Floating Point Calculator

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Project Description

- A circuit that calculates various operations of addition, subtraction, multiplication, and division on floating point numbers.
- The user will Input numbers of 32-bit size via USB keyboard and the result will display on a 7-segment display.
- The project will utilize the topics of floating point mathematics and external interfacing.

Design components

External: USB keyboard and 7 segment displays.

Internal:

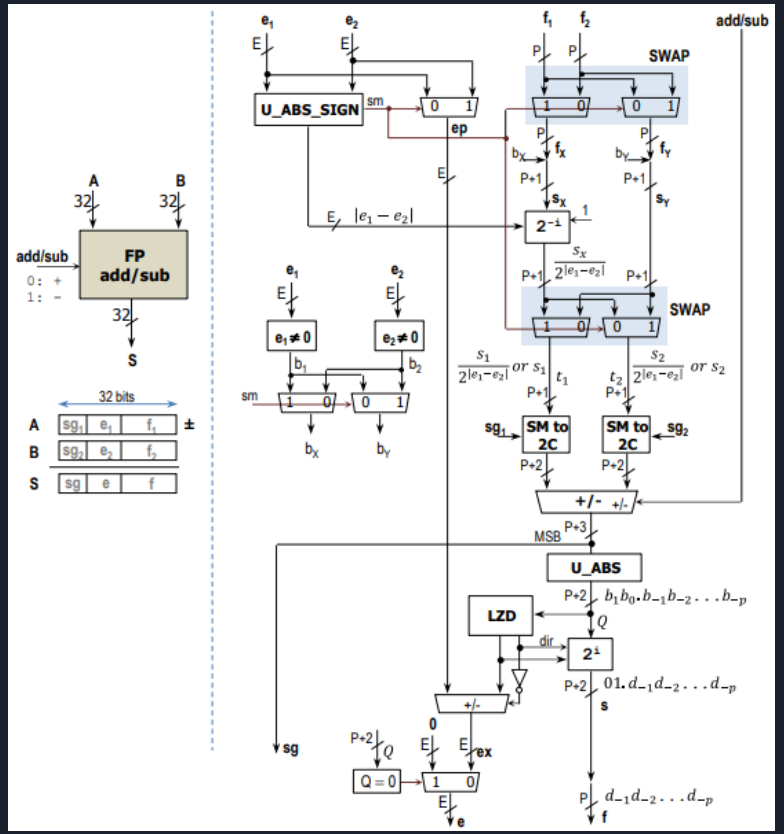
- Adder, Subtractor, Multiplier, and Divider.

  Sub components: LZD, Barrel Shifter, MUX, ADDSUB, SM2C, U_ABS_SIGN, XOR gate

- keycode, LUT, FSM, Hex to 7-seg display.

