# UEE1302: Programming Homework 04

**!!! DUE : 2017/01/22 PM23:59 !!!**

**[Instruction]**

Please upload only the source code file which is named StudentID_hw4.c. Ex: 9713609_hw4.c. **If the source code file name is wrong, your grade of this homework is 50% off.**

**[Problem Description]**

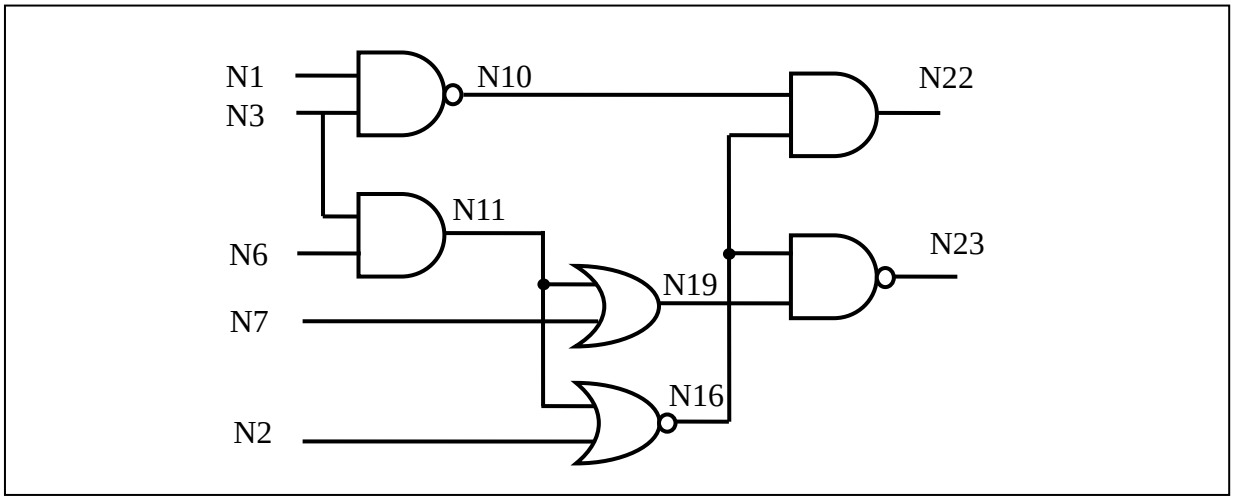
- Please write a C program for circuit simulation.

  The program has three functions:

  1. Levelization: find the level of each gate in the circuit.
  2. Simulation: read the input pattern and find the output value.
  3. Find path: find the longest path from input pins to the indicated gate.
  4. Exit the program.

- Input file format :

  Circuit c17 is as below:



The input file (c17.v) is as below (please check the given file):

```
c17 5 2 6 //circuit name, number of inputs, number of outputs, number of gates

module c17 (N1,N2,N3,N6,N7,N22,N23); //module header

input N1,N2,N3,N6,N7;

output N22,N23;

wire N10,N11,N16,N19;

nand NAND2_1 (N10, N1, N3); //gates
and AND2_1 (N11, N3, N6);
nor NOR2_1 (N16, N2, N11);
or OR2_1 (N19, N11, N7);
and AND2_2 (N22, N10, N16);
nand NAND2_2 (N23, N16, N19);

endmodule

Pattern
0 0 1 1 0 //according to the input order: N1=0,N2=0,N3=1,N6=1,N7=0
```

