INPUTS: 2.2.2.1

InputA is the input of 16 bits representing an unsigned integer that is used to bring data bits to the Adder, Subtractor, Divider, Modulus and the multiplier.

InputB is the input of 16 bits representing an unsigned integer that is used to bring data bits to the Adder, Subtractor, Divider, Modulus and the multiplier.

OPCode is the input of 4 bits that represents a unique code to signify which calculation will be used as the result. All 4 bits feed into the decoder. Also, the least significant bit feeds into the Adder-Subtractor as the mode.

OUTPUTS: 2.2.2.2

Result is a 32 bit output representing the result of the chosen arithmetic calculation.

Error is a two bit output where the most significant bit represents the error from the Divider or the Modulus modules and the least significant bit represents the error from the Adder-Subtractor.

INTERFACES: 2.2.2.3

ADDtoMUX Interface is a 32 bit wire that connects from the Adder-Subtractor result to the MULTIPLEXOR channel 0.

SUBtoMUX Interface is a 32 bit wire that connects from the Adder-Subtractor result to the MULTIPLEXOR channel 1.

MULTtoMUX Interface is a 32 bit wire that connects from the Multiplier result to the MULTIPLEXOR channel 2.

DIVtoMUX Interface is a 32 bit wire that connects from the Divider result to the MULTIPLEXOR channel 3.

MODtoMUX Interface is a 32 bit wire that connects from the Modulus result to the MULTIPLEXOR channel 4.

DIV_ERR Interface is a 1 bit wire that connects the Divider error output to the OR GATE

Mod_ERR Interface is a 1 bit wire that connects the Modulus error output to the OR GATE

DEC_to_MUX is a 16 bit one hot wire that connects from the Decoder to the Multiplexor select.

Mode is a 1 bit register that holds the value of the first bit of OPCode and feeds into the Adder-Subtractor mode input.

COMBINATIONAL LOGIC COMPONENTS: 2.2.2.4

HalfAdder is a half-adder that is used when constructing the full adder.

FullAdder is a full-adder that is used when constructing the adder-subtractor.

AddSub16B is a 16 bit adder-subtractor that is used when constructing the AddSub32B and Multiplier modules.

AddSub32B is a adder-subtractor that will calculate the addition or subtraction of two 16 bit unsigned integers. The result is the result from the 16 bit addition or subtraction with the 16 most significant bits equal to 0. The error is equal to 1 if there is overflow or underflow, otherwise the error is equal to 0.

Mux16x32b is a 16 channel 32 bit multiplexor. It takes the results from the arithmetic components and selects one based on the result from the decoder. Channels 5 through 15 are all equal to 0.

Dec4x16 is a 4-bit to 16-bit-one-hot decoder that takes 4 bits from the input OPCode and converts it into a one-hot to send as the select to the multplexor.

Multiplier is a 16x16 bit structured multiplier constructed using 15 16-bit adder-subtractors. The result is sent to the multiplexor channel 3.

Divider is a 16x16 bit behavioral divider. If divide-by-zero occurs, the divider will return 0 as the result and 1 as the error.

Modulus is a 16x16 bit behavioral component to calculate modulus. If modulus-by-zero occurs, Modulus will return 0 as the result and 1 as the error.

Circuit Diagram: 2.2.2.5