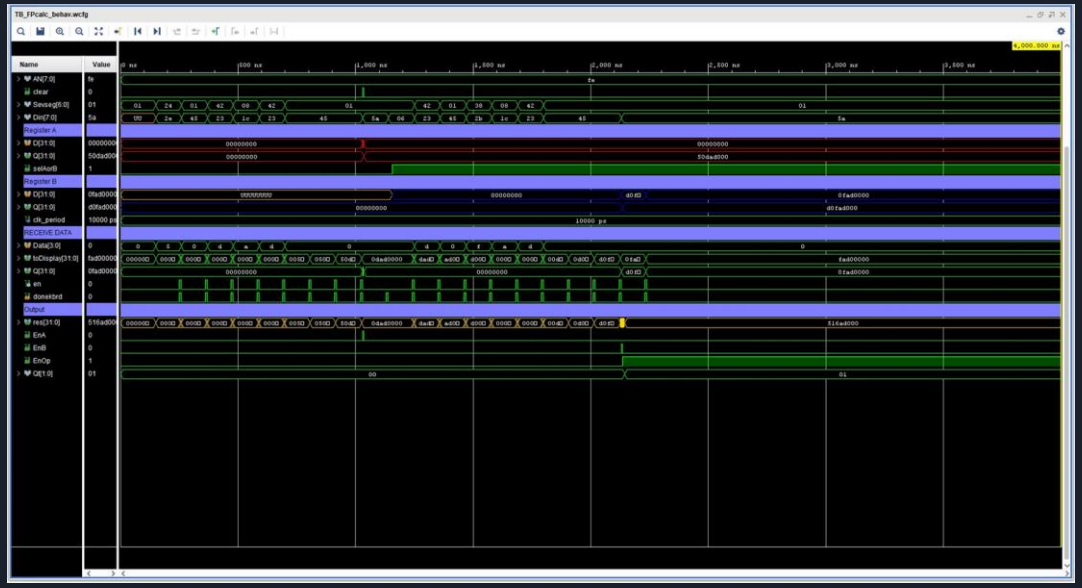
Design Process

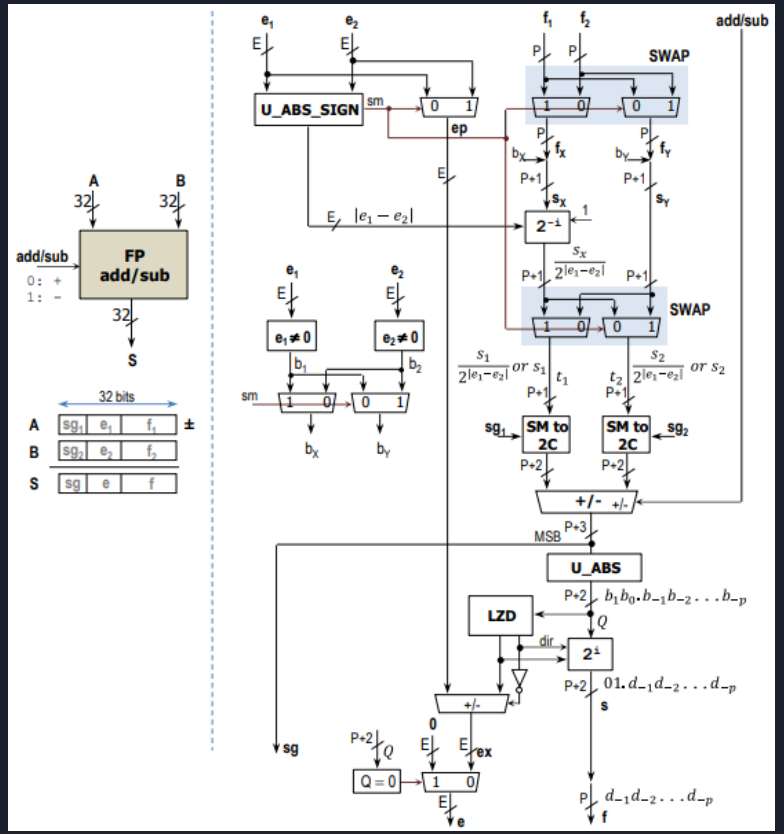
- Adder



Design Process

