD07	3
XNOR	4	USD08	5
INV	1	USD09	2
USD01	5	USD10	4
USD02	2		

Gate(A1, A2)	00	01	10	11
USD01	0	0	0	0
AND	0	0	0	1
USD02	0	0	1	0
USD03	0	0	1	1
USD04	0	1	0	0
USD05	0	1	0	1
XOR	0	1	1	0
OR	0	1	1	1
NOR	1	0	0	0
XNOR	1	0	0	1
USD06	1	0	1	0
USD07	1	0	1	1
USD08	1	1	0	0
USD09	1	1	0	1
NAND	1	1	1	0
USD10	1	1	1	1

3. Output Format

Output file (.txt) should contain three components:

- Max delay
- Outputs of each pattern // follow the order in the first line in the netlist file.

M1.txt

```
8
0 1 1
0 0 0
0 1 1
```

4. E3 Submission

- a. Submit your source file to the E3 system
[Student_ID_Number]_fp.cpp (.c)
- b. Please submit the source code of your latest submission for each question on the OJ. Please make sure that all characters of the filename are in lowercase. For example, if your student number is 9711592, the name of your source file should be "9711592_fp.cpp".
- c. Remember the submission rules mentioned above, or you will get punished on your grade by **-15 points**.

5. Policy

- a. The upload deadline would be at 23:59 on January 9, 2024. The score will be **30% off** if your submission is late.
- b. Get 50 points for the open case
Get 10 points for each hidden case
- c. **Naming error -10 points**
- d. **Plagiarism: -100 points.** It will be checked out with MOSS.

6. Problems

- a. If you have any problem with this project, please post it on the E3 forum.
- b. If you have any private problem, you can send emails to:
havenchen.ee11@nycu.edu.tw