

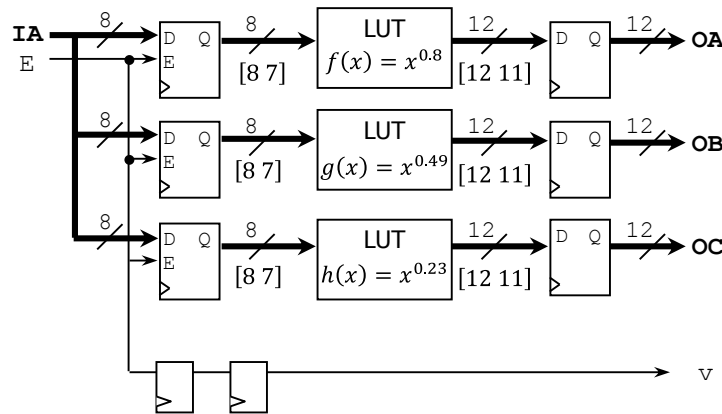
# Solutions - Homework 3

(Due date: March 22<sup>nd</sup> @ 7:30 pm)

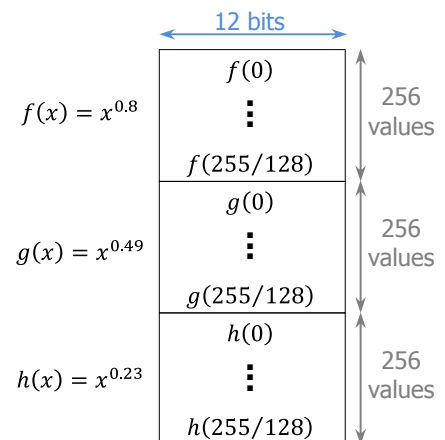
Presentation and clarity are very important! Show your procedure!

## PROBLEM 1 (75 PTS)

- Implement the following circuit using the LUT approach.
  - Input format: [8 7] (unsigned)
  - Output format: [12 11] (unsigned)



- Pre-compute the LUT values and store them as binary numbers in a text file. Your VHDL code should read the text file.
- The text file should be divided as follows: the first 256 entries for the first function, the second 256 entries for the second function, and the third 256 entries for the third function:



