Assignment 3

Due July 17, 13:59

Important: Late submissions will NOT be accepted. Please submit a hardcopy of your solutions in the ECE 466 **drop-box** (ELW, second floor) and your SystemC code via the ECE 466 **CourseSpaces** webpage, following the submission guidelines posted on the course website.

1. *[10 points]* Slides **6-10** of the **"Design"** lecture notes describe a UTF model using `sc_fifo` channels. Consider the **adder_out** channel connecting the **adder** output to the **fork** input. Your task is to perform the following communication refinement:

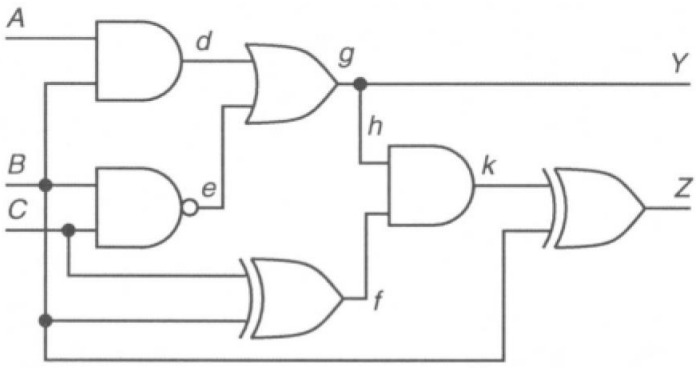
(a) Replace `sc_fifo` **adder_out** with the hardware FIFO described on slides **36-37**.

(b) Introduce the read adapter (see slide **39**) to interface the hardware FIFO with the **fork** input.

(c) Merge the write adapter (see slide **38**) with the **adder** module, thus refining its output interface so that it connects directly to the hardware FIFO.

(d) Put it all together (i.e., create new `sc_main`) and verify that your refined system model works correctly.

2. *[5 points]* Using Boolean differences, obtain all 3-bit test vectors **ABC** detecting a stuck-at-0 fault on branch ***h*** in the logic circuit below.



3. *[5 points]* Consider an LFSR with the polynomial $f(x) = x^8 + x^5 + x^3 + x^2 + 1$. Show its standard and modular implementations.

4. *[5 points]* Slide **38** of the **"Test"** lecture notes shows a one-dimensional 5-cell CA circuit implementing the **90-150-90-150-90** rule structure. Show a CA circuit that implements the **150-150-90-90-150** rule structure instead (it produces all $2^5-1=31$ possible 5-bit nonzero patterns).

5. *[5 points]* Let the LFSR from **Question 3** be a response compactor accepting the following input from some circuit under test: $\mathbf{1011001111001101_{LSB}}$.
(a) Show the signature computed by the LFSR.
(b) Show another input example producing the same signature as in (a).

6. *[10 points]* Let a multiple input signature register (MISR), with 4 inputs and characteristic polynomial $\mathbf{f(x) = x^4 + x^3 + 1}$, accept the same 10-bit response sequence $\mathbf{0011001100_{LSB}}$ on all of its inputs.
(a) What is the signature computed by the MISR?
(b) Show the modular implementation of the MISR polynomial.
(c) Show another example of 4 inputs that yield the same signature as in (a).