ECE 2700
Group 3 Final Presentation

8-bit Simple Signed Calculator: Keyboard and Display

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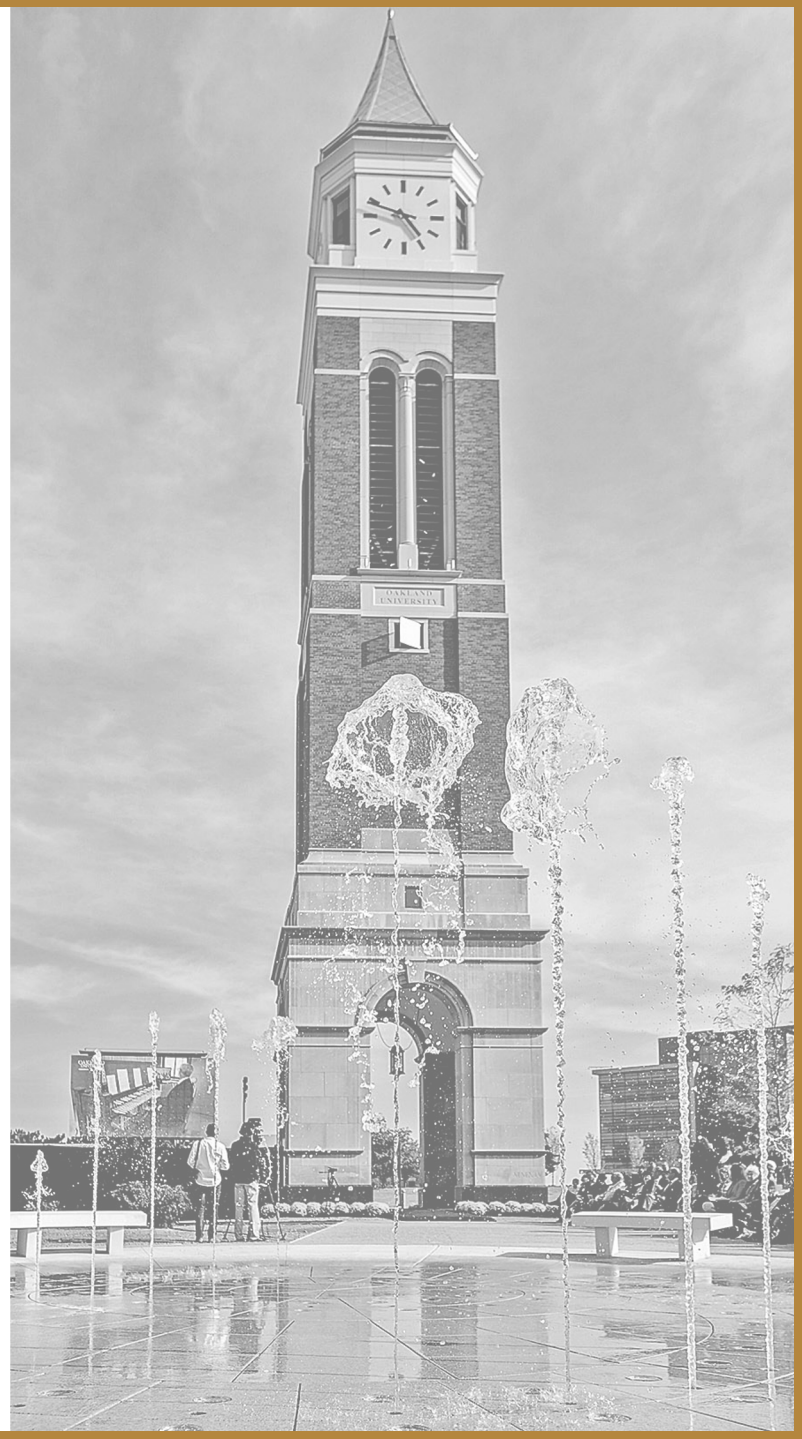


