Ain Shams University

Faculty of Engineering

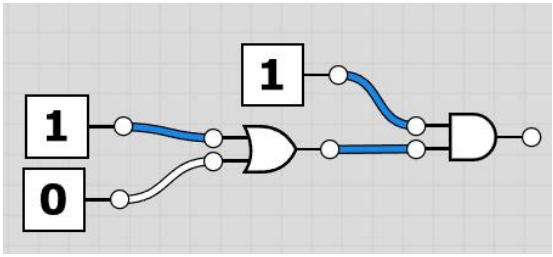
Credit Hours Programs

CSE131: Computer Programming "C++"

Final Project Fall '23

Project Description:

- A Logic gate is an elementary building block of any digital circuits. It takes one or two inputs and produces output based on those inputs. Outputs may be high (1) or low (0).
- Well,in most logic circuits are usually mixed types of gates connected together.
- You are required to write a C++ program designed to solve logic circuits based on user-defined input. The program takes input as a string representation of a logic circuit and provides the corresponding output as a high(1) or low(0) digit. This project aims to provide a reliable and efficient solution for evaluating logic circuits .
- For example, the user input: **AND 1 OR 1 0 e e** describes the following circuit:

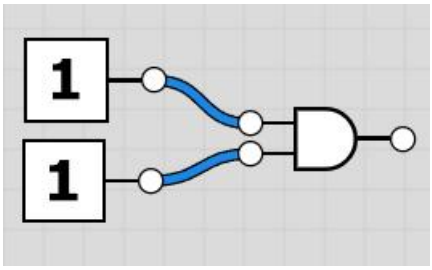
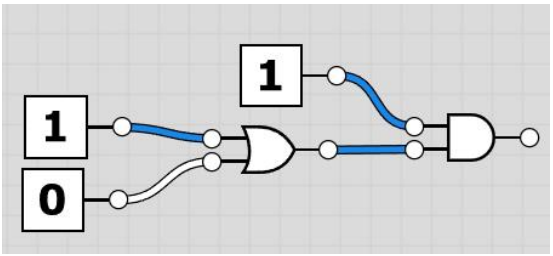
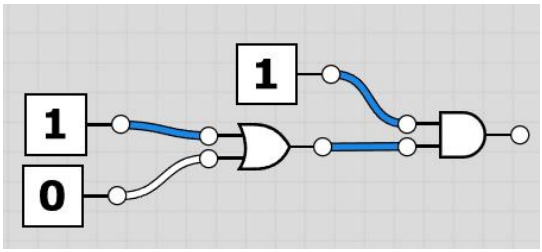
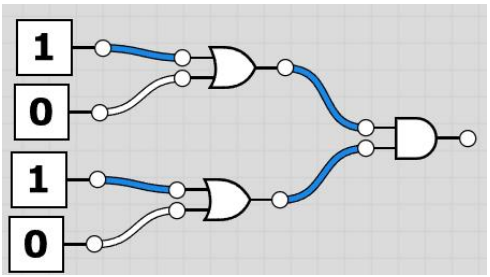


- Your application should provide the following features:

1. Enable user to input logic circuit configurations using a string representation.
2. Implement logic gate operations (AND, OR,NOT,NAND,NOR, XOR) to process the circuit inputs.
3. Establish a systematic approach to evaluate the circuit and generate the desired output.
4. Offer a user-friendly interface to enhance the program's accessibility and ease of use.

Halfway submission: ***(Dec 07, 2023)*** [6 marks]

- The Logic Circuit Solver must handle **a parent logic gate** that has 2 inputs; each input can be a high(1) digit or low(0) digit or **another logic gate** .
- Logic gates that must be supported(AND, OR,NOT,XOR,NAND,NOR).
- The user will enter a string that describes at first the Parent logic gate type followed by the 2 inputs separated by one space.
- It is guaranteed that each connection will end by **e** (ex: AND 1 1 **e**)
- Different Test cases that program can handle:

