**CSC 3210**

**Computer Organization and Programming**

**Assignment #1**

**Spring 2024**

**Due on 1/30/2024, 11:59 PM Eastern Time (US and Canada)**

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

**Name:** Hemant Kosaraju

**Total 15 points**

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

**Assembly language is not used when writing large application programs because assembly language is a low level whilst large application programs are written usually with high level languages like Python, Java, C, C++, and similar. These high level program languages when compiled go through becoming compiled into assembly language which passes an Assembler and Linker and finally is processed as Binary values by the computer. Also, because high level languages (e.g., Java, Python C, C++, et cetera) are application oriented and though their compiler they translate into assembly code and finally to Machine Language.**

1. **(1 point)** Assume that you have three 8-bit storages (memory) named A, B, and C to store binary numbers. Memory A contains 11110100 and memory B contains 10110111. 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.**



|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 244 |
| + B | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 183 |
| = C | 11 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 427 |

1. **(2 points)** Assume that you have 4-bit storage to store the numbers. Calculate the following operations using **two's complement method**. Show all the computations in details. (assuming 4-bit register is used)

-3 -1 -1

A close-up of a white board with black writing

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

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

1000101001010101111000011001101111

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 10 = 2 in hexadecimal and 2 in decimal | 0010 = 2 in hexadecimal and 2 in decimal | 1001 = 9 in hexadecimal and 9 in decimal | 0101 = 5 in hexadecimal and 5 in decimal | 0111 = 7 in hexadecimal and 7 in decimal | 1000 = 8 in hexadecimal and 8 in decimal | 0110 = 6 in hexadecimal and 6 in decimal | 0110 = 6 in hexadecimal and 6 in decimal | 1111 =  F in hexadecimal and 15 in decimal | The hexadecimal representation of the following binary numbers is 22957866F |

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

-58

A close-up of a math problem

Description automatically generated

1. **(2 points)** What is the decimal representation of each of the following *signed binary* numbers? Show the computation.
   1. **(1 point)** 01110111  **= (1 \* 20) + (1 \* 21) + (1 \* 22) + (0 \* 23) + (1 \* 24) + (1 \* 25) + (1 \* 26) + (0 \* 27) = 119**
   2. **(1 point)** 11110001  **= (1 \* 20) + (0 \* 21) + (0 \* 22) + (0 \* 23) + (1 \* 24) + (1 \* 25) + (1 \* 26) + (1 \* 27) = 241**
2. **(2 point)** Evaluate the following Hexadecimal expression. **All the numbers are hexadecimal**. Show all the steps of computation and the carries.

A1C + CCF – FFE

A close-up of a math problem

Description automatically generated

1. **(1 point)** Is it possible to store **-10** in a 4-bit storage. If your answer is YES, then show how to store -**10** in 4-bit register. If your Answer is No, Explain why.

**No, you can not store the signed integer of -10 within a 4-bit storage and the reason being because the minimum value that can be stored in a 4-bit storage register is represented as -2n-1 = -24-1 = -23 = -8 and the maximum value that can be stored in a 4-bit storage register is represented as 2n-1 – 1 = 23 – 1 = 7. Therefore -10 can not be stored in a 4-bit storage register.**

1. **(1 point)** What is the smallest decimal value you can represent, using a **120-bit signed integer?** You can write the number in exponent form.

**For minimum decimal value which can be represented for n-bit signed integer the equation would be**

**-2n – 1 where n is the number of bits for the signed integer and the maximum decimal value is represented by 2n-1 – 1**

**The smallest decimal value you can represent using a 120-bit signed integer is -2120 – 1 = -2119**

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

**The Boolean expression for P is, P = (¬X ⋀ ¬Y ⋀ ¬Z) ⋁ (¬X ⋀ Y ⋀ Z) ⋁ (X ⋀ Y ⋀ ¬Z)**

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

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

X

Y

Z

X

Y

Z

X

Y

Z

P

Hint:

1. When X=0, Y=0, and Z=0, P=1.
2. When X=0, Y=1, and Z=1, P=1.
3. When X=1, Y=1, and Z=0, P=1.

Write these conditions as logical expressions, and combine them using OR

**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.

**Late submission:**

A late penalty will be applied to any submission after the due date.

* If you submit the assignment within 2 day of due date, the late penalty is 10% of the grade.
* For any assignment submitted after 2 day, the late penalty is 35%.

**How to calculate the late penalty?**

Let’s assume that the assignment has total point of 15. And you submitted the assignment within 2 days after the due date. After grading you received 13 out of 15 in the assignment. The late penalty will be 15% of 15 = 2.25 points. After late penalty deduction your grade is 10.75 out of 15.