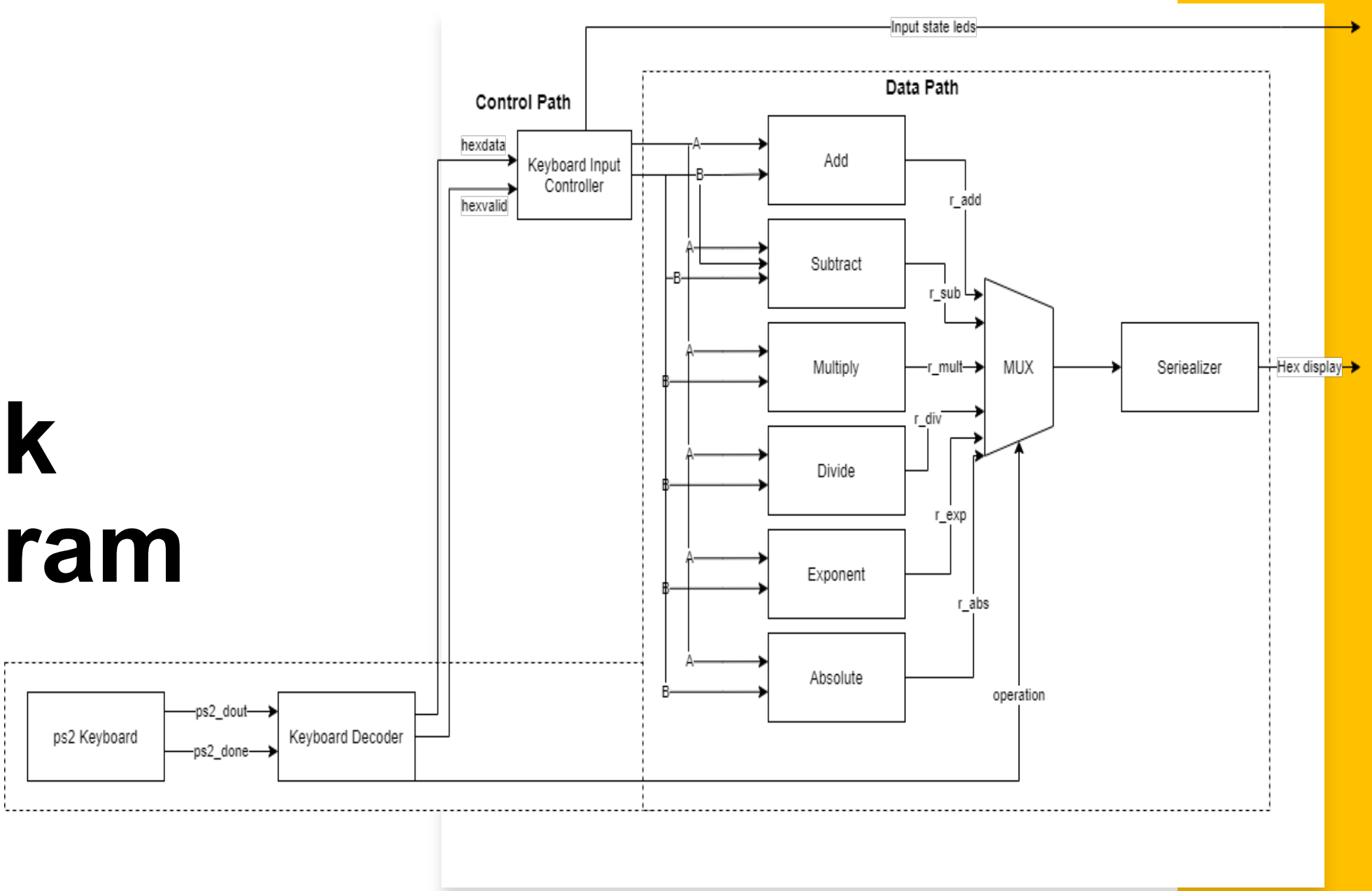
Introduction

- The simple 8-bit calculator takes the input from the keyboard and then shows the results on the seven-segment display on the FPGA Nexys-A7 board.
- The keyboard inputs and the seven-segment display are in hexadecimal.

Ps2 Keyboard

- Ps2 Keyboard is used to interface the keyboard with the FPGA. The ps2 sends the scanned codes which we identify and translate into our hex inputs.
- The input is as follows:
  - 1st data entered is the first digit of the first input (A) from keyboard, bits (3 - 0)
  - 2nd data entered is the second digit of the first input (A) from keyboard, bits (7 - 4)
  - 3rd data entered is the first digit of the second input (B) from keyboard, bits (3 - 0)
  - 4th data entered is the second digit of the second input (B) from keyboard, bits (7 - 4)
  - The default operation is addition (F1) , then press the function keys to select the next desired operation.

