Algorithm Analysis

CSI 5301

# Description: Big Multiplication

# Data Structure: vector<string>

# Algorithm:

1) Store number1 as a vector with single digits as its string elements

2) Store number2 as a vector with single digits as its string elements

3) Apply divide-and-conquer algorithm for integer multiplication from figure 2.1 of textbook. Below is the Algorithm copied from the textbook.

function multiply(x, y)

Input: Positive integers x and y, in binary

Output: Their product

n = max(size of x, size of y)

if n = 1: return xy

xL , xR = leftmost dn/2e, rightmost bn/2c bits of x

yL , yR = leftmost dn/2e, rightmost bn/2c bits of y

P1 = multiply(xL , yL )

P2 = multiply(xR , yR )

P3 = multiply(xL + xR , yL + yR )

return P1 × 2n + (P3 − P1 − P2 ) × 2n/2 + P2

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| --- | --- |
| Input N | Integers as string |
| Basic Operation | Basic arithmetic operations  Vector manipulation |
| Summation or Recurrence Relation |  |

# Worst Case Analysis:

O(n) = nlog3(n); That is expressed as O(nlog(n))

Array with elements n is split recursively until each array is a single element array. Each split is n/3 so there are log3(n) steps and during each of those steps and split single element arrays are merged to a sorted array of size n, hence O(n) becomes n times log3n.