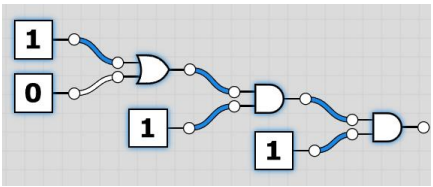
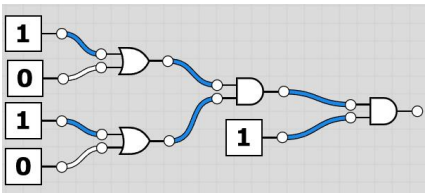
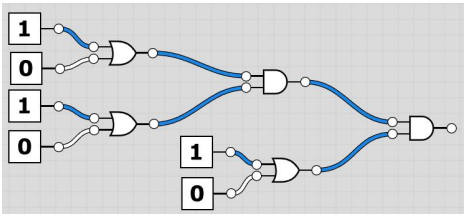
AND 1 1 e 	AND 1 OR 1 0 e e 
AND OR 0 0 e 1 e 	AND OR 1 0 e OR 0 0 e e 

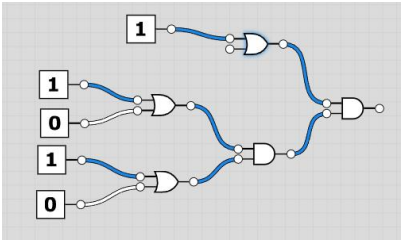
- **Half submission Test cases:**

  While Submission on Hacker Rank your code must pass first 6 test cases , you must print number of gates for each logic gate and the result 1/0.

Final submission: ***(Dec 26, 2023)*** [10 marks]

- The Logic Circuit Solver must handle **multiple parent logic gate** that has 2 inputs; each input can be a high(1) digit or low(0) digit or **another logic gate,** and also **must handle error** if there is error in the string input, and **must handle** if user entered a character instead of number, so you can replace it
- Handling multiple parent logic gate circuit - 3 marks -
- **Error handling**:
  1. if the user entered another type of logic gate that is not known (ex:OND) then you must print **"Wrong Logic Circuit Description"** and end the program. - 2 marks -
  2. If the user forget to enter an input for a logic gate (ex: AND 1 e) then you must print **"result : BAD input : missing input number"** and end the program. - 2 marks -
- Your program must support variable characters so you can ask him to enter their values "**x variables are missing please enter them in separate lines**", The user will enter them in separate lines (ex:a=1), replace each a by 1 then continue your program. - 3 marks -
  NOTE : (variable characters can be any letter between a-z,A-Z)
- Different Test cases that program must handle:

<table>
<tr>
<td>AND 1 AND 1 OR 1 0 e e e
 
</td>
<td>AND 1 AND OR 1 0 e OR 1 0 e e e
 
</td>
</tr>
<tr>
<td>AND OR a b e AND OR 1 0 e OR 1 0 e e e
2 variables are missing please enter them in separate lines
a=1
b=0
 

<u>Where your code printed :</u>
2 variables are missing please enter them in separate lines
<u>and the user entered</u>
a=1
b=0</td>
<td>AND OR 1 e AND OR 1 0 e OR 1 0 e e e
 

result : BAD input : missing input number</td>
</tr>
</table>

- **Final submission Test cases:**

While Submission on Hacker Rank Your code must pass last 9 test cases , your code must print number of gates for each logic gate and the result 1/0 in case of correct Logic Description, otherwise print "**Wrong Logic Circuit Description"** if wrong logic gate entered , or "**result : BAD input : missing input number"** in case of missing input number .

Bonus:

- Simple GUI for the program

Deliverable:

- Test your code on Hacker Rank
  Hacker Rank Link : www.hackerrank.com/logic-circuit-solver-project
- **Upload the cpp file** on LMS
- **Upload a Documentation for the project** [4 marks]
  Must contain (Description of the code with some screenshots - screenshots of some test cases - Passed test cases from Hacker Rank - flowchart describes your code - etc….).
- Discussion of the Final submission. [5 marks]
- **Plagiarism is prohibited and a plagiarized submission will result in a ZERO.**

Helpful Insights :

- **Truth table**

AND

Inputs		Output
A	B	AB
0	0	0
0	1	0
1	0	0
1	1	1

OR

Inputs		Output
A	B	A + B
0	0	0
0	1	1
1	0	1
1	1	1

NAND

Inputs		Output
A	B	$\overline{AB}$
0	0	1
0	1	1
1	0	1
1	1	0

NOR

Inputs		Output
A	B	$\overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

XOR

Inputs		Output
A	B	$A \oplus B$
0	0	0
0	1	1
1	0	1
1	1	0