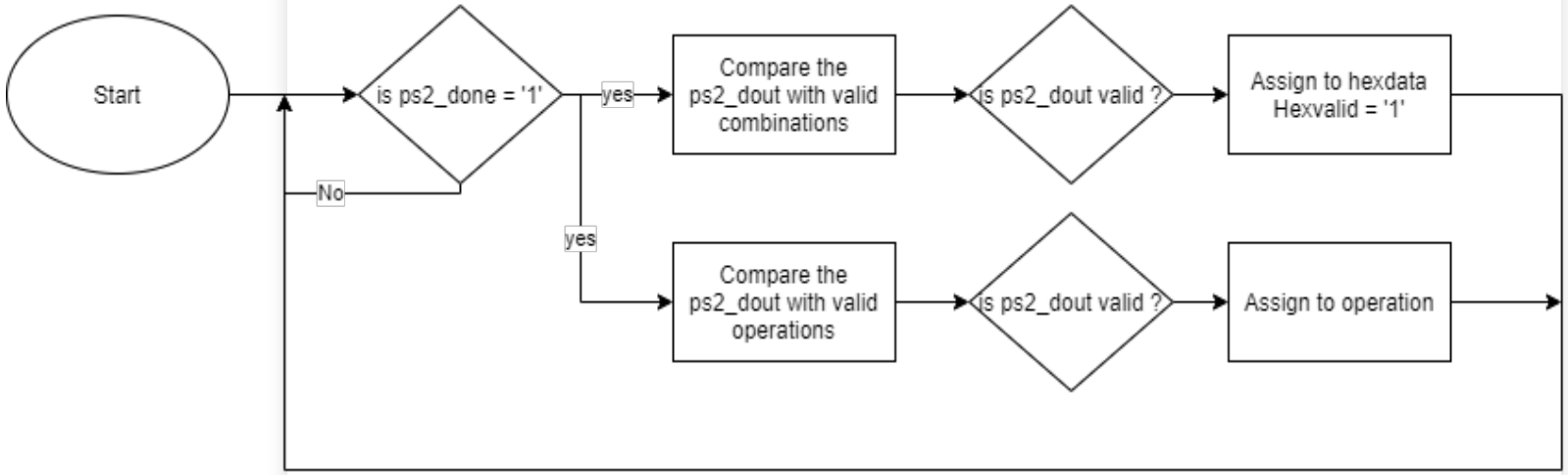
Block Diagram

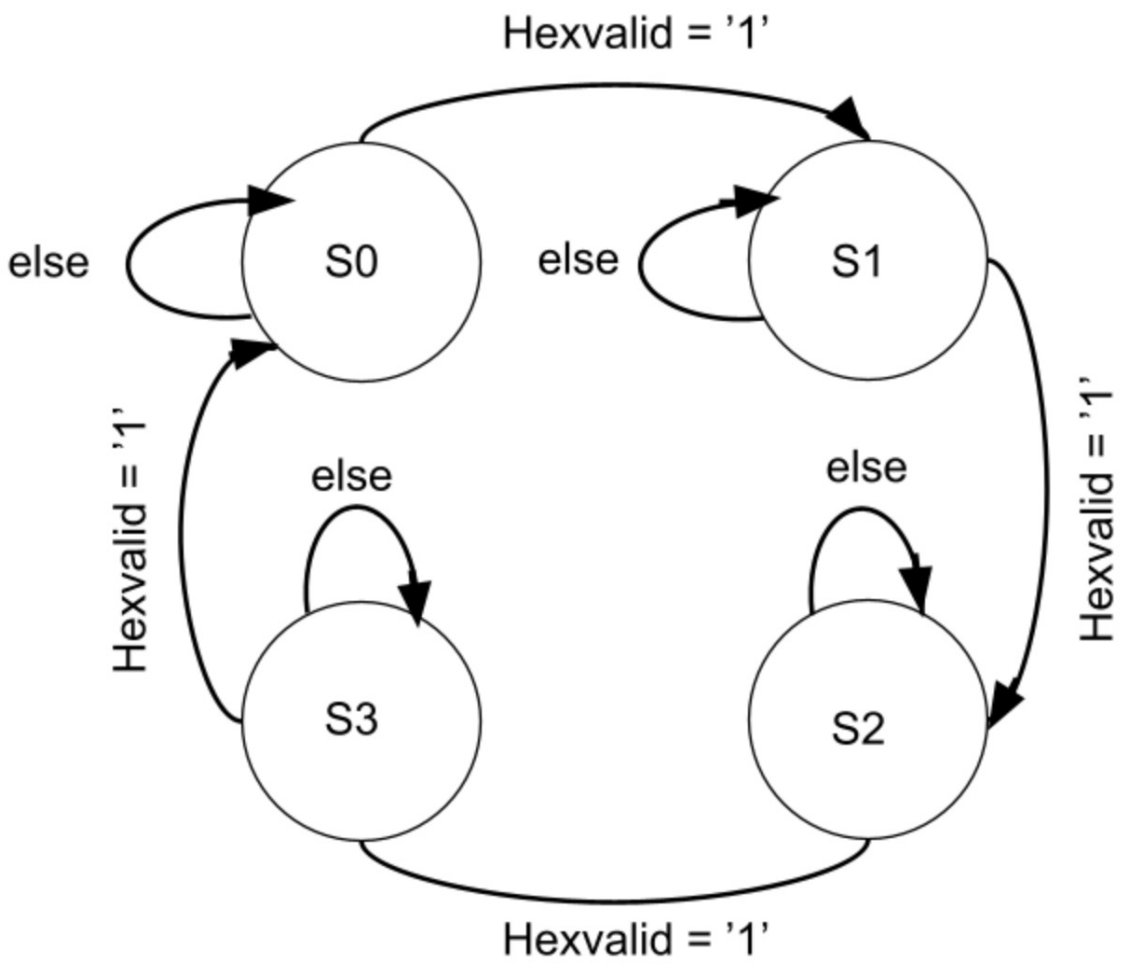


Keyboard Decoder

- Note:
- Valid Inputs: 0-9, A-F
- Valid Operations: F1 - F6

- Operations:
- F1 => Add
- F2 => Subtract