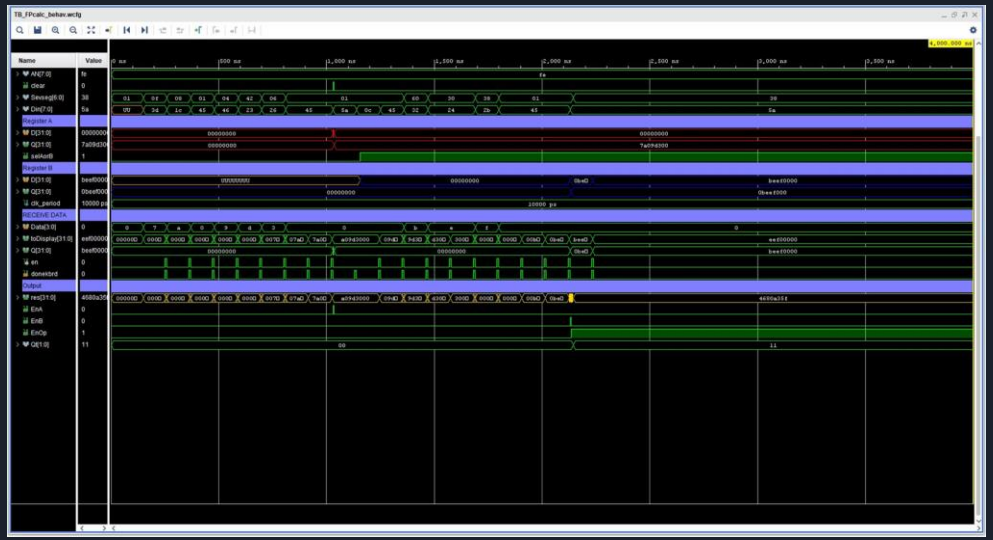
- Subtractor

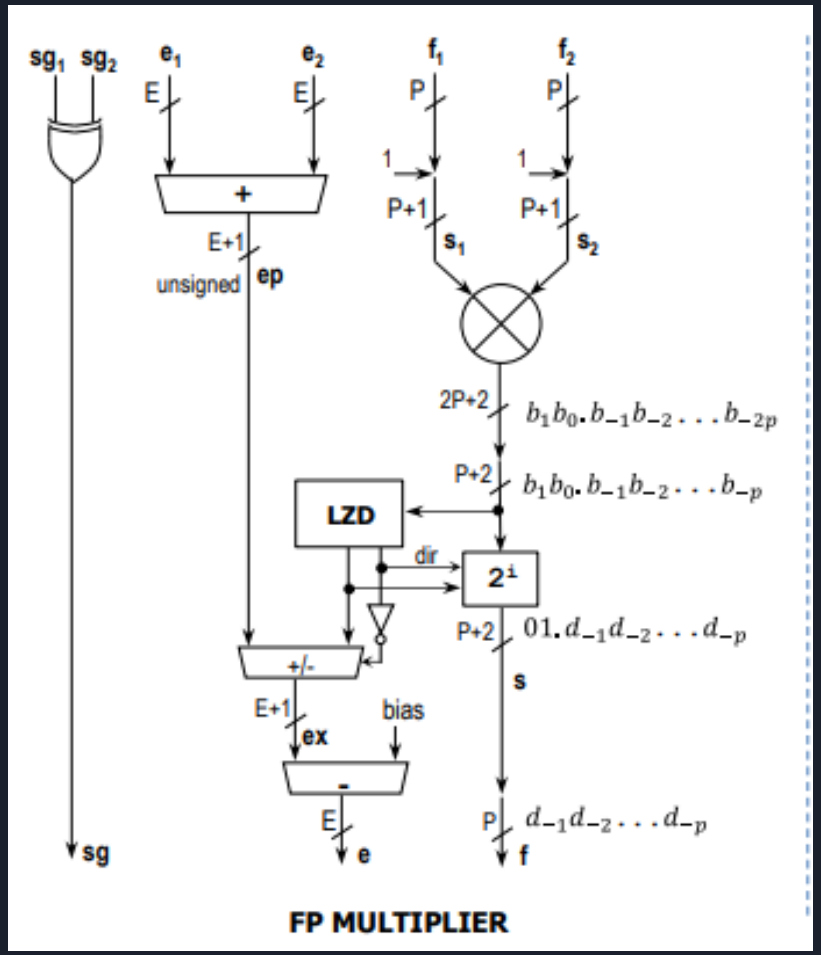




Design Process

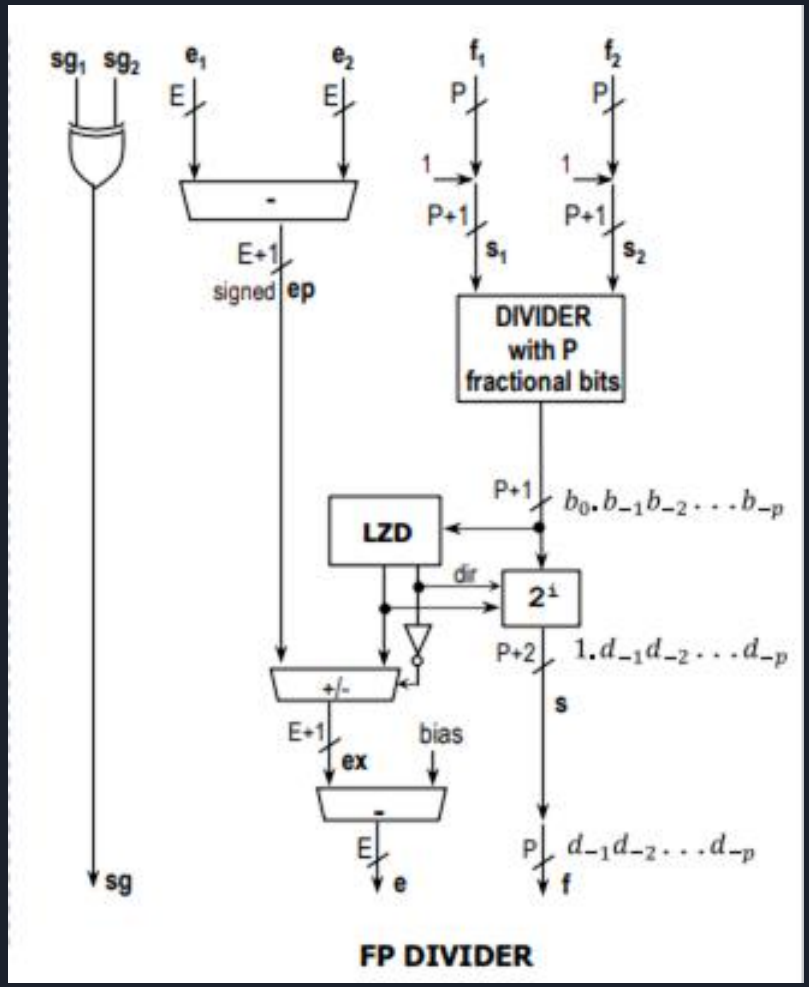
