**It's used to multiply two N-digit large integer numbers, x & y in an efficient way**

Solution:

***refer to its video in*** [D&C Lecture](https://www.dropbox.com/sh/ghnwctvxuz2ya4l/AADZ5HMUEM2_qdkbSiezRSnCa?dl=0)

**D&C Steps:**

1. **Divide:**
   1. split x into two halves: a & b
   2. split y into c & d.
   3. Calculate a+c and b+d
2. **Conquer:** Recursively calculate 3 multiplications: ac, bd and (a+c)(b+d).
3. **Combine:**
   1. subtract the first two multiplications from the third one.
   2. pad the second multiplication (bd) with N zeros and the subtraction result with N/2 zeros.
   3. add them together with the first multiplication (ac).

**Explanation:**

|  |  |  |
| --- | --- | --- |
|  | N/2 | N/2 |
| **x =** | **b** | **a** |
|  | N/2 | N/2 |
| **y =** | **d** | **c** |

We can write x and y as follows:

Multiplying x by y will give the following:

Now, we have four multiplications, each of size N/2…

However, the two multiplications can be reduced to one using the **Gauss trick**, as follows:

We can rewrite the multiplication of x and y using three multiplications only instead of four: