# The Calculator

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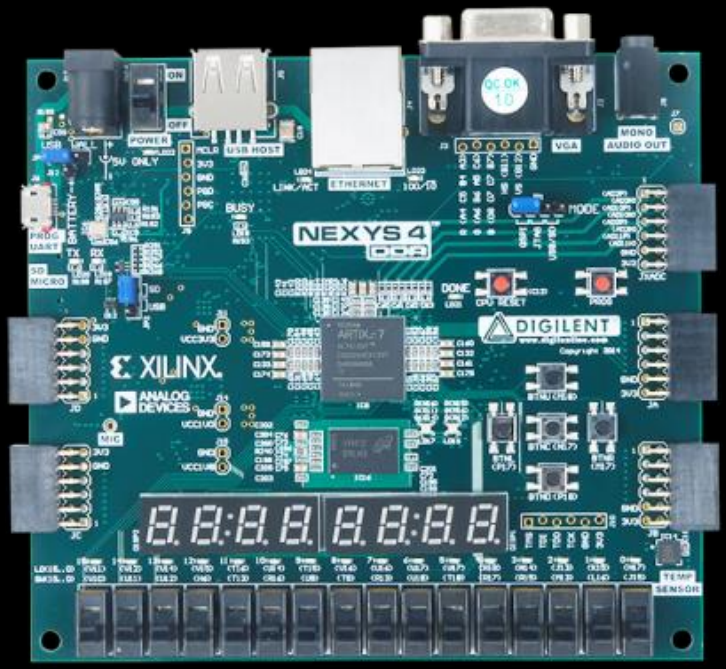
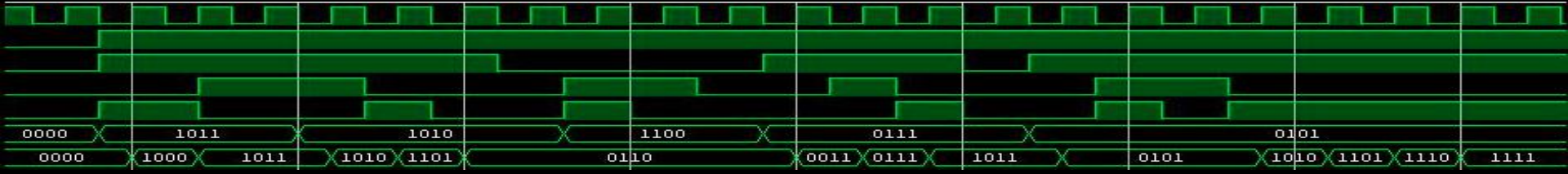
# Introduction

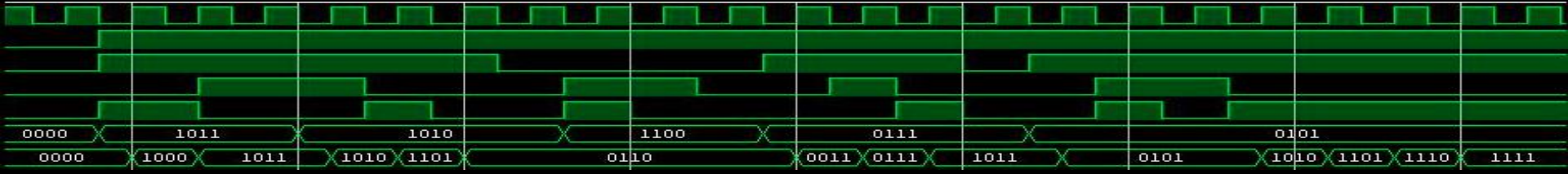
- Design a simple calculator
  - Addition
  - Subtraction
  - Division
  - Multiplication
- Display the Inputs
  - Switches
  - LEDs
- Display the Output
  - 7-Segment Display