- Multiplier





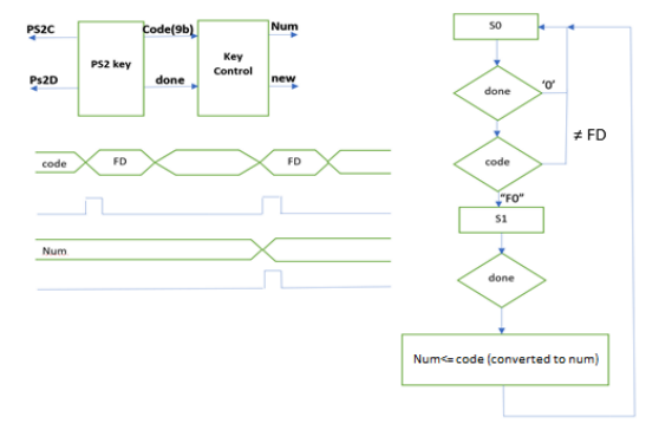
Design Process

- Divider

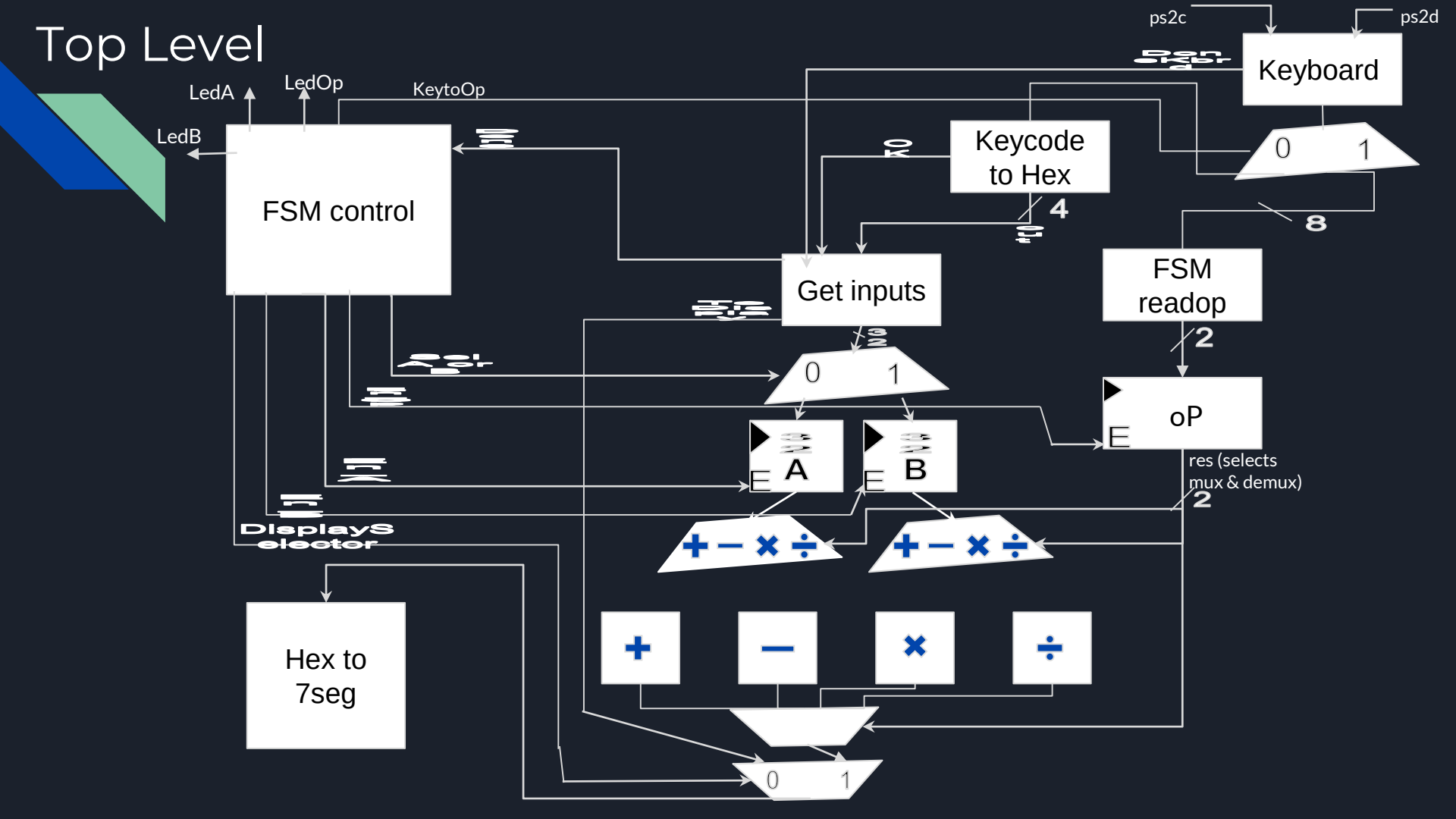


Design Process

