Lab 1 – Application of Boolean Algebra (Unit4)

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Problem: Design a 4-input 1-output logic circuit and verify with Simuaid

Problem assignment

- The problem is assigned based on first letter of your last name
- If your last name starts with [A-M] do problem 4.13 otherwise do problem 4.14
  You are allowed to use inverters for the input but please make sure you use minimum number of inverters. (Do not use multiple inverters for the same input)

Review

- Study guide review problems:
  4.1(a-d),4.2(a-b),4.3,4.4,4.5,4.6(a-b),4.7,4.8(a-b),4.9(a-d), 4.10(a-d),4.11(a-b),4.11(a-b),4.12
- These problems are to help you ramp up for the lab. You do not need to turn them in.

Key Goals

- Learn how to input logic netlist into SimUaid
- Test functionality of netlist in SimUaid

Procedure:

Hand Design:

- Work your assigned problem and get the optimized logic equation
  - Use truth table and algebraic minimization
- Draw your simplified logic circuit on paper
- Complete all your design work together and place it in a compressed folder and submit this for evaluation.
  (Do not modify your designs once you have submitted the lab. In case of discrepancies between submitted version from the check out version, you will be heavily penalized)

Simulation in SimUaid

- Read the SimUaid User's Guide, found on the CD with SimUaid that accompanies the text. For now, you only need to read everything up to and including part2.
- Enter your design into SimUaid
- Use only 4 switches and minimum number of inverters
- When the circuit is complete, test it for all 16 possible input combinations and verify the functionality
- Record your results in a truth table
  Save your circuit on a flash drive or on your LRC Z:/drive

Demo Example

Implement a function which outputs 1 iff ("ifandonlyif"="iff") the majority of 3 inputs is 1

Solution

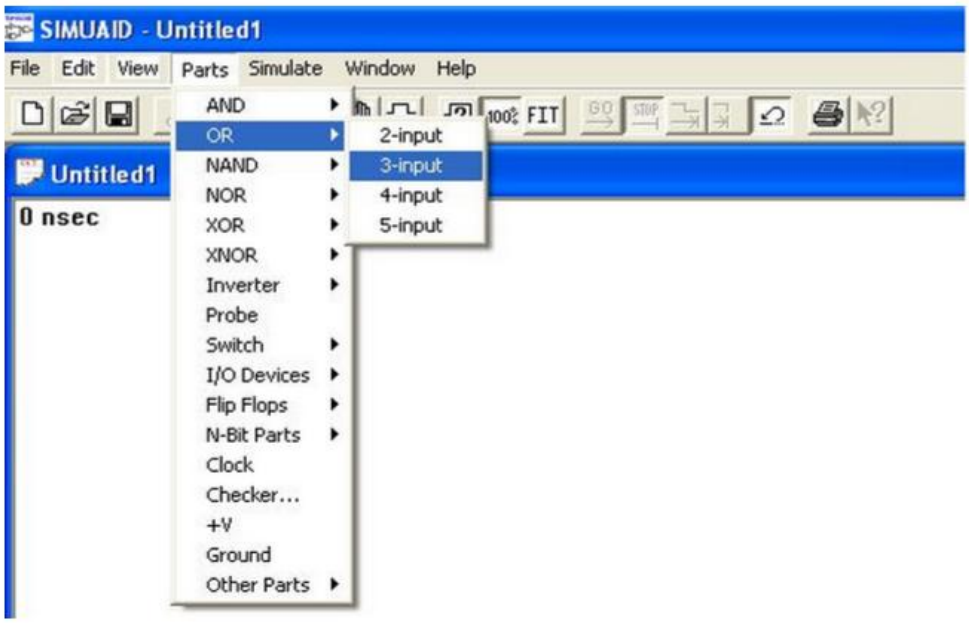
- Start with the truth table for the given specification

000	0
001	0
010	0
011	1
100	0
101	1
110	1
111	1

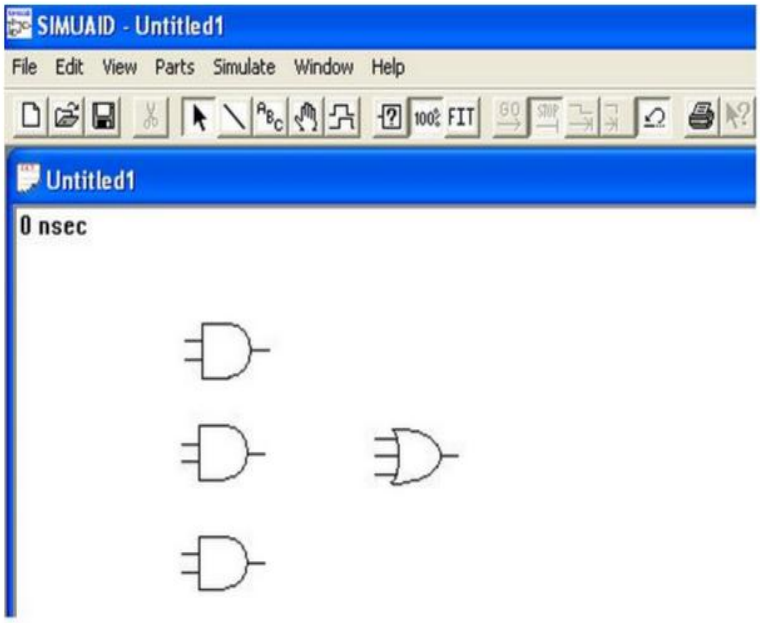
- Write the minterm expansion: A'BC+AB'C+ABC'+ABC
- Minimize the above expression to get the optimized equation: AB+BC+AC
- Follow the following steps in order to simulate your design. Please note that the circuit drawn in this step is just the demo example. You need to draw the logic circuit for the problem assigned to you.

