Lecture 09: Integer Representations

Assume that the size of an integer in a machine is 1 byte (8 bits). And it uses a 2’s complement representation. Answer the following questions with respect to this machine.

1. What is the maximum value of an unsigned integer (in decimal)?

255 (2^8-1)

1. What is the maximum value of a signed integer (in decimal)?

127 (2^7-1)

1. What is the minimum value of a signed integer (in decimal)?

-128 (-2^7)

1. If 8 (eight) bits are used to represent an address on this machine, how many unique addresses are there?

256 (2^8)

1. What is the value of the bit pattern 1010 1010 when it is interpreted as:

a. a hexadecimal integer:

0xAA

b. an unsigned decimal integer:

170

c. a signed decimal integer:

-86

1. Suppose the machine used a 1’s complement representation of integers. What would the value of the bit pattern 1010 1010 when it is interpreted as:
   1. a hexadecimal number:

0xAA

* 1. an unsigned decimal integer:

170

* 1. a signed decimal integer:

-85

1. What is the value of the 0xF2 when it is interpreted as:
   1. a 2’s complement binary representation:
   2. a 1’s complement binary representation:
   3. a signed magnitude binary representation:
   4. an unsigned decimal integer:

242

* 1. a signed decimal integer:

-14

8. Suppose that integers are **signed** and they take up only 1 byte. What is the **binary** representation of the following integers? You may assume that the machine uses two’s complement representation to represent negative numbers.

|  |  |
| --- | --- |
| **Integer** | **Binary** |
| -1 | 11111111 |
| 42 | 00101010 |
| 27 | 00011011 |
| -14 | 11110010 |
| 0 | 00000000 |