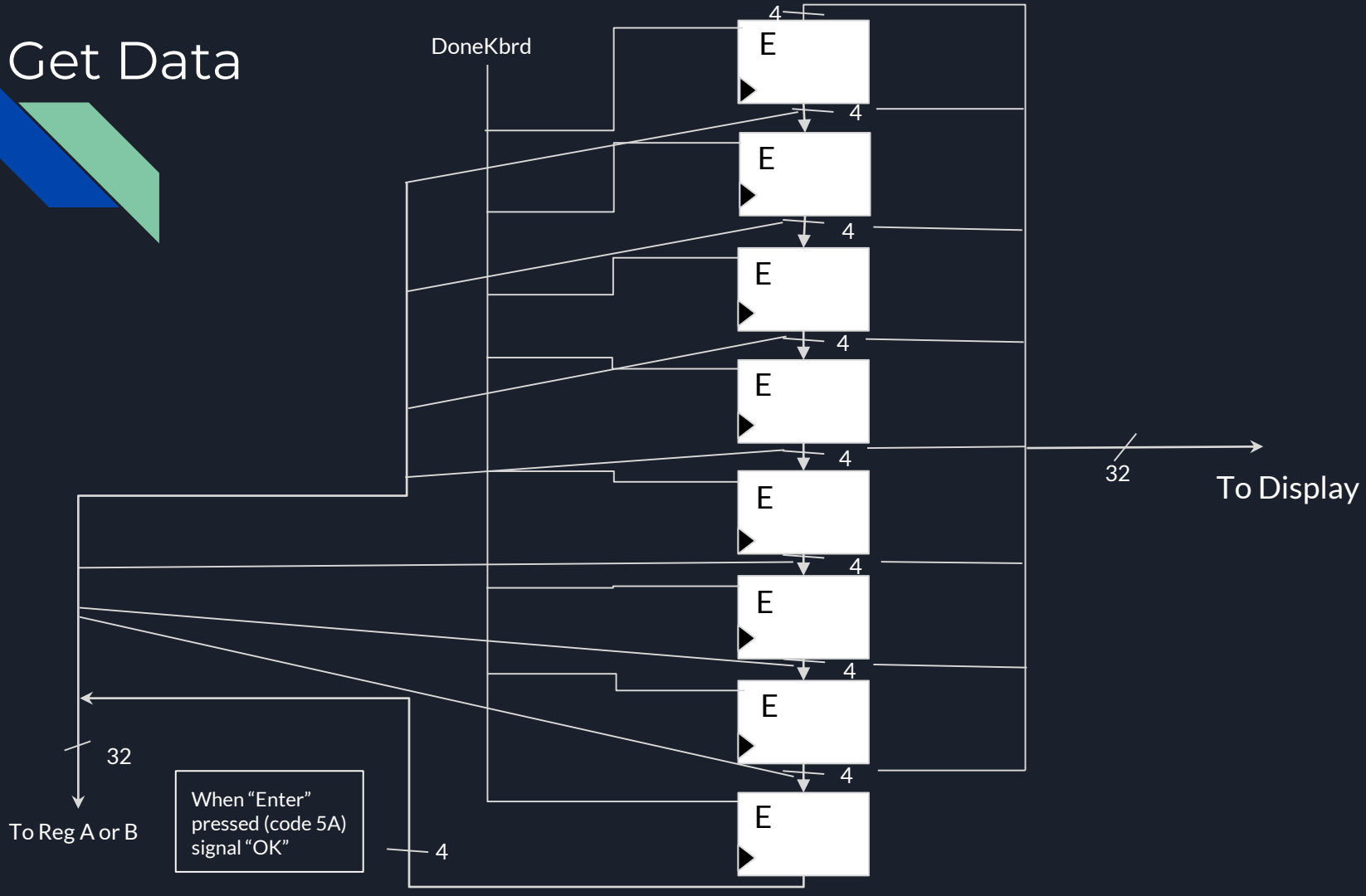
- Keyboard



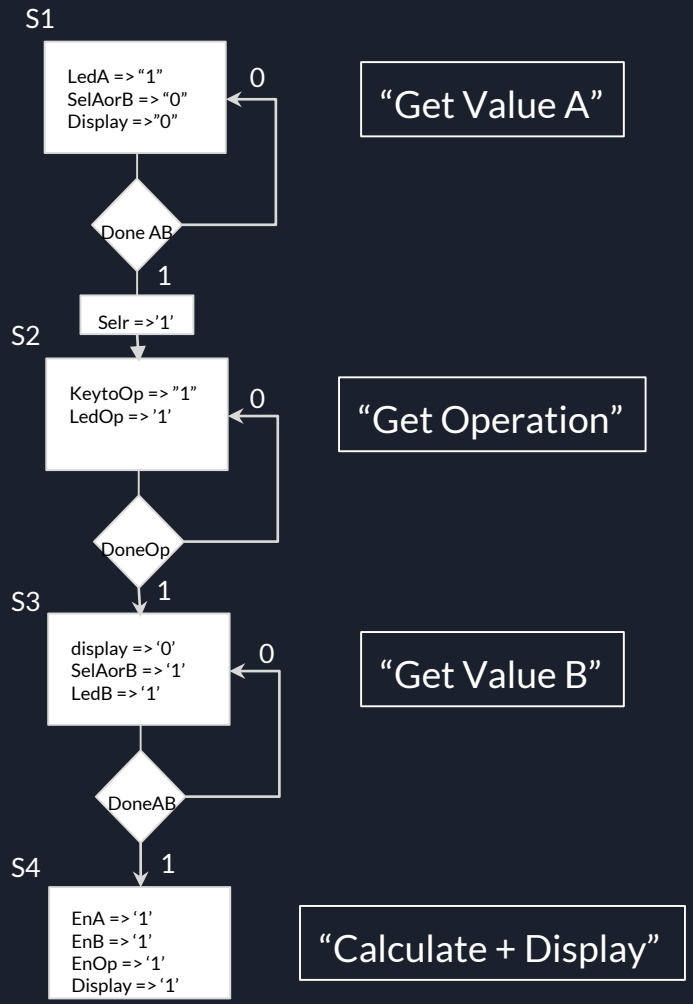
Top Level


ps2c
ps2d
Keyboard
LedA
LedOp
KeytoOp
LedB
FSM control
Keycode to Hex
0
1
4
8
Get inputs
FSM readop
2
0
1
oP
E
A
B
res (selects mux & demux)
2
Hex to 7seg
+
−
×
÷
0
1

