Lab-3
EL 114 Digital Logic Design

Notes:

- In your lab-book, remember to write your steps/methods, and the observations/results
- Get TA's signature after completing each question.

In this Lab you need to familiarize yourself with the Logisim simulator tool:

- Learn how to drag and drop various gates
- Learn how to change the number of binary inputs to your gate
- Learn how to put input and output pins
  - Learn how to label your input and output pins
- Learn how to connect wires to/from the pins to/from the gates.
- Learn how to manually provide "1" or "0" to the input pins, and observe your 1/0 outputs at the output pin
  - Look at the color coding of the wires when you do that

Question-1

- Inside Logisim, simulate a 2-input AND, and 2-input OR gate.
  - Manually provide all input combinations and verify that the truth-tables corresponding to those gates are obtained.

Question-2

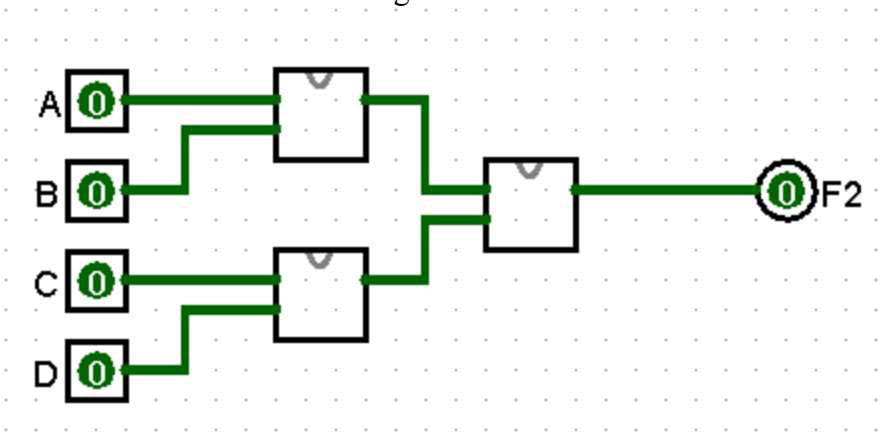
- For the given Boolean function $F = AB'C' + CD$
  - Draw the gate level-schematic in your lab-book
  - In Logisim, make the gate-level schematic, and the derive the truth-table by manually providing all input combinations (keep in mind that there are 4 binary input variables)
  - Once you derive the truth-table, in your lab-book write the Boolean expression in terms of minterms
    - In Logisim, make the gate-level schematic for this (minterm based) expression. Simulate the same, and verify the truth-table.
  - In your lab-book write the Boolean expression in terms of maxterms
    - In Logisim, make the gate-level schematic for this (maxterm based) expression. Simulate the same, and verify the truth-table

Question-3

- For the given Boolean function F = x'y + xy'
  - Draw the gate-level schematic in your lab-book
  - In Logisim, go to "projects", and do "add circuit"; Give a name for your circuit, such as "gateXOR"

- In this new schematic, make the gate-level schematic (using INVERTER, AND, OR gates) for this Boolean expression, and derive the truth-table by manually applying all input combinations.
- Make sure to label your inputs and output pins

- In Logisim, go to "projects", and do "add circuit"; and give a new name such as "bigXOR".
  - In this new schematic window, learn how to place instances of what you have already made earlier (gateXOR).
  - Put 3 instances or copies of gateXOR , and try to make a schematic that looks like the following



- In the above figure (each block) is the gateXOR circuit. In other words, each block implements the function F = x'y+xy'.
- Derive the truth table for this large circuit (Inputs are A, B, C, D, and output is F_2)
  - In simple words, what does this large circuit do? (Hint: something related to Even or Odd)