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CS M152A

Lab 4 Proposal

Project Description

We propose to implement a basic integer calculator. Our implementation will have functions for add, subtraction, multiply, and (truncated) divide. In addition, we will have 4 registers, similar to the implementation of Lab 1. Unlike Lab 1, however, we plan to display the results of the selected register with the four LED 7-segment displays instead of the UART interface. Using buttons and switches, users can specify which register to operate on, what operations to perform (add, multiply, subtract, divide), and what to display (registers, most recent calculation, etc.).

Design

Inputs:

clk - Used to make clocks for other functionality (display, counters, etc.)

Operations (Default)

btnU - *Multiplication:* enter digit editing mode and multiply the current register by the input
btnD - *Division:* enter digit editing mode and divide the current register by the input
btnL - *Subtraction:* enter digit editing mode and subtract the input from the current register
btnR - *Addition:* enter digit editing mode and add the input to the current register
btnS - *Memory:* enter memory mode

Operations (Digit Editing Mode)

btnU - Increase the current digit by one
btnD - Decrease the current digit by one
btnL - Move the cursor by one digit to the left
btnR - Move the cursor by one digit to the right
btnS - Exit Digit Editing mode with the currently displayed number as input to the calculator

Operations (Memory Mode)

btnL - Change to the register to the left
btnR - Change to the register to the right
btnD - Reset the currently displayed register to zero
btnS - Select the current register and exit memory mode

Operations (PEMDAS, Stretch Goal)

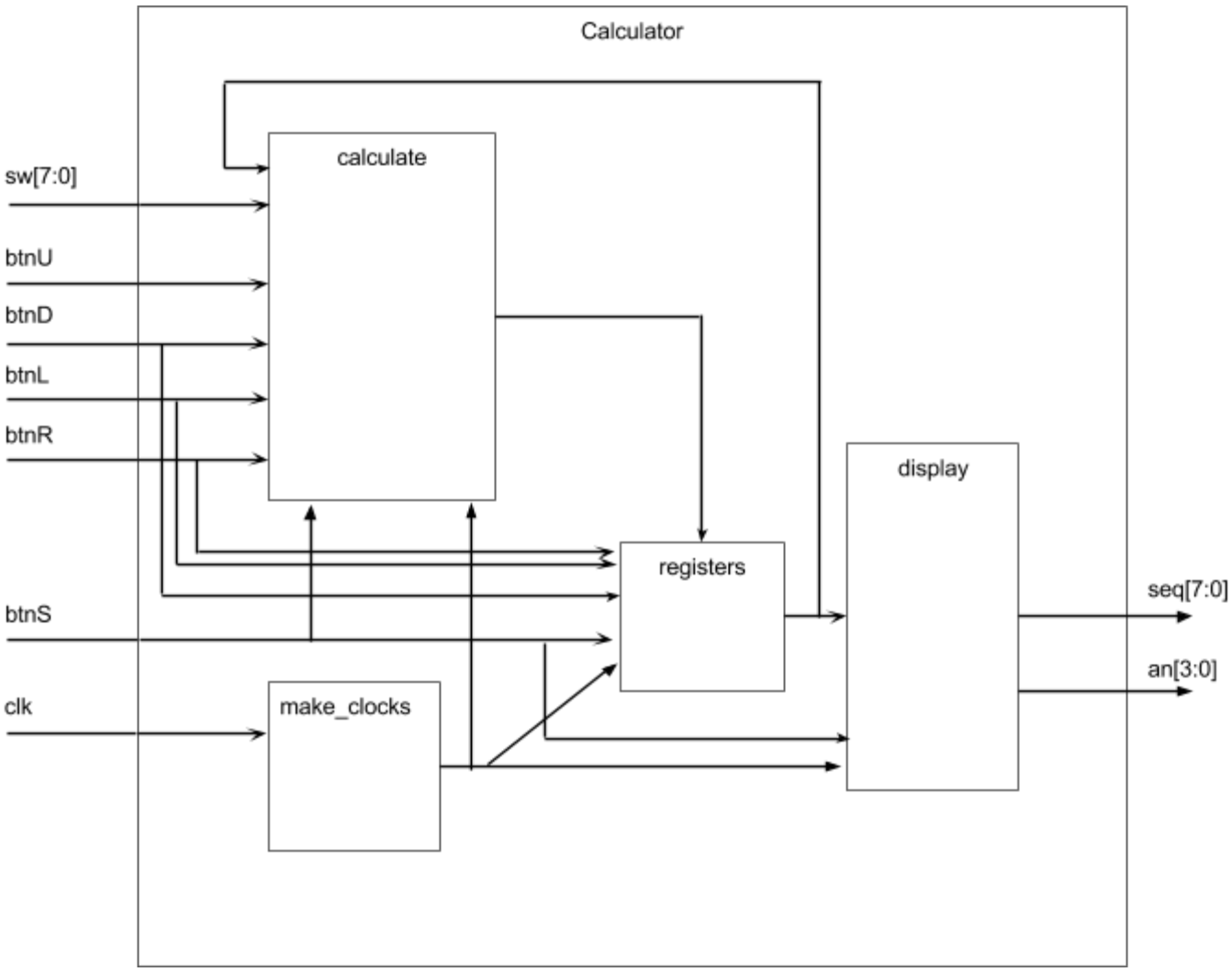
sw[0] - set to 1 to immediately enter and 0 to immediately exit (discarding any current operations)
btnU - *Multiplication:* request calculator multiply the two registers displayed
btnD - *Division:* request calculator divide the two registers displayed
btnL - *Subtraction:* request calculator subtract the two registers displayed
btnR - *Addition:* request calculator add the two registers displayed

Once 3 operations are requested, the calculator executes the operations in the correct order and briefly displays the result

***Outputs*:**

Seven-Segment Display - Displays value of current register
- Flashes all digits if changing registers and switches between register number and value if in Memory Mode
- Flashes the digit being adjusted in Digit Editing Mode
- Displays the number of the two registers currently being operated on in PEMDAS mode

Structure:



Modules:

make_clocks - uses input **clk** to make additional clocks used for the calculator implementation
registers - holds the recorded value for each “register” value; handles selecting active register
calculate - fed active register, input value, and operation; does the number crunching
display - displays the output; handles blinking

Rubric (out of 100):

- Display (20): Show current register value, immediately updates after operations
- Basic Functionality (30): Calculator successfully performs arithmetic operations when requested upon button press
- Memory (40): User can cycle between registers that store input
    - Storage (30): four independent registers
    - Display (10): When cycling, alternates between register and register number
- Stretch Goal - PEMDAS Mode (10): Flicking a switch allows users to operate on four registers at once and specify which operations to perform on all four, to