EGC-442 HW #3 Dr. Izadi

First Name: _____ Last Name: _____

Problem 1 (25 Points)
Show the internal architecture of a 4-bit ALU with the following function table:

ALU Control Lines	Functions
	AND
	OR
	XOR
	NAND
	NOR
	ADD
	Subtract
	SLT

Your design should have the following flags:
Carry, Sign, Zero, Overflow

Problem 2 (15 Points)
Write a MIPS subroutine to carryout the following function.

```
temp = v[k];
v[k] = v[k + 1];
v[k + 1] = temp;
```

Assume base address of v is register $a1, k is in register $a2, and temp is assigned to $s1.

Problem 3 (15 Points)
Show the IEEE 754 binary representation of the number $+0.375_{ten}$ in single precision

Problem 2 (15 Points)
Show the IEEE 754 binary representation of the number -0.9375_{ten} in double precision:

Problem 3 (20 Points)
Convert the single precision binary floating-point representation to decimal.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	1	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1 bit 8 bit 23 bit

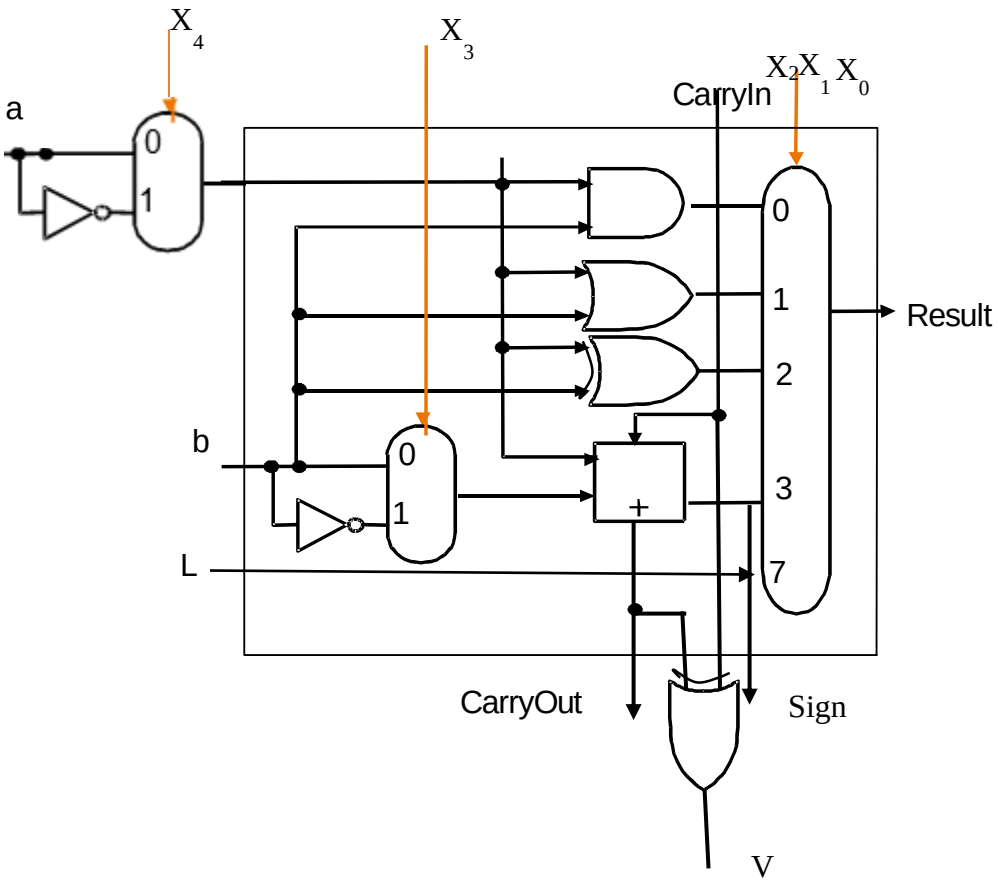
Figure 1: Floating point representation

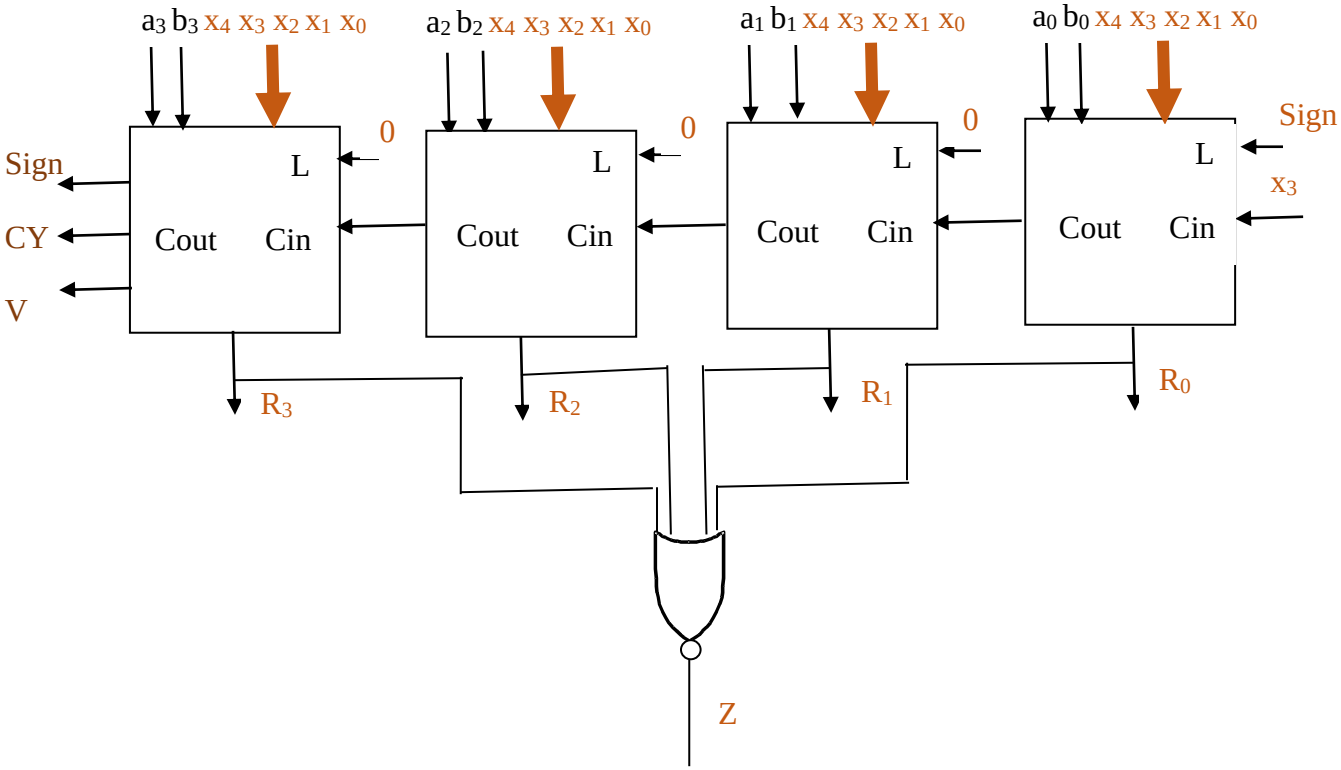
Due 3/3/2023

Problem 1 (25 Points)
Show the internal architecture of a 4-bit ALU with the following function table:
Your design should have the following flags:
Carry, Sign, Zero, Overflow