- F3 => Multiply
- F4 => Divide
- F5 => Absolute
- F6 => Exponent





Keyboard Input Controller FSM

Outputs:

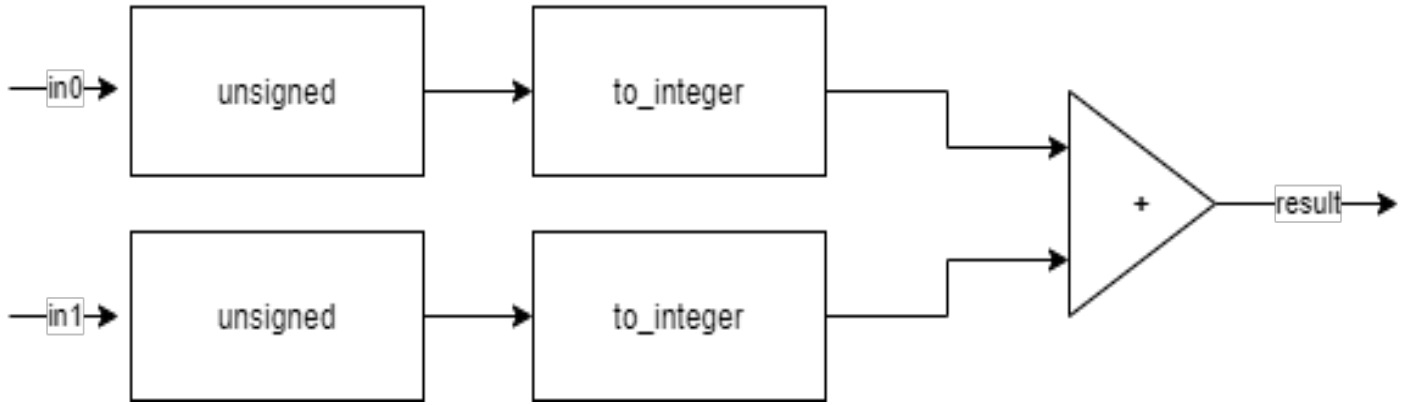
S0 → Gets the first digit of first input from keyboard → A(3 - 0) = Hex data

