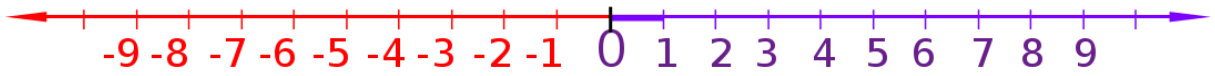
Test Cases for Bigint Addition

Folder setup:

You already have bitgint folder.
Inside bigint folder , look at **test_add.cpp** and **test_multiply.cpp**
test_add.cpp → contains test cases template for testing bigint add operation
and
test_multiply.cpp → contains test cases template for testing bigint multiply operation
They are not comprehensive. Need to write more test cases.

Boundary Value Analysis

Numbers can be negative, zero or positive



(image source : obviously wikipedia)

Negative Out of scope	**0**	**Positive**

NEgative Bigint's are not considered for project 1. Hence, forget them for now. Let's focus on only 0 and positive numbers. And let's assume the **char array** to store bigint digits is of length 5(Actually it's of length 200. Because your **const int CAPACITY = 200;.** I don't want to write too long bigints. But you are going to write some really bigints!!!!)

Q. What bigints can we store in a 5 length char array?
Ans.

0	**Positive** (assume 5 length char array for bigint)
	1 ---------- 99999
	1---9, 10-----99, 100----999, 1000 ----9999, 10000--- 99999

So we have **5** boundaries here
We divided them in 5 equivalence classes
Add 0 with them → 6 classes

Class	Range
1	0
2	1--9
3	10---99
4	100---999
5	1000-9999
6	10000--99999

Add operation

LHS + RHS = RESULT

Q. How many test cases will be comprehensive

Ans.

6 x 6 ---> 36 test cases

For i =1 to 6:

Take a number **x** from **class i**

Use x as **LHS** of add operation

For j = i to 6

Take a number **y** from **class j**

Use **y** as **RHS** of add operation

Write test case using template given by professor in **test_add.cpp**

```
{
    //-----------------------------------------------------
    // Setup fixture
    bigint left(x);
    bigint right(y);
    bigint result;

    // Test
    result = left + right;  //calculate z = x+y in paper . You will need it

    // Verify
    assert(left   == x);
```

```
        assert(right  == y);
        assert(result == z);
    }
```

Wait Wait Wait !!!!!

Number of digits in Result = Max(Number of digits in LHS, Number of digits in RHS) or Max(Number of digits in LHS, Number of digits in RHS) + 1

Example :
5+4=9 -- result contains only 1 digit
9+9 = 18 -- result contains 2 digit . **This has carry over!!!**
91 + 3 = 94
91 + 9 = 100

So for each of the 36 classes, result can be of 2 types
So in total
6 x 6 x 2 = 72

So, 72 test cases seems pretty good .
But we don't want to spend so much time. Let's observe more

Example 1 : 22 + 39 = 61
Example 2 : 222 + 339 = 561

Q. What's the similarity?
Ans.
If your code is ok for 2 digits it should be also good for 3/4/5 digits.

So, if test works only for bigint's with 3 digits and 4 digits. Combine them and if you get correct results. We are confident that, out code will work for bigints with 195 and 125 digits. Right !!!!

Doing tests for 192 and 125 digits also gives confidence for testing with 94 and 25 digits bigint.

Some other important points

1. I have discussed for only 5 digit bigint. But your **const int CAPACITY = 200;**
2. Make variation on LHS and RHS digits and repeat them.

    a. Example:
        i. 3 digits on LHS, 4 digits on RHS
        ii. 4 digits on LHS, 3 digits on RHS
3. Make sure you are testing for carry!!
4. For really large bigints use char array constructor
    a. Example : bigint (“99999999999999……...9999”). Assume you have hundred and twenty five 9 in a bigint You can’t use **int constructor**. You have to use **char array constructor**
5.

Test Cases for Multiplication

Same as addition. Only change the operation from **Add(+) to Multiply(*)**

Pro Tips !!!!

1. Always study existing codes.
2. Look at **test_multiply.cpp**
3. **Almost everything discussed upto now is provided as example in the file.**