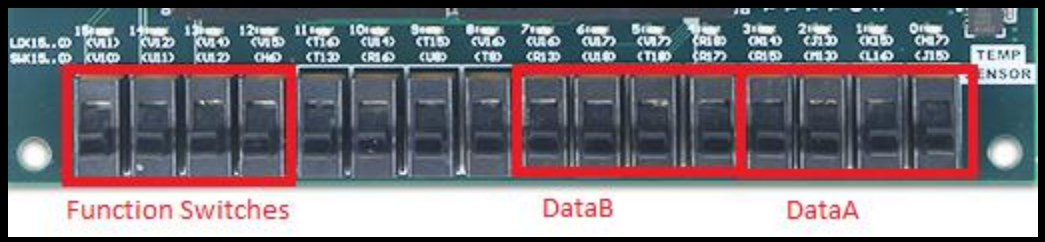

# Purpose

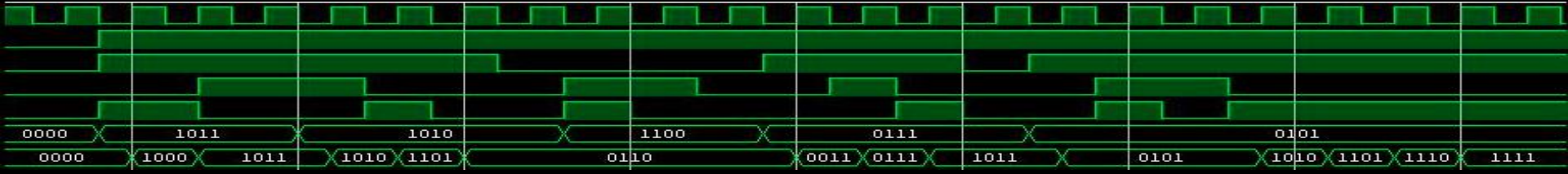
- Create a calculator that operates off binary inputs
- Able to calculate up to 4 bit outputs
- Utilizes switches as inputs
- Utilizes 7-segment display to represent outputs in hex
- Utilizes LEDs to display the inputs in binary




# Inputs

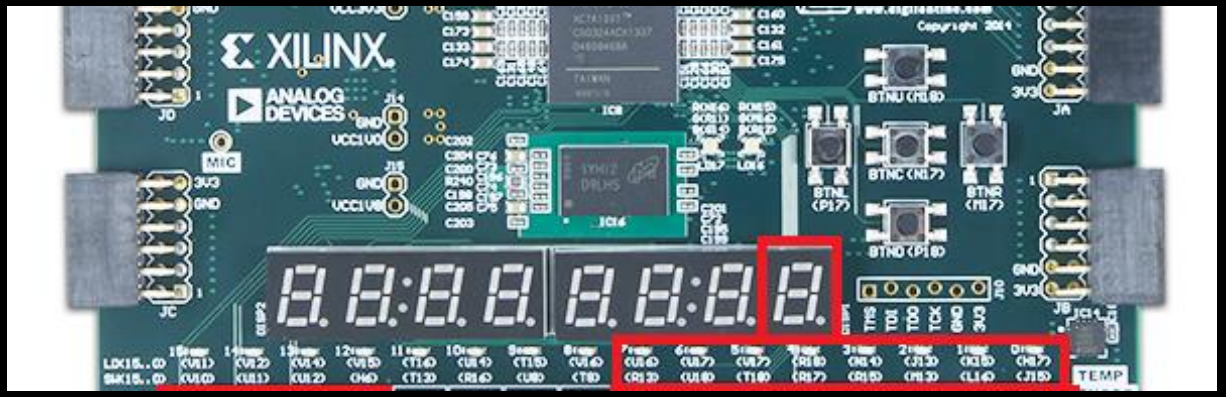
- The switches are used as the inputs for the calculator
- All inputs are unsigned binary
  - DataA is the first input and will always start the equation
    - 4-bit: SW(0-3)
  - DataB is the second input and always operates on DataA
    - 4-bit: SW(4-7)
  - The operation of the calculator will also be selected by the switches
    - Addition: SW(12)
    - Subtraction: SW(13)
    - Multiplication: SW(14)
    - Division: SW(15)

