For simplicity, consider a 4-bit binary odometer. This *nibble*-sized counter is capable of representing 16 different integers.

For the *unsigned* range of numbers, the binary representation of the decimal values from 0 to 15 are obvious.

For a *signed* representation, although the range may be less clear at first, it is surprisingly straightforward!

1. Imagine for the sake of illustration that our familiar number *line* is in fact a 1D projection of a *circle* of infinite radius. Two observations are useful in this context.

a) Travelling in one direction from 0 would eventually bring you back to your starting position, with the number of positive number and negative numbers being equal, and,

b) The farthest positive distance and the farthest negative distance are adjacent to one another (think, *slope*).

2. **After** our class discussion, complete the table below, employing the **2’s Complement Algorithm** for signed binary representation of integers.

|  |  |  |
| --- | --- | --- |
| **Representation** | **Unsigned**  | **Signed** |
| Decimal | Binary |  |
| 15 | 1111 |  |
| 14 |  |  |
| 13 |  |  |
| 12 |  |  |
| 11 |  |  |
| 10 |  |  |
| 9 |  |  |
| 8 |  |  |
| 7 |  |  |
| 6 |  |  |
| 5 |  |  |
| 4 |  |  |
| 3 |  |  |
| 2 | 0010 |  |
| 1 | 0001 |  |
| 0 | **0000** |  |
| -1 |  |  |
| -2 |  |  |
| -3 |  |  |
| -4 |  |  |
| -5 |  |  |
| -6 |  |  |
| -7 |  |  |
| -8 |  |  |