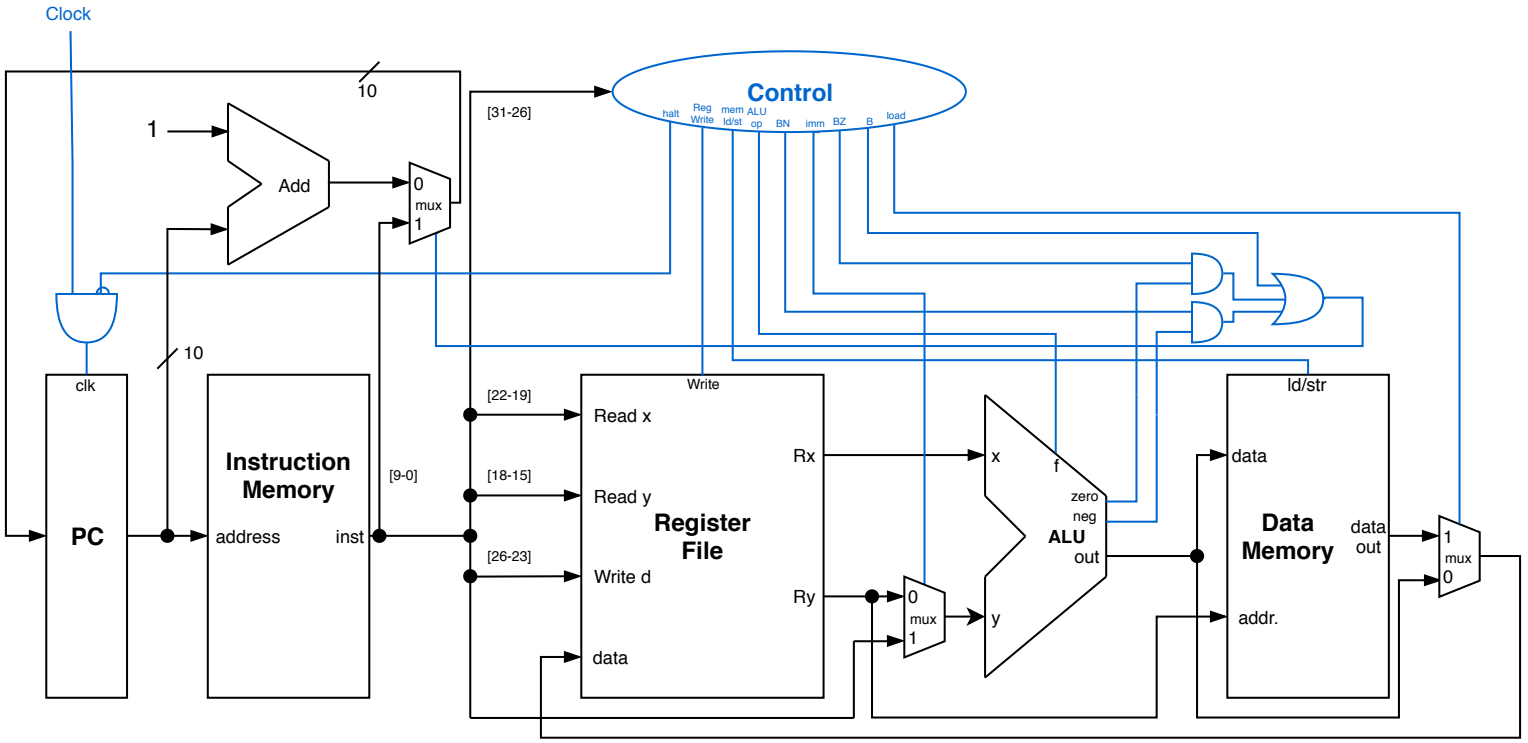
CPU Data and Control Path Diagram

The following is an approximation of the control and data paths for the floating point processing unit.



A multiplexer is used between Ry data output of the register file and the ALU in order to choose between the register Ry itself and the integer value of the `POW` instruction. For the `MOVE` and `STORE` instructions, an x input bypass function was added to the ALU to allow for a copy of Rx to move through to write-back. For the `LOAD` instruction, the output of data memory shares the path of ALU output, selected by a multiplexer.

The program counter by default incremements by one, unless the input is overriden by a branch command. The ALU flags for negative or zero, AND'ed through their corresponding control signals and passed to the PC multiplexer. The `B` instruction bypasses any AND and always sets this mux select to 1 unconditionally.

An AND gate at the PC clock with one of its inputs inverted allows the clock signal through, but closes the path on the halt signal from control. A 1KB instruction memory unit is given, therefore 10 bits are used to address instruction memory.

