**Practice Problems – Subtraction using 2’s Complement**

**Important Note:**

* Do all the subtractions using 2’s complement subtraction method
* Verify your answers by converting original numbers (given in questions) into decimal and performing the required operation.
* Type of number representation is mentioned in each question

**Question 1:** [Unsigned Numbers] 01100100 – 10010110

**Question 2:** [Unsigned Numbers] X = 1010100 and Y = 1000011. Find X-Y and Y-X.

**Question 3:** [Signed Numbers] Perform following operations in binary numbers:

1. + 6 +13
2. -6 +13
3. +6 – 13
4. -6 – 13
5. – 6 – (-13)
6. +6 – (-13)

**Question 4:** Fill the table given below and answer the following questions.

Help: For column 6, Magnitude X = 2’s Complement of (-X) and Sign can be either (+) or (-)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **(Column 1)**  **Decimal Number** | **(2)**  **Signed Magnitude Representation of Column 1** | **(3)**  **1 Byte Equivalent of previous column** | **(4)**  **Signed 2’s Complement Representation of Column 1** | **(5)**  **1 Byte Equivalent of previous column** | **(6)**  **(Sign)(Magnitude) Representation of Previous Column** |
| **+29** |  |  |  |  |  |
| **-29** |  |  |  |  |  |
| **+36** |  |  |  |  |  |
| **-36** |  |  |  |  |  |

1. What are the differences and similarities in values of Column 2 and column 4?
2. What changes you made to make 1 byte in column 3 and 5?
3. Convert values of Column 3 back to decimal. Are they still representing the same decimal number?
4. Convert values of Column 6 back to decimal. Are they still representing the same decimal number?

**Question 5:** Fill the table given below. Perform simple subtraction (borrow method) to fill rows 4-6. Use short algorithms of 1’s and 2’s complements to fill row 7 and 8. Answer the following questions.

Help: ‘n’ is the total number of bits in N.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **1** | **N** | **101** | **11010** | **1010110** | **11** |
| **2** | **n** |  |  |  |  |
| **3** | **2n** |  |  |  |  |
| **4** | **2n – N** |  |  |  |  |
| **5** | **2n-1** |  |  |  |  |
| **6** | **(2n-1) - N** |  |  |  |  |
| **7** | **1’s Complement of N** |  |  |  |  |
| **8** | **2’s Complement of N** |  |  |  |  |

1. Are the values in row 4 and 8 equal?
2. Are the values in row 6 and 7 equal?

**Question 6:** Given 9 bits to save a binary number, what range of numbers will be supported for:

1. Unsigned Binary Numbers: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Signed Magnitude Representation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Signed 2’s Complement Representation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Note:** write exact numbers e.g. -7 to +7 or 0 to 7.

**Question 7:** For the signed numbers given below, perform the required operations. Follow the Signed 2’s complement representation for all the numbers. Perform subtraction using 2’ Complement method.

1. (+53) + (+15)
2. (-53) – (+15)
3. (+53) – (-15)
4. (-53) – (-15)

Exercises 4-3, 4-4, 4-5, 4-6 and 4-7 from Chapter 4 (Moris Mano 4th Edition) (We have not covered the overflow concept).