S1 → Gets the second digit of first input from keyboard → A(7 - 4) = Hex data

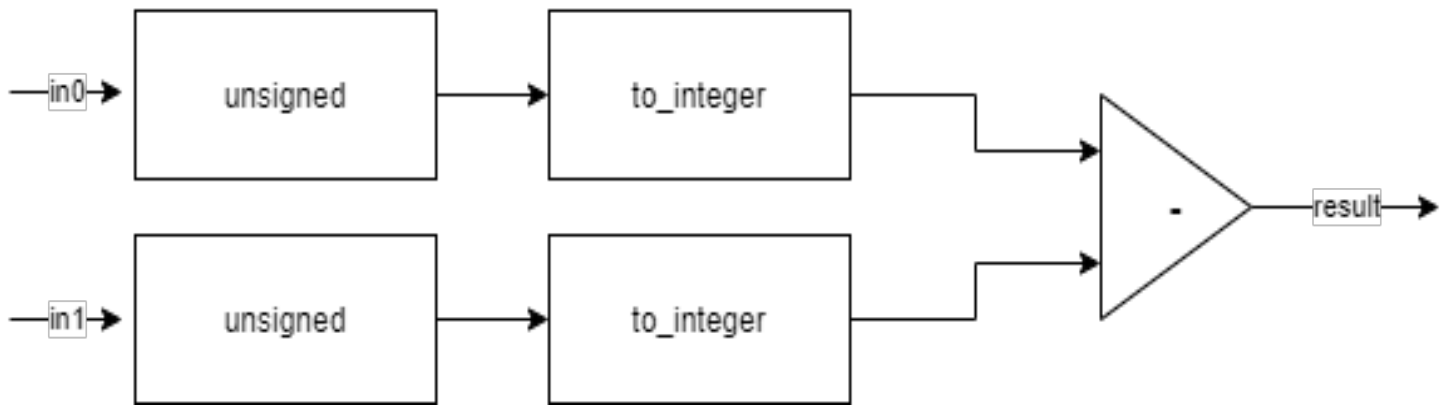
S2 => → Gets the first digit of second input from keyboard → B(3 - 0) = Hex data

S3 => → Gets the second digit of second input from keyboard → B(7 - 4) = Hex data

