

Vivian Po
09/16

CSC 3210
Computer Organization and Programming
Assignment #1
Fall 2021

Due on 09/16/2021, 11:59 PM Eastern Time (US and Canada)

Objective: Learn some core concepts closely relating to assembly language.

Total 15 points

- (1 point)** Why is assembly language not usually used when writing large application programs?
assembly language has a minimal formal structure that has to be forced to be used by programmers on different levels of experience, and this makes keeping the code alive hard.
- (1 point)** Assume that you have three 8-bit storages (registers) named A, B, and C to store binary numbers. Register A contains 10100111 and register B contains 11110110. Compute A+B and store the value in C register. What is the content of register, C after the computation?

Show the computation in details with carries.

$$\begin{array}{r} (A) \quad 10100111 \\ + (B) \quad 11110110 \\ \hline 0110011101 \end{array}$$

C = 0110011101

- (2 points)** Assume that you have 4-bit storage to store the numbers. Calculate the following operations using **two's complement method**. (assuming 4-bit register is used)

$$-7 - 1 + 4 = \boxed{-4 = 1100}$$

[Hint: Perform the computation in binary system, then convert it back to decimal]

-7 → Binary
7 = 3 R1
3 = 1 R1
1 = 0 R1
7 = 0111 → 1000 + 1 = 1001
1 = 1111

Binary
+4 = 0100
-7 = 1001
1 = 1111

-7 = 1001
-1 = 1111
+ 1111
011000

(-7-1) 1000 1100
+ 4 + 0100 1100
1100

-8 + 4 = 0 + 0 = -4

- (1 point)** What is the binary representation of the following hexadecimal numbers? Show the conversion in details.

4AE7F98A0 → 4 10 14 7 15 9 8 10 0

4 = 0100	7 = 0111	8 = 1000	Putting it together								
10 = 1010	15 = 1111	10 = 1010	(4)	(10)	(14)	(7)	(15)	(9)	(8)	(10)	(0)
14 = 1110	9 = 1001	0 = 0000	0100 1010 1110 0111 1111 1001 1000 1010 0000								

- (2 points)** What is the 16-bit hexadecimal representation of the following signed decimal integer? Show all the steps of conversion in details.

Binary

0/2 = 30	R	-61
30/2 = 15	1	16 Bit Binary
15/2 = 7	0	000000000011101
7/2 = 3	1	Flip 2 + 1
3/2 = 1	1	11111111000010
1/2 = 0	1	+
	1	111111111000011

(16) (16) (12) (3)
-61 = 1111 1111 1100 0011
↓ ↓ ↓ ↓
F F C 3

-61 = FFC3

Both are Negative!

8 bits = $2^7 + 2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0$
 multiply by 1 or 0 depending on binary

6. (2 points) What is the decimal representation of each of the following signed binary numbers?

a. (1 point) 11110101

= -11

11110101
 $128 \ 64 \ 32 \ 16 \ 8 \ 4 \ 2 \ 1$
 $-128 + 64 + 32 + 16 + 0 + 4 + 0 + 1 = -11$

b. (1 point) 10110101

= -75

10110101
 $128 \ 64 \ 32 \ 16 \ 8 \ 4 \ 2 \ 1$
 $-128 + 0 + 32 + 16 + 0 + 4 + 0 + 1 = -75$

7. (2 point) Evaluate the following Hexadecimal expression. All the numbers are hexadecimal.

Show all the steps of computation and the carries.

AED + CEF - F51

$AED + CEF \rightarrow 17DC$
 $17DC - F51 = 88B$

(AED + CEF) - F51

$17DC - F51$
 $0 \ 7 \ 13 \ 12$
 $-0 \ 15 \ 5 \ 1$
 $0 \ 8 \ 8 \ 11$

$88(11) = 88B$

8. (1 point) Is it possible to store -19 in a 4-bit storage. If your answer is YES, then show how to store -19 in 4-bit register. If your Answer is No, Explain why.

No, it is not possible to store -19 in a 4-bit storage. for -19, you need at least 6 bits to be stored. Out of the four bits, one of the bits is used as a sign, the other three are represented as $2^3 = 8$ numbers.

9. (1 point) What is the smallest decimal value you can represent, using a 125-bit signed integer?

You can write the number in exponent form.

smallest decimal number in 125-bit signed integer = -2^{124}

consider $(-2^{n-1} \text{ to } -2^{n-1}-1)$ as the range

10. (2 points) What is the Boolean expression for P? $n = 125$, so $-2^{(125-1)} = -2^{124}$

x	y	z	P
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Design a circuit that can produce output P for inputs x, y, and z as expressed in the table above.

$P = (x \wedge z) \vee (\neg x \wedge y \wedge \neg z) \rightarrow (x \text{ and } z) \text{ or } (\text{not } x \text{ and } y \text{ and not } z)$