**The declaration of a gate is :**

**gate_type gate_name (output_wire_name, input_wire_1_name, input_wire_2_name)**

**All the gates have only two input wires.**

- Explain the requests by using a simple circuit

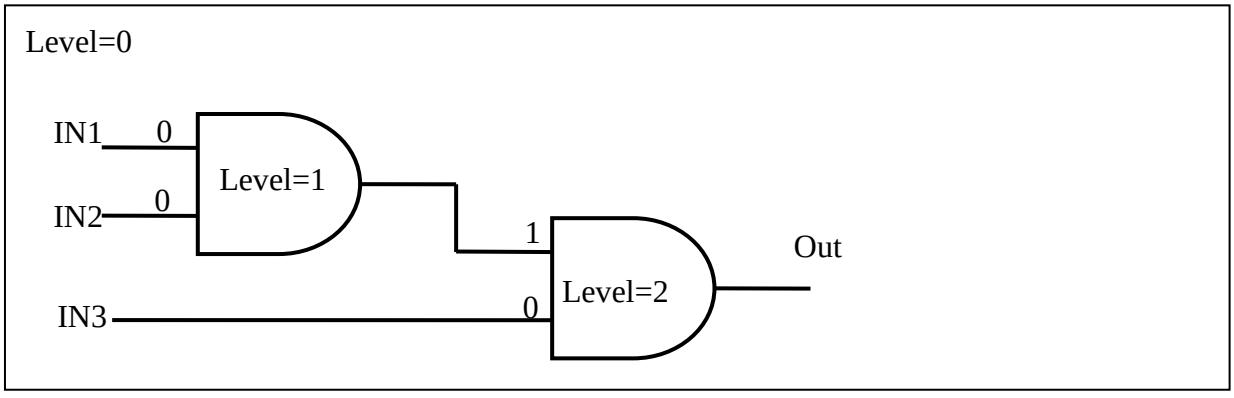
```
nand3 3 1 2
module nand3 (IN1,IN2,IN3,Out);
input IN1,IN2,IN3;
output Out;
wire W1;

and AND2_1 (W1,IN1,IN2);
and AND2_2 (Out,IN3,W1);

endmodule

Pattern
1 1 0 //according input order
```

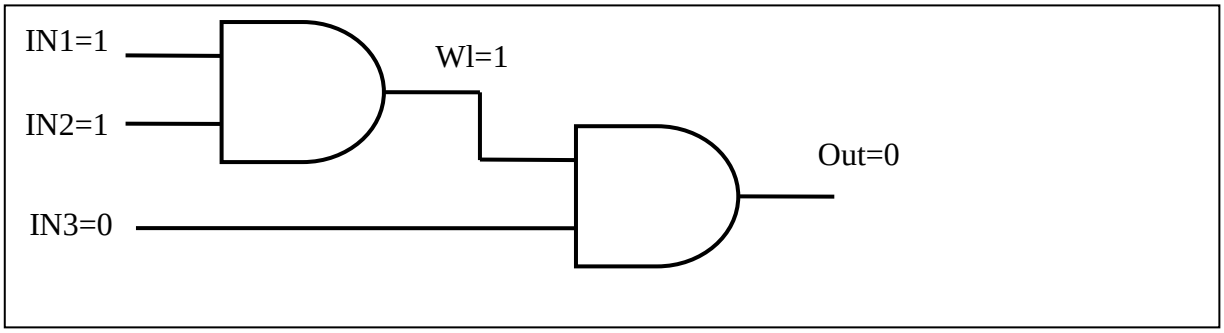
1. Levelization: how to choose the level of each gate? Each gate has two input wires, choose the bigger level of them and add one to get the level of the gate.The example is as follow:




The result of levelization

```
Levelization
Name = level
AND2_1 = 1
AND2_2 = 2
```

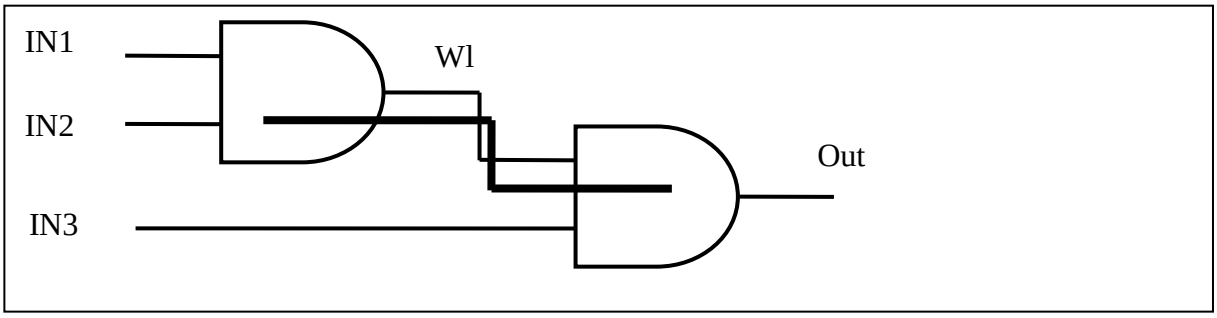
2. Simulation: read the input pattern in the example: IN1=1, IN2=1, IN3=0. After simulation, we can find W1=1, Out=0. Print all the output values of the module (for this example: Out ).




The result of simulation

```
Simulation
Output = value
Out = 0
```

3. Find the longest path to the indicated gate: user can enter the gate's name and print the longest path form input to the indicated gate (all gates on the path in order).

