CS2100
Exam 1

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1> Write the formula for computing a two's complement number representation. (3)

2^n Neg n+1

2> Describe the implementation of two's complement number representation. (3)

You take the binary number and flip the 1's to 0's and 0's to 1's. Once that's done add 1 to the new number.

The purpose of this is for use representing signed integers.

3> Write the (entire) list (in both binary and decimal) signed integers, using 2's complement numbers to represent negative numbers, given a four bit cell. (8)

Decimal	Binary
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111

4> Write the polynomial representation of 31047 octal: (5)

$3 \cdot 8^4 + 1 \cdot 8^3 + 0 \cdot 8^2 + 4 \cdot 8^1 + 7 \cdot 8^0$

5> In a 9 bit cell what is the range of values, binary and decimal, that can be stored in an unsigned representation. (5)

Decimal: 511 to 0

Binary: 1 1111 1111 to 0 0000 0000

6> In a 9 bit cell what is the range of values, binary and decimal, that can be stored in a signed representation, assuming 2's complement? (5)

Decimal: 255 to -256

Binary: 0 1111 1111 to 11 0000 0000

7> List and briefly define the three flow of control methods used in programming: (12)

1. Selection - will only run if a condition is met
2. repetition - will repeat as long as condition is met
3. Recursion - solving a problem by reducing it to smaller versions of itself

8> Perform the following operations, assuming seven bit two's complement representation and show the values of the status bits after the operation is complete. (4)

```
    011 0100   N = 1   Z = 0   V = 1   C = 0
ADD 010 0110
    101 1010
```

```
    100 1001   N = 1   Z = 0   V = 1   C = 0
ADD 000 1100
    101 0101
```

9> Convert from decimal to binary: (4)

3.09375

11.00011

11.

0.09375
-0.06250
0.03125
-0.03125
0

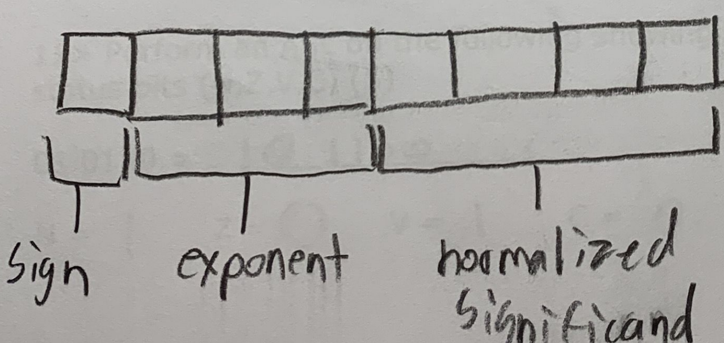
0.68

0.1010111000

0.68
-0.50
0.18
-0.125
0.055
-0.03125
0.02375

0.023750
-0.015625
0.008125
-0.0078125
0.0003125

10> (a-8;b-4;c-4)
a) Describe and diagram the internal form of an 8-bit floating point number which uses 1 bit for the sign and three for the exponent. Make sure you not only label, but also explain how the value is determined.



sign - determined by whether the number is negative or not

exponent - determined by what exponent the number uses

normalized significand - determined by the exponent minus 3 in binary

b) Represent the following value (base 10) in the format from a) using excess 3: -12.5

12 1100 100.1

-12 0011

+ 1

0100

0.5

-0.5

0

c) repeat b with this value (base 10): 0.03125

0,00001

0,03125

-0,3125

0

11> Perform an ASL on the following showing the bit setting for the status bits (N,Z,V,C) (5)

01 0110 = 10 1100

N = 1 Z = 0 V = 1 C = 0

12> Perform an ASR on the following showing the bit setting for the status bits (N,Z,V,C) (5)

11 0101 = 11 1010

N = 1 Z = 0 V = 0 C = 1

13> Perform an ROL on the following showing the bit setting the carry bit after the operation, given the carry bit setting before the operation. (5)

C = 1 ROL 01 1101 = 11 1011 C = 0

14> Perform an ROR on the following showing the bit setting the carry bit after the operation, given the carry bit setting before the operation. (5)

C = 1 ROR 01 1101 = 10 1110 C = 1

15> Perform the following logical operations, assuming a seven-bit cell: (9)

	010 1100
AND	110 1010
	010 1000

N = 0
Z = 0

	010 1100
OR	110 1010
	110 1110

N = 1
Z = 0

	010 1100
XOR	110 1010
	011 1001

N = 0
Z = 0

16> Show the representations of the following ***unsigned*** numbers in the indicated base. **(6)**

a) $1011\ 1101_2$ in base 10 189

b) $F7_{16}$ in base 2 1111 0111

c) 1433_{10} in base 16 599

d) $BA2_{16}$ in base 10 2978

e) 512_{10} in base 2 10 0000 0000

f) $1101\ 1110_2$ in base 16 DE

f. 222 / 16 = 13 R 14 (E); 13 / 16 = 0 R 13 (D) → DE

a. $1011\ 1101_2$

128 + 32 + 16 + 8 + 4 + 1 = 189

b. F7

1111 0111

c. 1433

1433 − 256 = 1177
1177 − 256 = 921
921 − 256 = 665
665 − 256 = 409
409 − 256 = 153
153 − 16 = 137
137 − 16 = 121
121 − 16 = 105

89 / 16 = 5 R 9; 5 / 16 = 0 R 5 → 599

d. BA2

(256 · 11) + (16 · 10) + (1 · 2)
= 2978

e. 512

512 − 512 = 0

f. 1101 1110

128 + 64 + 16 + 8 + 4 + 2 = 222