

## Extra Credit 1 - Two's Complement

Recall the method of converting a two's complement number to its opposite (i.e. to convert a positive number to its negative complement, and vice versa).

- Start from the right side (i.e. the **lowest order bit**).
- Read the bit and copy it to the new number in the same position, then move to the bit to its left.
- Continue in this fashion until you copy the first 1 (this could happen on the first bit).
- Copy that first 1, but from then on flip the bits when you copy them (replace a 1 with a 0, and replace a 0 with a 1).

Take a four bit number system as an example:

0111		7
0110		6
0101		5
0100		4
0011		3
0010		2
0001		1
0000		0
1111		-1
1110		-2
1101		-3
1100		-4
1011		-5
1010		-6
1001		-7
1000		-8

Now convert 6 to negative 6:

- Start with 0110 and copy the first bit: 0
- Move to the next bit and copy it: 10
- We have copied our first 1, so from now on we flip the bits.
- Move to the third bit and flip it: 010.
- Now flip the final bit: 1010 which is -6.

---

## Your Task

- Write a function called `complement(bits)` which takes a string of ones and zeroes called 'bits', converts it from a positive two's complement number to a negative (or vice versa), and returns the complementary value.
- Save your function in a file named `excred_1.py`
- You may submit this at any time during the quarter
- This extra credit assignment is worth a 1% bonus on your final grade (to compare, your quizzes vary from 1% to 2% of your final grade, so this assignment can help wipe out a bad quiz grade).

```
In [1]: #Example
        from excred_1 import complement
        complement('0110')
```

```
Out[1]: '1010'
```

```
In [2]: complement('1010')
```

```
Out[2]: '0110'
```

```
In [4]: complement('111100001100')
```

```
Out[4]: '000011110100'
```