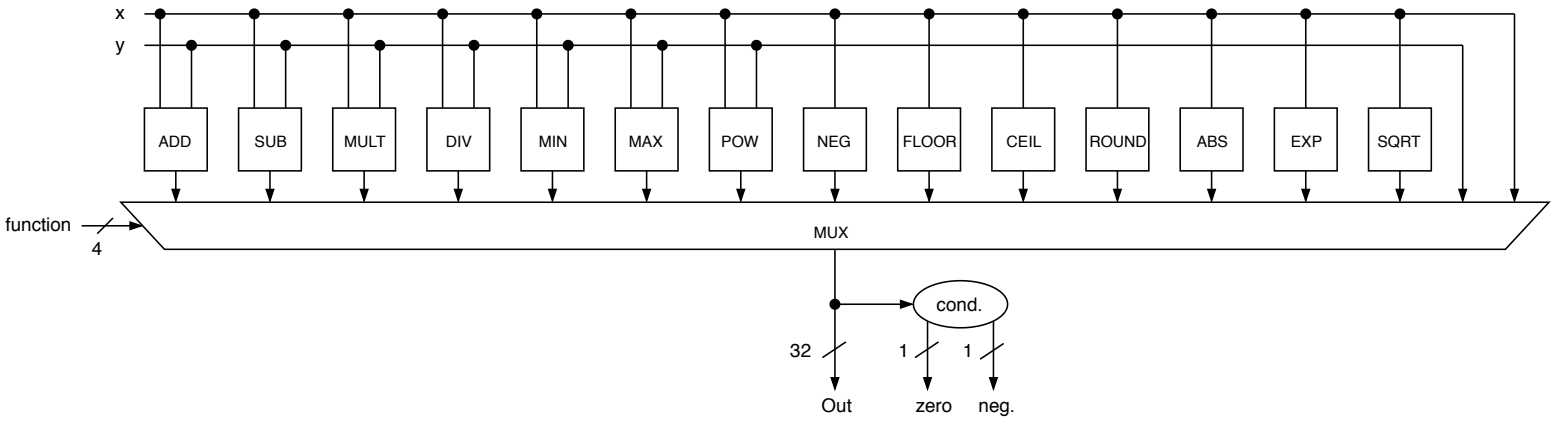
Table 1: Control Unit Codes

mnemonic	halt	Reg Write	Mem Store	ALU op	imm	BN	BZ	B	load	OP-CODE
Nop	0	0	0	0000	0	0	0	0	0	00000
Set	0	1	0	1111	1	0	0	0	0	00001
Load	0	1	0	0000	0	0	0	0	1	00010
Store	0	0	1	1110	0	0	0	0	0	00011
Move	0	1	0	1110	0	0	0	0	0	00100
Fadd	0	1	0	0000	0	0	0	0	0	00101
Fsub	0	1	0	0001	0	0	0	0	0	00110
Fmul	0	1	0	0010	0	0	0	0	0	00111
Fdiv	0	1	0	0011	0	0	0	0	0	01000
Min	0	1	0	0100	0	0	0	0	0	01001
Max	0	1	0	0101	0	0	0	0	0	01010
Fneg	0	1	0	0111	0	0	0	0	0	01011
Floor	0	1	0	1000	0	0	0	0	0	01100
Ceil	0	1	0	1001	0	0	0	0	0	01101
Round	0	1	0	1010	0	0	0	0	0	01110
Fabs	0	1	0	1011	0	0	0	0	0	01111
Exp	0	1	0	1100	0	0	0	0	0	10000
Sqrt	0	1	0	1101	0	0	0	0	0	10001
Pow	0	1	0	0110	1	0	0	0	0	10010
B	0	0	0	0000	0	0	0	1	0	10011
BZ	0	0	0	1110	0	0	1	0	0	10100
BN	0	0	0	1110	0	1	0	0	0	10101
Halt	1	0	0	0000	0	0	0	0	0	10110

Table 2: ALU opcodes

Fadd	0000
Fsub	0001
Fmul	0010
Fdiv	0011
Min	0100
Max	0101
Pow	0110
Fneg	0111
Floor	1000
Ceil	1001
Round	1010
Fabs	1011
Exp	1100
Sqrt	1101
pass x	1110
pass y	1111

ALU Diagram


x
y
ADD
SUB
MULT
DIV
MIN
MAX
POW
NEG
FLOOR
CEIL
ROUND
ABS
EXP
SQRT
function
4
MUX
cond.
32
1
1
Out
zero
neg.