Steps in SimUaid

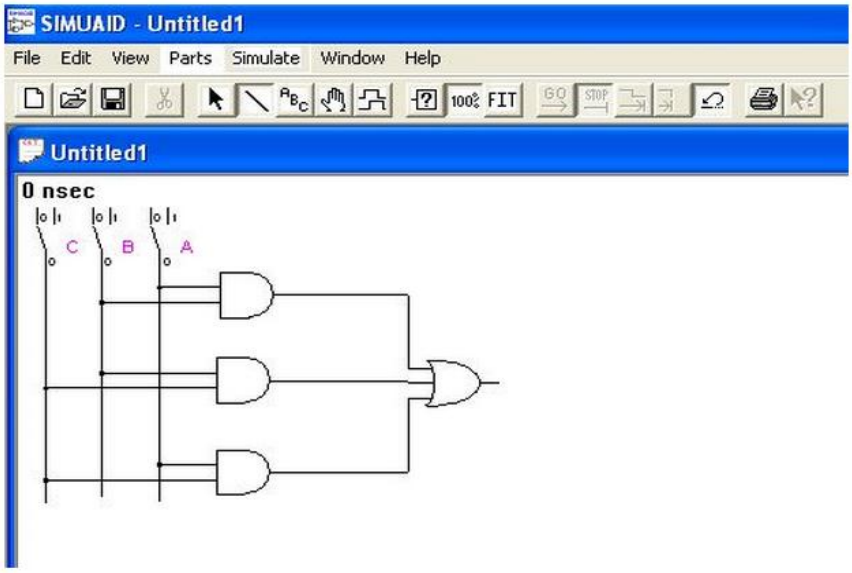
Bring up SimUaid. Select the parts to place from the parts tab on the Simuaid menu



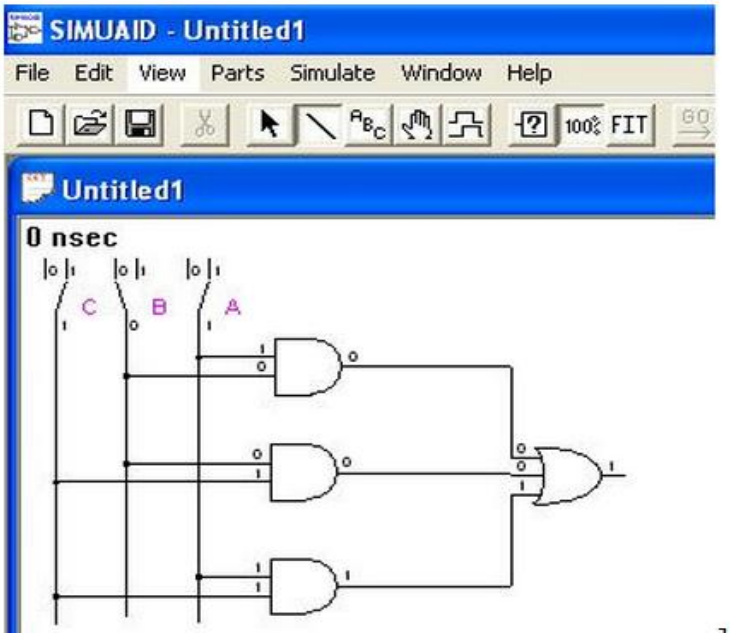
Place the required gates in the circuit area.



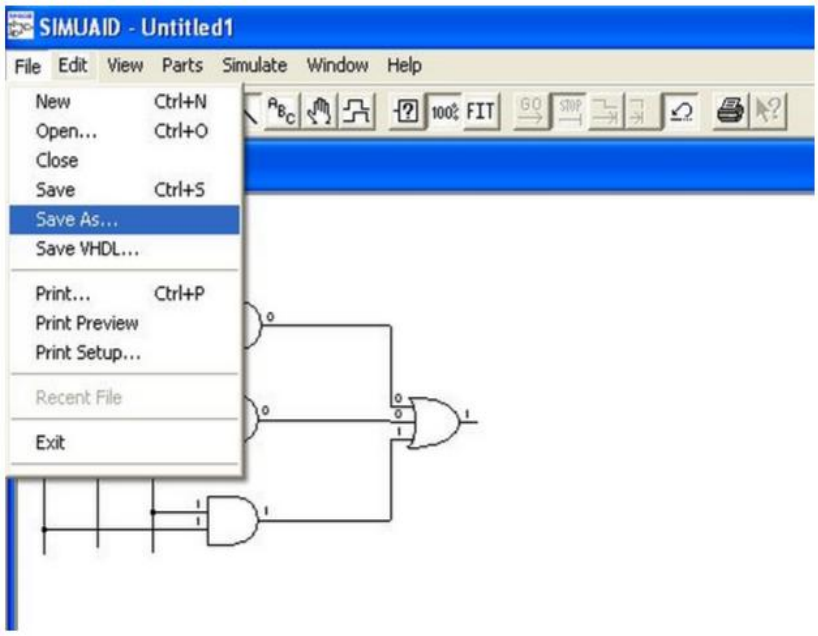
Place wires and switches



Verify the functionality



Save the design.



Lab Submission

- A pdf containing
  1. Hand work for simplifying the Boolean expression
  2. Hand drawn circuit
  3. Screenshot of the the Simuaid circuit
- The SimuAid circuit File

Put these in a **compressed folder** and **submit online.**

Use the cover sheet for this Lab along with your submission. This Lab cover sheet must be used as the first page on your lab report. You may type in the same but make sure, your name, UT eID, lab section, problem number are not missed.