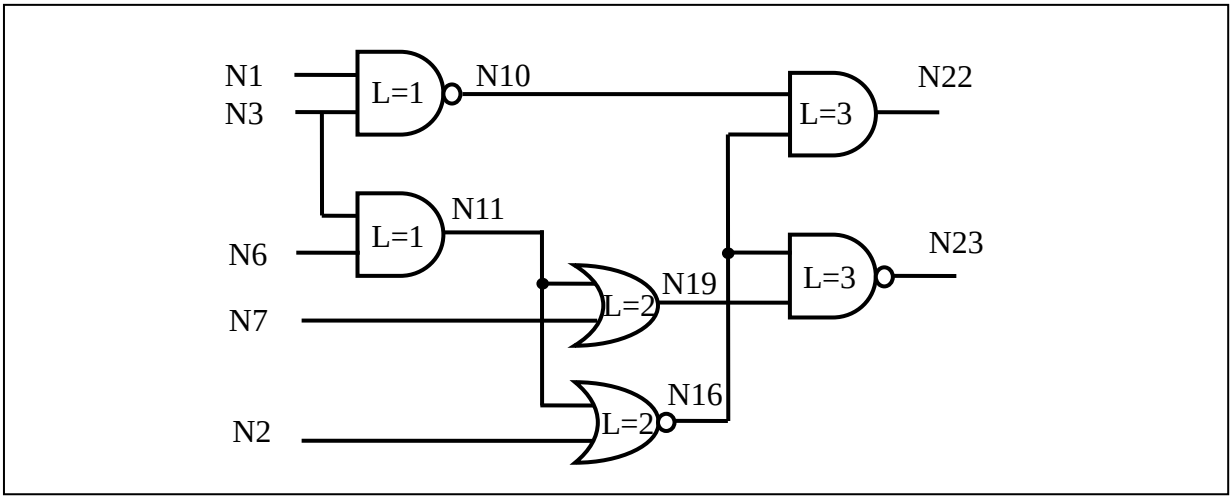



The result of finding the longest path

```
Find path
Please enter the indicated gate: AND2_2
AND2_1 => AND2_2
```

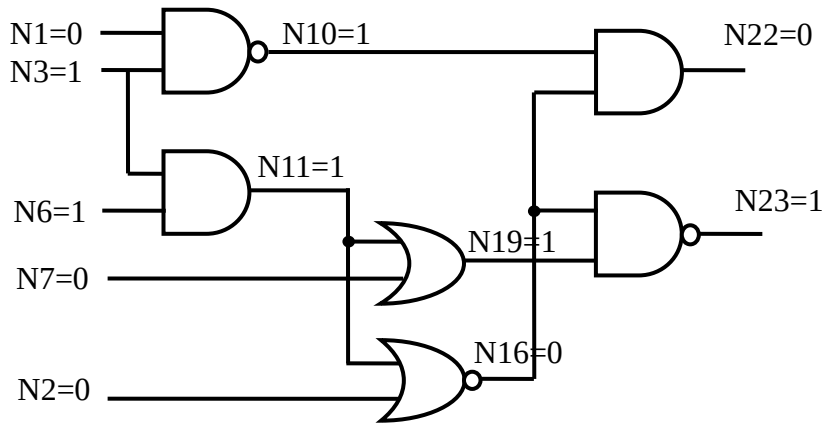
- The total result of c17.v

The levelization result




Levelization
Name = level
NAND2_1 = 1
AND2_1 = 1
NOR2_1 = 2
OR_2 = 2
AND2_2 = 3
NAND2_2 = 3

The result of simulation




```
Simulation
Output = value
N22 = 0
N23 = 1
```

The result of finding the longest path

```
Find path
Please enter the indicated gate: NAND2_2
AND2_1 => OR2_1 => NAND2_2
```

- please complete the program, run the program as follow:

```
./hw4 example.v
example.v has read

please choose one function
levelization(1), simulation(2), find path(3), exit(4): 1
Levelization
Name = level
AND2_1 = 1
AND2_2 = 2

please choose one function
levelization(1), simulation(2), find path(3), exit(4):2
Simulation
Output = value
Out = 0

please choose one function
levelization(1), simulation(2), find path(3), exit(4):3
Find path
Please enter the indicated gate: AND2_2
AND2_1 => AND2_2

please choose one function
levelization(1), simulation(2), find path(3), exit(4):4
Good Job! SEEYOU
```

You can use any structure or modify this structure.

```
struct gate{
    int type;
    string name;
    string InputPin[2];
    int InputValue[2];
    string OutputPin;
    int OutputValue;
    gate* InGate[2];
    gate* OutGate;
    …

}gate;
```