Add



Subtract



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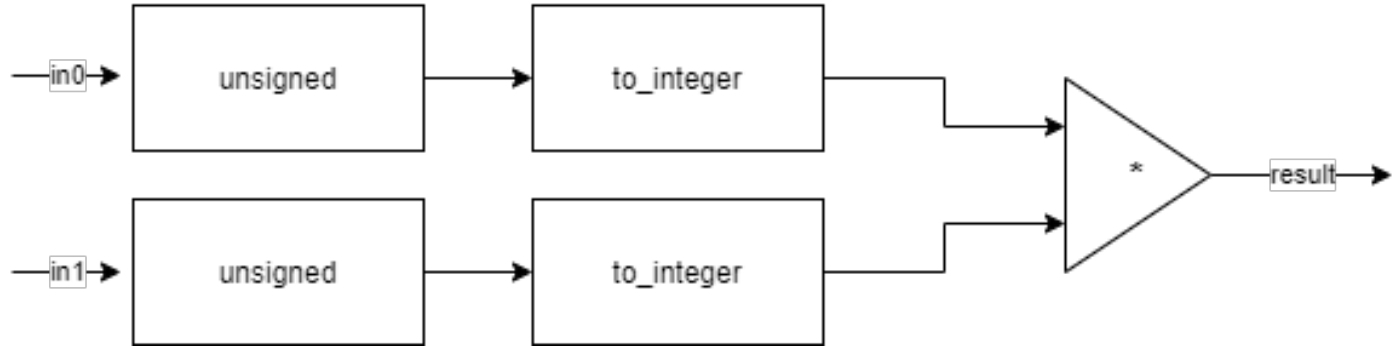
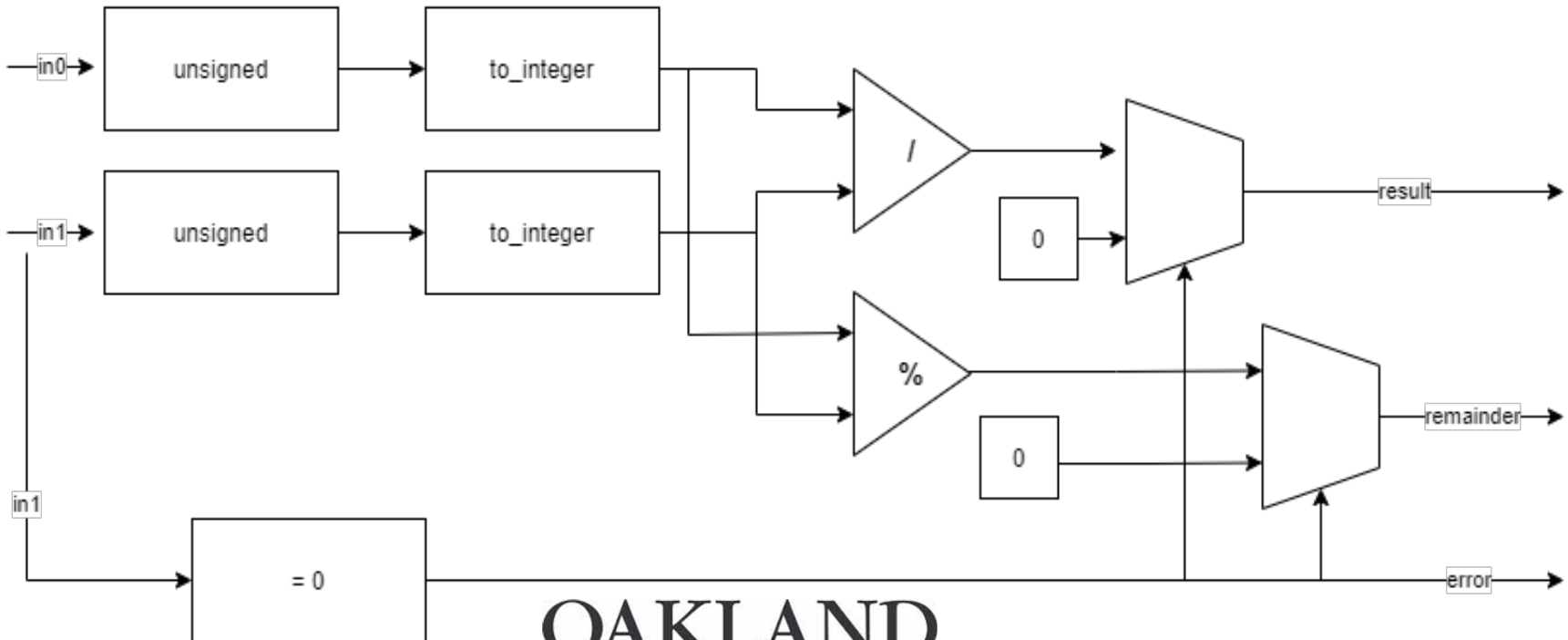
Multiply



