<u>GUIDANCE DOCUMENT</u>

This document guides how to run some examples in our manuscript.

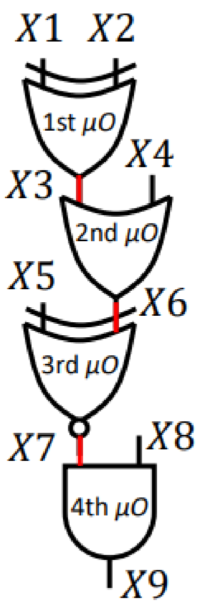
The following folders are different examples attached:

- Cascaded Gates Simple Example
- Image Processing
- Ripple Carry Complex Circuit Example
- XOR with NANDS

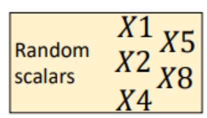
Each subfolder requires `CT.m`, which is the necessary file for simulations. Each folder constructs generic contingency table (CT) set-ups based on the examples; the depth of the circuit and the randomization procedure is important (e.g., *binomial distribution*)

Cascaded Gates Simple Example

Please refer to the manuscript *Figure 5 (b)* for this example. This is a simple example of CT simulation. The main code file in the folder is: gates cascaded circuit.m



The circuit has four terminals to be assigned with random scalars: X1, X2, X4, X5, and X8. Using 1000-times random assignments, the circuit is simulated for the mean absolute error (`MAE`) calculations.



The probability of each input terminal is calculated considering the bitstream size, *N*.

$$P_{X1} = \frac{X1}{N} \quad P_{X5} = \frac{X5}{N}$$

$$P_{X2} = \frac{X2}{N}$$

$$P_{X4} = \frac{X4}{N} \quad P_{X8} = \frac{X8}{N}$$

On the other hand, the other terminals those are binding to the gate outputs: X3, X6, X7, and the final output X9 are calculated for the expected values:

$$P_{X3} = P_{X1} + P_{X2} - 2P_{X1}P_{X1}$$

$$P_{X6} = P_{X3} + P_{X4} - P_{X3}P_{X4}$$

$$P_{X7} = 1 - (P_{X5} + P_{X6} - 2P_{X5}P_{X6})$$

$$P_{X9} = P_{X7}P_{X8}$$