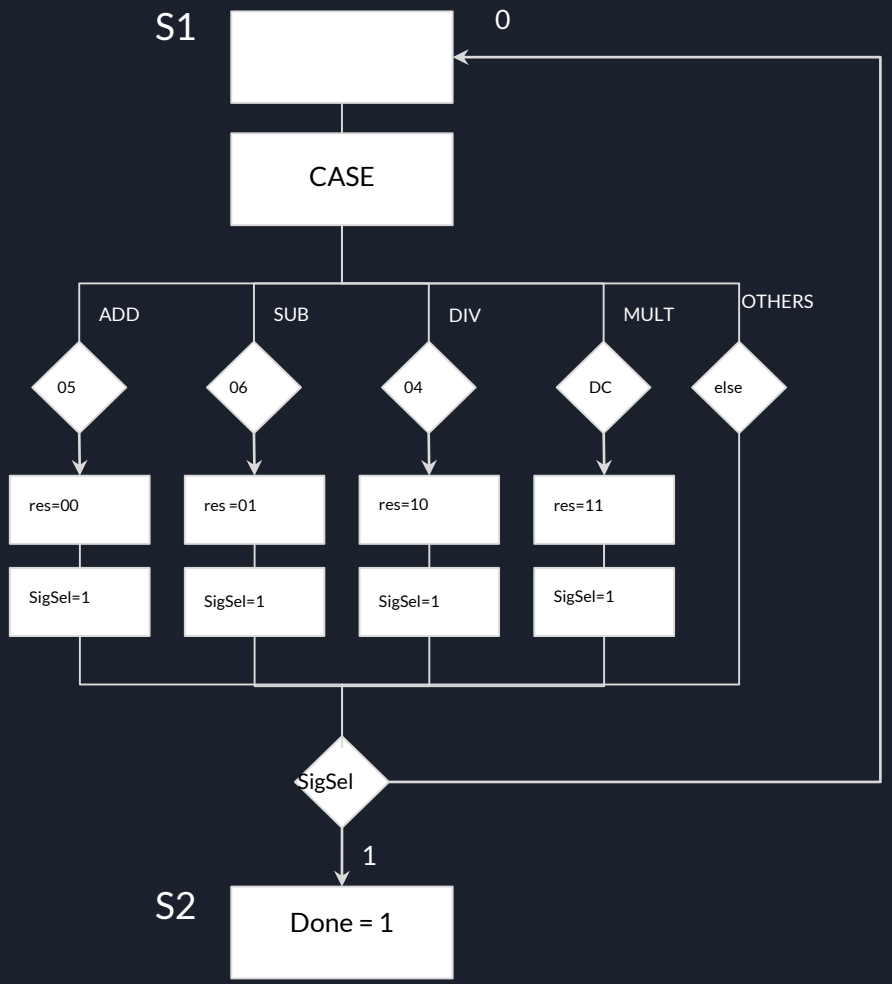
Get Data


DoneKbrd
E
E
E
E
E
E
E
E
4
4
4
4
4
4
4
4
32
To Display
32
To Reg A or B
When “Enter” pressed (code 5A) signal “OK”
4

FSM Control


S1
LedA => “1”
SelAorB => “0”
Display =>”0”
0
Done AB
1
Selr =>’1’
S2
KeytoOp => ”1”
LedOp => ’1’
0
DoneOp
1
S3
display => ‘0’
SelAorB => ‘1’
LedB => ‘1’
0
DoneAB
1
S4
EnA => ‘1’
EnB => ‘1’
EnOp => ‘1’
Display => ‘1’
“Get Value A”
“Get Operation”
“Get Value B”
“Calculate + Display”

FSM readOp (gets operation)



Challenges

- Divider and Multiplier Circuit debugging.
- Designing and implementing a 32bit input system using a PS2 Keyboard.
- Having a problem with the input system that would lag too many inputs inwards even though we had a fully operational and perfect simulation set (using wrong DONE from PS2 Keyboard)
- Putting all the pieces together

DEMONSTRATION

https://www.youtube.com/watch?v=ea7pYvGC4_g&feature=youtu.be