Divide



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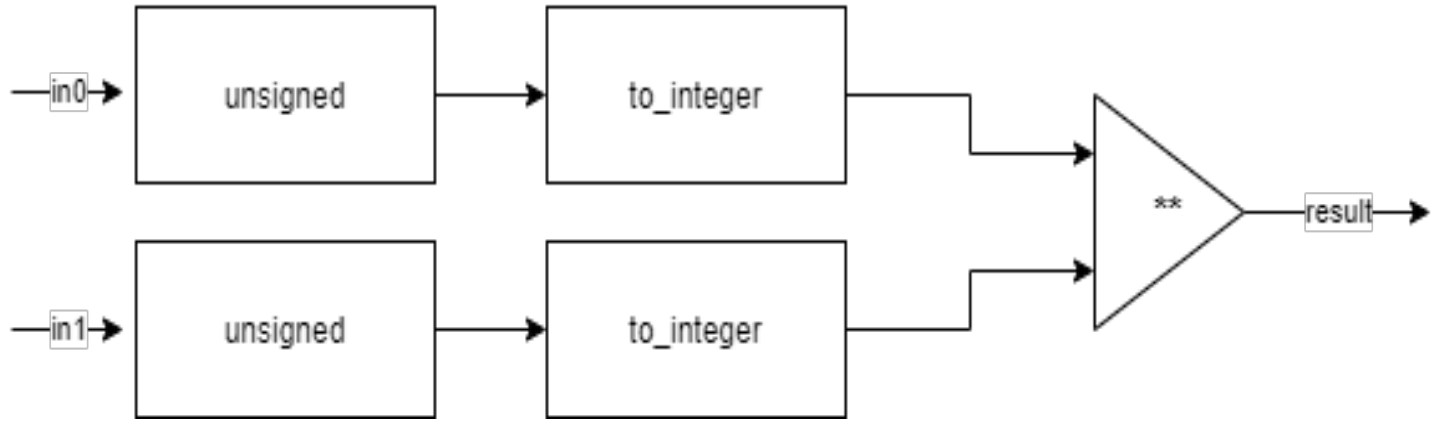
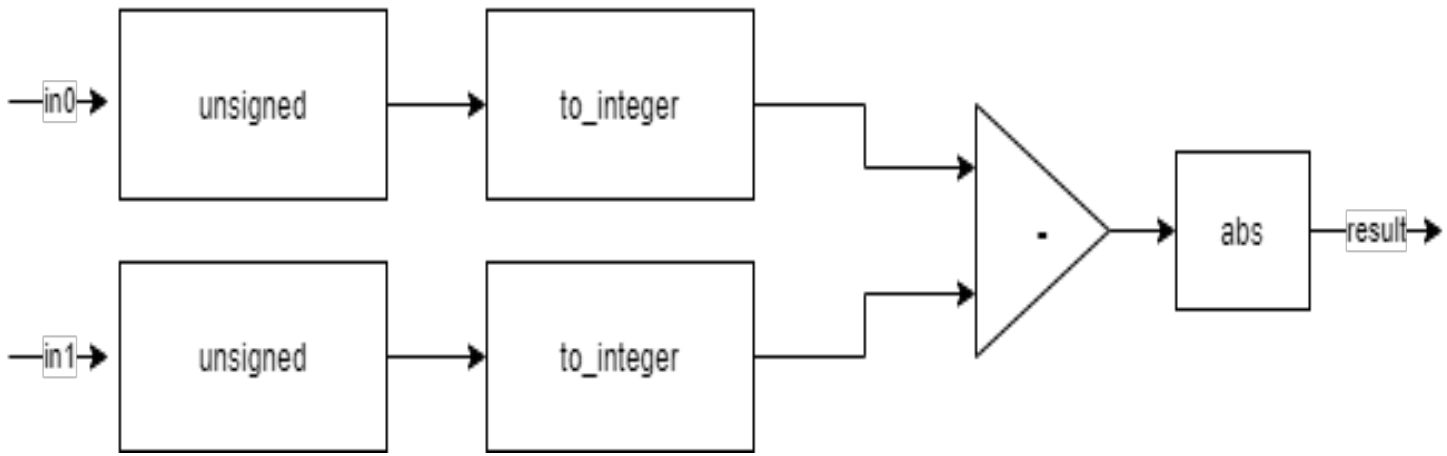
Exponent