X_4 X_3 X_2 X_1 X_0	Functions
0 0 0 0 0	AND
0 0 0 0 1	OR
0 0 0 1 0	XOR
1 1 0 0 1	NAND
1 1 0 0 0	NOR
0 0 0 1 1	ADD
0 1 0 1 1	Subtract
0 1 1 1 1	SLT

MSB





Problem 2 (15 Points) Write a MIPS subroutine to carryout the following function. temp = v[k]; v[k] = v[k + 1]; v[k + 1] = temp; Assume base address of v is register $a1, k is in register $a2, and temp is assigned to $s1.

```
SWAP;   addi   sp, sp, -4
        sw     $s1, 0(sp)
        sll    $a2, $a2, 2
        add    $a1, $a1, $a2
        lw     $s1, 0($a1)
        lw     $t1, 4($a1)
        sw     $s1, 4($a1)
        sw     $t1, 0($a1)
        lw     $s1, 0(sp)
        addi   sp, sp, 4
        jr     $ra
```

Problem 3 (15 Points) Show the IEEE 754 binary representation of the number +0.375ten in single precision

$.375_{10} = .011_2 = 1.1 \times 2^{-2}$

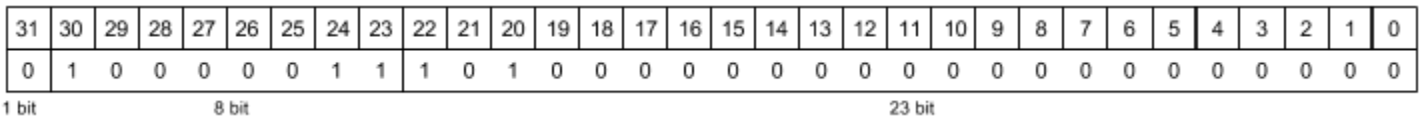
Exponent = 127 -2 = 125

10111110111000000000000000000000

Problem 2 (15 Points) Show the IEEE 754 binary representation of the number -0.9375ten in double precision
$- .9375_{10} = .1111 = 1.111 \times 2^{-1}$
Exponent = 1023 + 1 = 1024

1100000000011100000000000000000000000000000000

Problem 3 (20 Points) Convert the single precision binary floating-point representation to decimal.



+ 131 – 127 = 4
$1.101 \times 2^4 = 11010$
=26