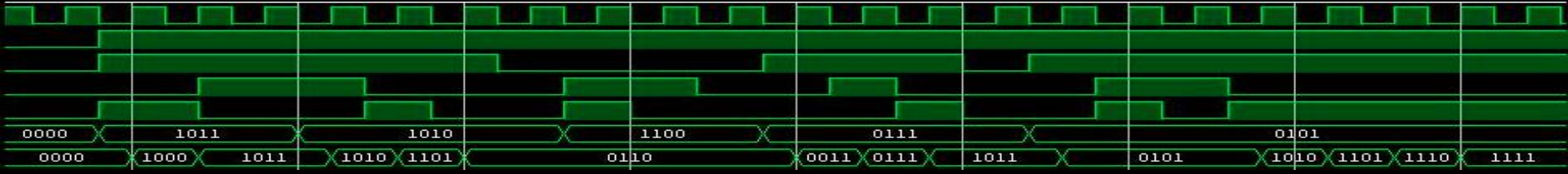




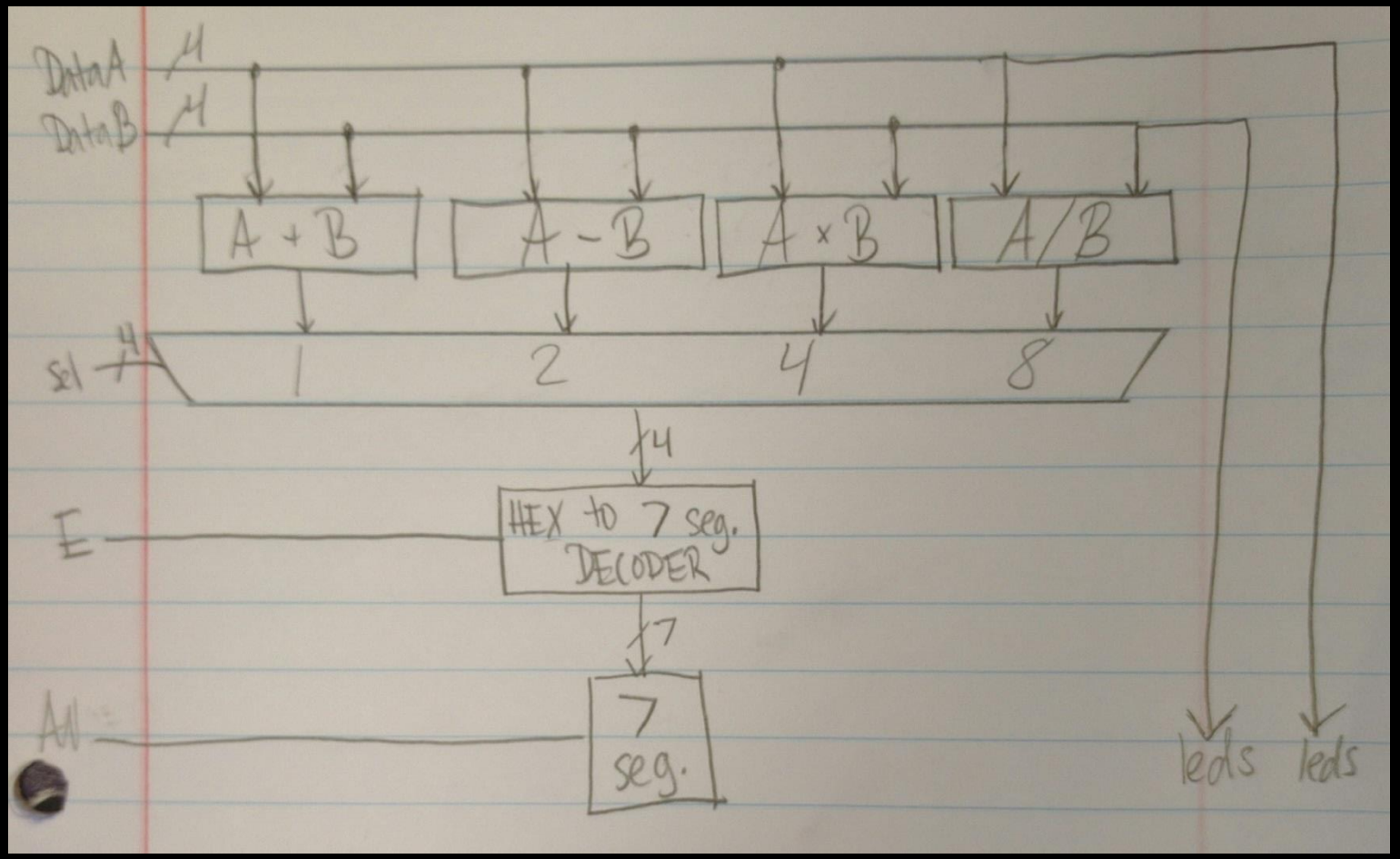

# Outputs

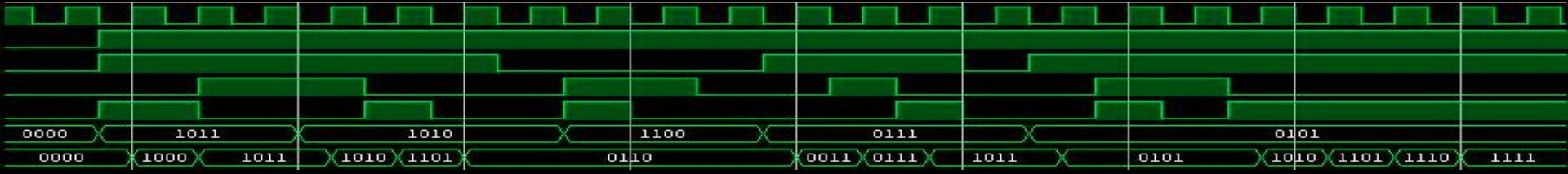
- The 7-segment display is used to display the answer of the selected equation.
  - The display on the right side will display the answer in hexadecimal form.
- The LEDs above the switches will light to show the binary of the input.





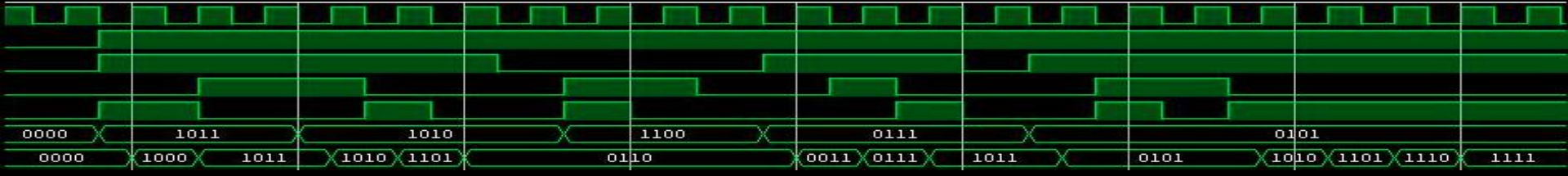

# Inputs and Outputs





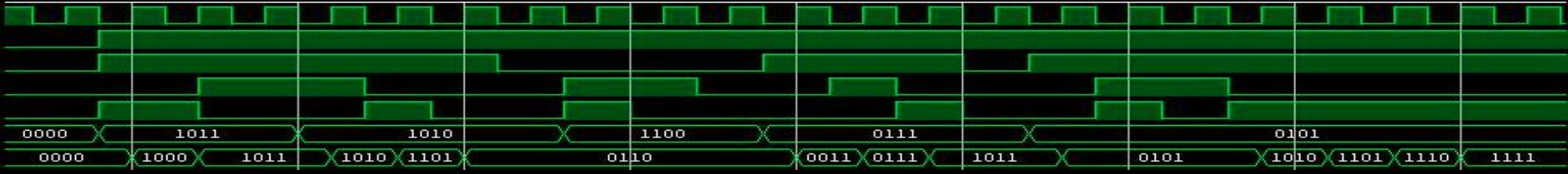

# Difficulties

- Extending the 7-segment display
- Original Top file idea
- Time




# Improvements

- Extend the number of bits in the input and output
- Use a keyboard or number pad as the input
- Use a VGA display to show the output
- Allow it to work with signed binary inputs
- Add more functions to the calculator:
  - Square Root
  - Exponentials




# References


- https://www.alteraforum.com/forum/showthread.php?t=47925
- http://www.secs.oakland.edu/~llamocca/VHDLforFPGAs.html