Absolute



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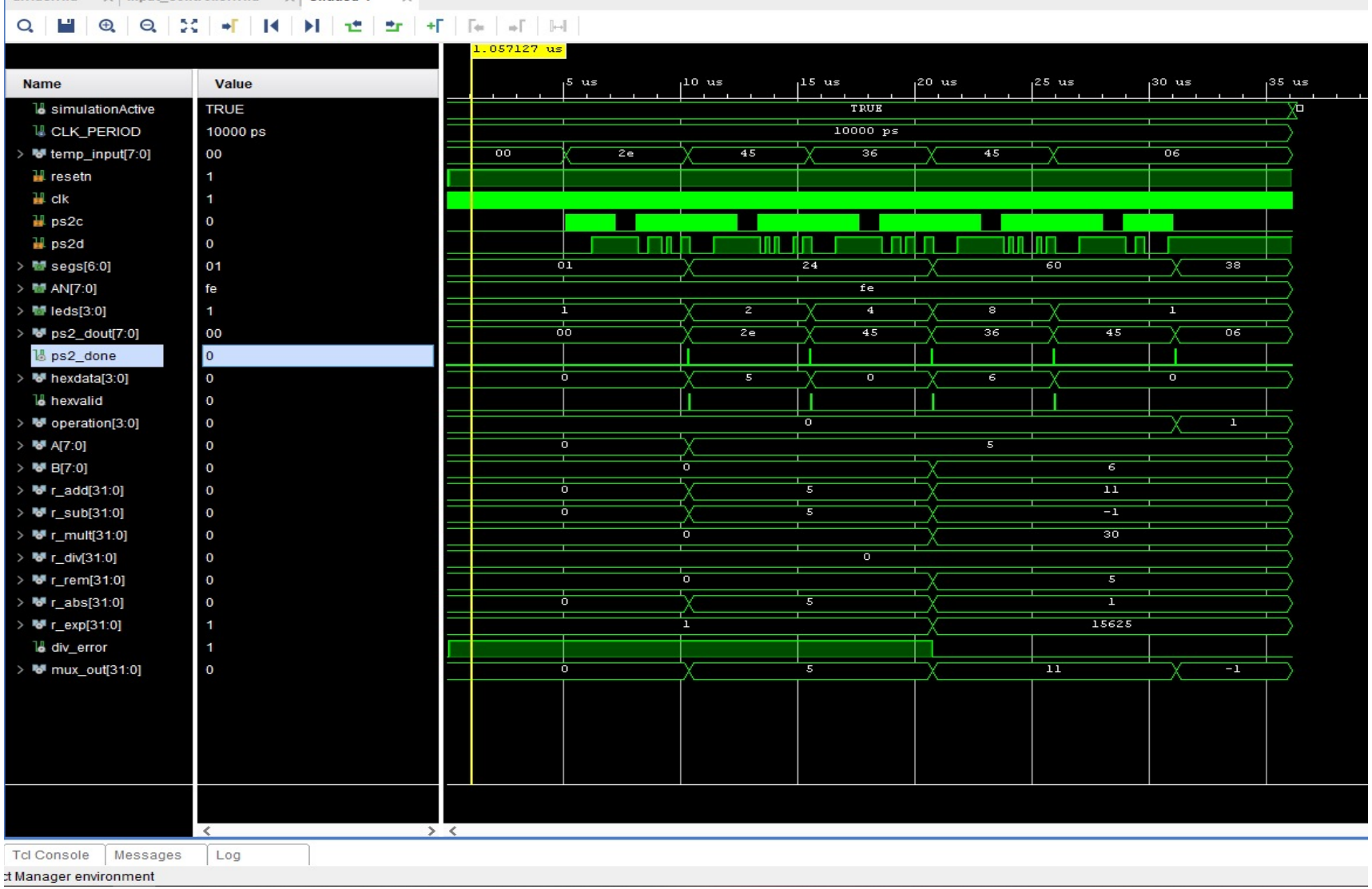
Serializer

- The serializer used in the project was the one we used in the lectures with a slight modification to support all the eight seven segment displays.

Simulation Results

- This test bench is used to verify our model.
  - In it we first simulate the ps2 inputs which are as follows
    - Keyboard input → 5 this input will be calculator's 1st input unit digit
    - Keyboard input → 0 this input will be calculator's 1st input tens digit
    - Keyboard input → 6 this input will be calculator's 2nd input unit digit
    - Keyboard input → 0 this input will be calculator's 2nd input tens digit
    - Keyboard input → F2 this input will select the operation to perform
    - F2 → Subtraction

Simulation Result



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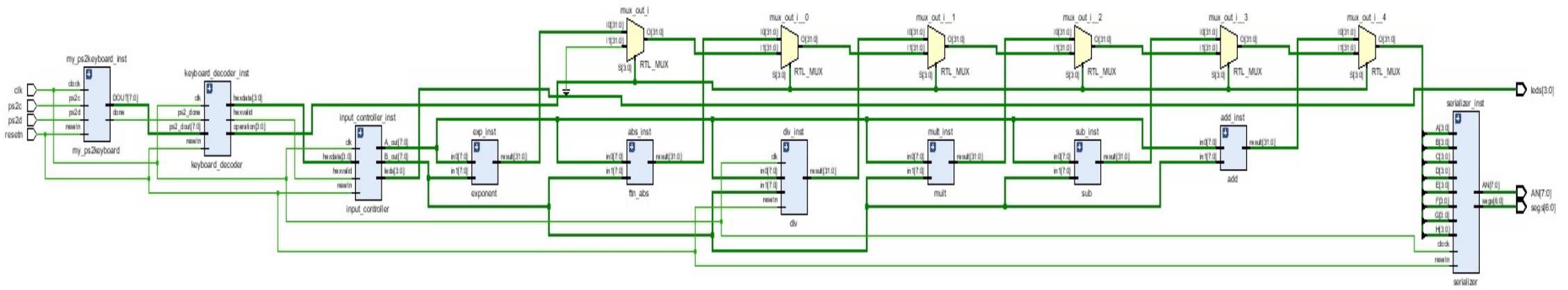

Synthesis RTL