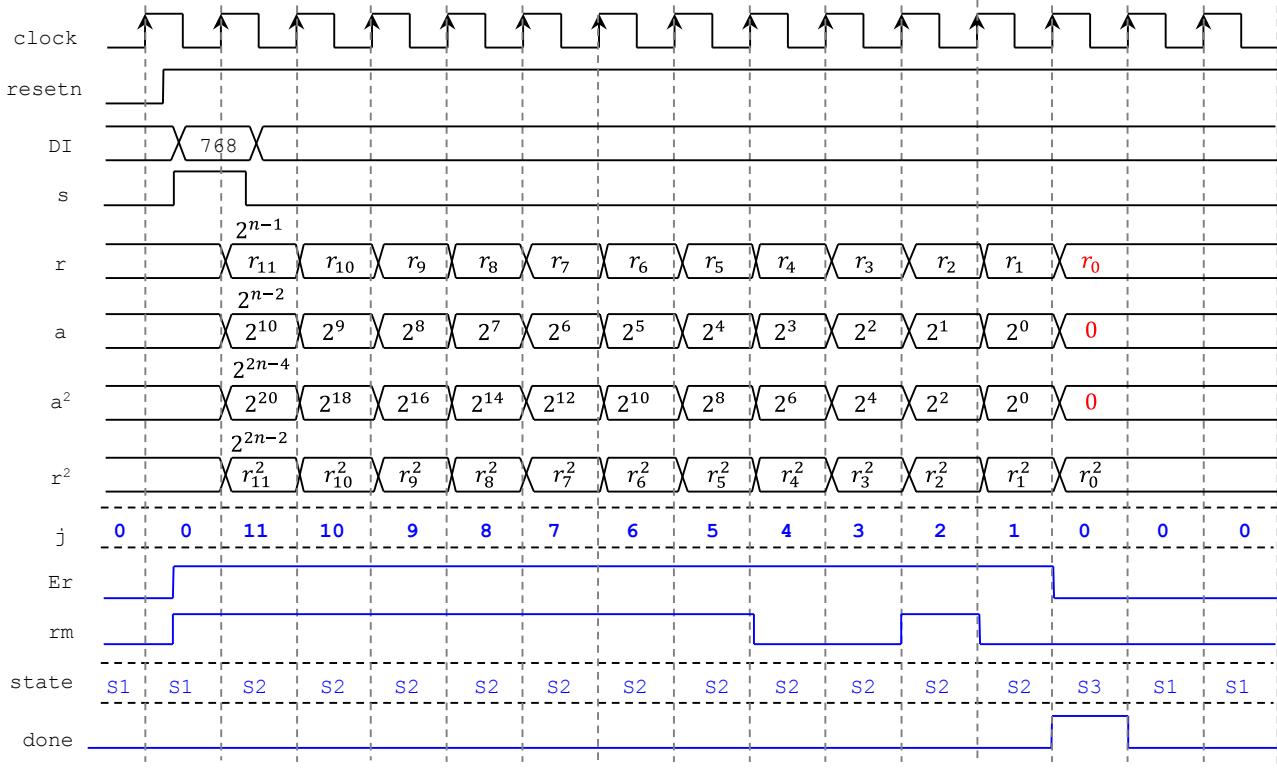
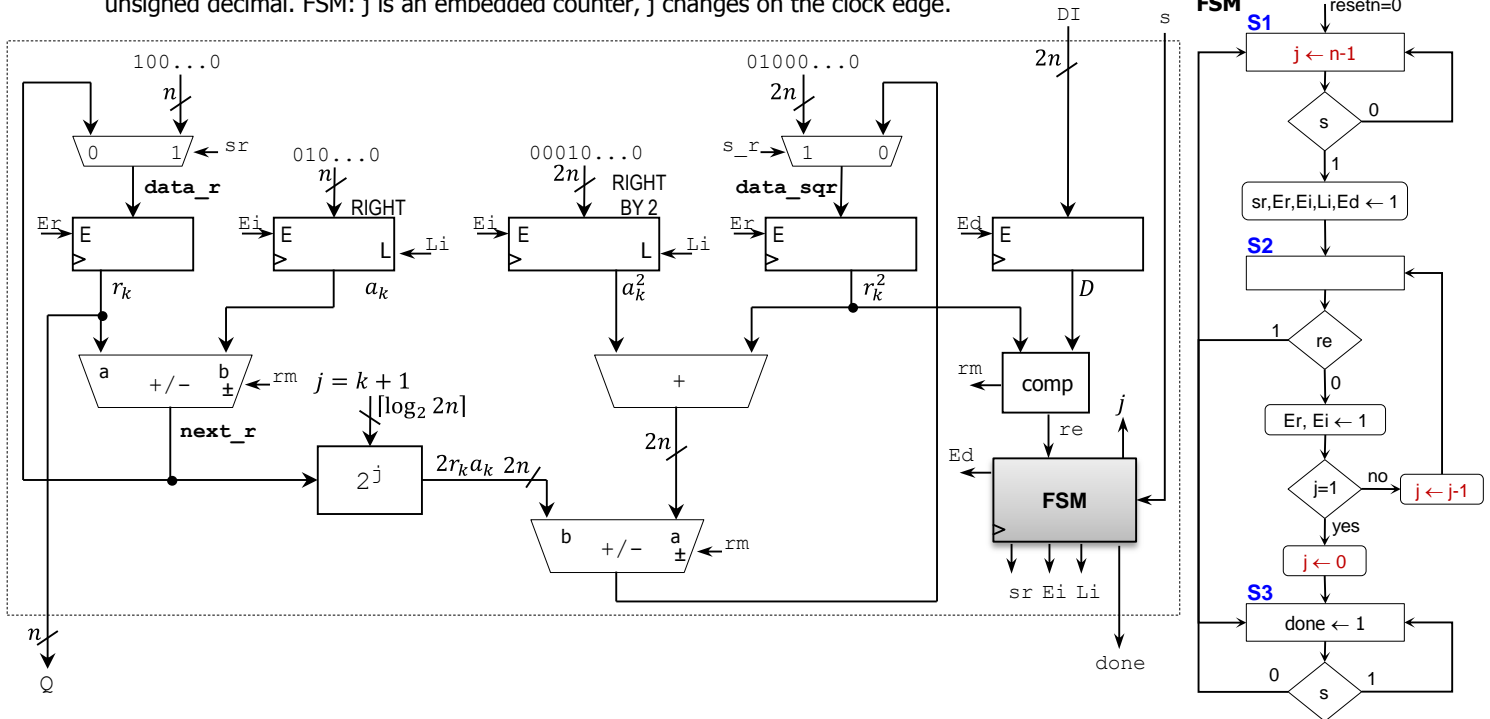
## SIMULATION

- Create a testbench to test your circuit. The testbench must generate all the possible input cases (from 00000000 to 11111111) and write the output results in a text file. For simplicity's sake, it is suggested that you write three 12-bit words per line (256 lines), where each 12-bit word represents the output of a different function.
- To verify the correct operation of your circuit, compare the text file you are generating on the Simulation with the input text file you created for Synthesis.
- Upload the following files to Moodle (an assignment will be created):
  - VHDL code
  - VHDL testbench
  - Input and output text files.

See attached .zip file: solutionsHW3\_p1.zip.

**PROBLEM 2 (15 PTS)**

- Complete the timing diagram of the following circuit, which computes integer square root using a binary search approach.  $n = 12$ . Note that  $rm = 1$  if  $r_k^2 > D$ , else 0,  $re = 1$  if  $r_k^2 = D$ , else 0. Shift registers: serial input is '0'. The value of  $D$  is an unsigned decimal. FSM:  $j$  is an embedded counter,  $j$  changes on the clock edge.



$r_{11}$	$r_{10}$	$r_9$	$r_8$	$r_7$	$r_6$	$r_5$	$r_4$	$r_3$	$r_2$	$r_1$	$r_0$
2048	1024	512	256	128	64	32	16	24	28	26	27

**PROBLEM 3 (10 PTS)**

- Attach a printout of your Initial Project Report (no more than a page). This report should contain the project title, a brief project description, and the current status of the project. Use the provided template (Final Project - Report Template.docx).