**CSC 3210**

**Computer Organization and Programming**

**Assignment #1**

**Spring 2021**

**Due on 02/01/2021, 11:59 PM Eastern Time (US and Canada)**

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

**Total 15 points**

1. **(1 point)** Why is assembly language not usually used when writing large application programs?

Assembly language is not as portable as high-level languages. Moreover, they are to be written with more detail and precision and are often prone to human error. It takes many lines of assembly language to write large applications. It is also very difficult to maintain code.

1. **(1 point)** Assume that you have three 8-bit storages (registers) named A, B, and C to store binary numbers. Register A contains 11101011 and register B contains 10110110. Compute A+B and store the value in C register. What is the content of C register the computation? **Show the computation in details with carries.**

Register A value: 11101011 = (00010100+1) = 00010101= -21

Register B value: 10110110 = (01001001+1) = 01001010 = -74 (the 1 from the first place carries over to add to the 0 in the 2^1 place)

Register C value: 00010101+01001010 = 01011111

Since I know it is negative, I need to get it’s 2’s complement form:

01011111 = 10100000 + 1 = 10100001

1. **(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)

-5 – 2 + 4

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

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

457898A0

Hex to binary: Each can be represented as 4 binary bits. 0001 = 1, 0010 = 2, 0011 = 3, 0100 = 4, 0101 = 5, 0110 = 6, 0111 = 7, 1000 = 8, 1001 = 9, 1010 = A.

457898A0h = 010001010111100010011000101000002

1. **(2 points)** What is the *16-bit* hexadecimal representation of the following *signed* *decimal* integer? Show all the steps of conversion in details.

-39

First, I will need to convert this number’s absolute value to hexadecimal.

39 in hex: 39/16 = 2 R 7

2/16 = 0 R 2

Hex value = 0027

Hex subtraction: 0027-FFFF = FFD8

Final value = FFD8 + 1 = FFD9

1. **(2 points)** What is the decimal representation of each of the following *signed binary* numbers? a. **(1 point)** 10010101: I know this is a negative number, so, I should take the 2’s complement first. 10010101 = (01101010 + 1) = 01101011 = 1\*2^6 + 1\*2^5 + 1\*2^3 + 1\*2^1 + 1\*2^0 = 105. But since it is negative, I must apply the negative sign to this, this is -105.

b. **(1 point)** 01110111: This is a positive integer, so I can conventionally convert it. 2^6 + 2^5 + 2^4 +2^2 + 2^1 + 1 = 119.

1. **(2 point)** Evaluate the following Hexadecimal expression. **All the numbers are hexadecimal**.

Show all the steps of computation and the carries.

**** ABC + DEF - F51













1. **(1 point)** Is it possible to store **-11** in a 4-bit storage. If your answer is YES, then show how to store -**11** in 4-bit register. If your Answer is No, Explain why.

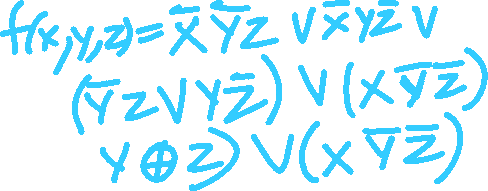
No, it is not possible to store -11 in a 4-bit storage, as it is smaller than the minimum value possible for 4-bit signed integers. In a 2-bit storage, you can store a max of 2^3 - 1 and a minimum of -2^3 (values ranging from -8 to 7). This does not include -11, so it is not possible.

1. **(1 point)** What is the smallest decimal value you can represent, using a **183-bit signed integer?** You can write the number in exponent form.

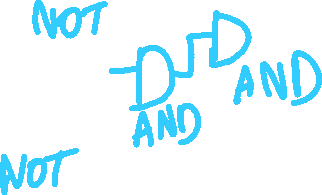
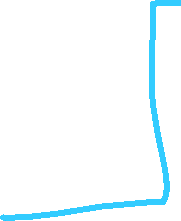
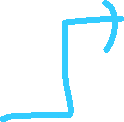
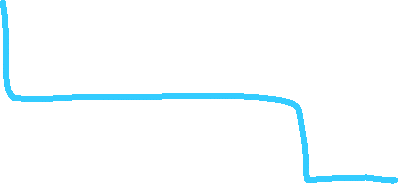
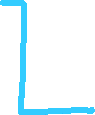
-2^182

1. **(2 points)** What is the Boolean expression for P?

|  |  |  |  |
| --- | --- | --- | --- |
| **x** | **y** | **z** | **P** |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 |



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



**Note:**

* + **Make sure to justify all answers – show all work.**
  + The Assignment **must be submitted electronically** through ICollege.
  + You can do your work in a text editor (Microsoft word, open office, etc.)
  + Or you can do it in a piece of paper, then scan or take a picture of the paper.
  + Upload the answers in a **pdf file** to iCollege in the respective assignment dropbox.
  + All work must be neat and legible. Illegible work will receive no credit. This includes work where the print contrast or darkness are too faint.
  + The work that you turn in must be your own --- copying is not allowed for any assignments.
  + Using another student's work as your own, allowing another student to use your work as their own, is academic misconduct.