E2 Histogram

90-100	15
80-89	28
70-79	33
60-69	36
50-59	29
40-49	10
30-39	7

↑ OK

↓ Need to Improve

A : ≥ 85

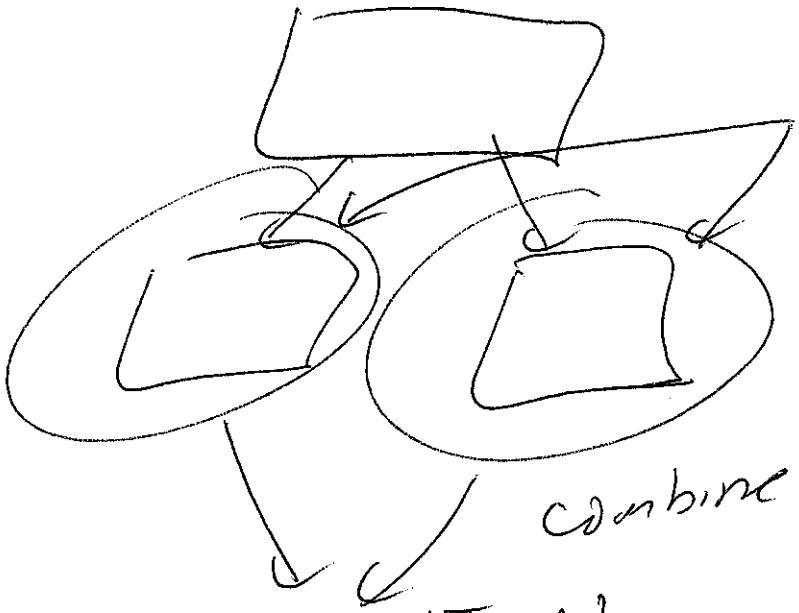
B : ≥ 70

C : ≥ 55

Divide + Conquer

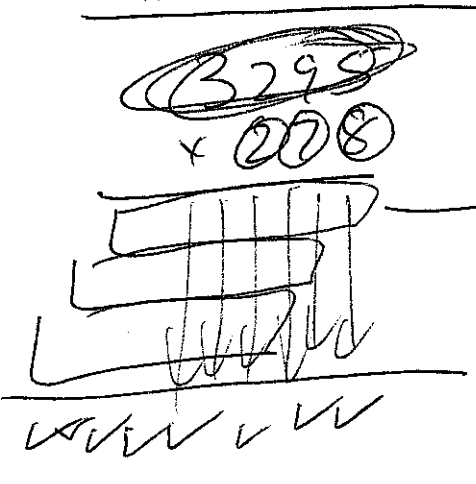
LCS, ~~Chorse~~, ~~Subset~~ Sum

Int Mult, Tromino, Skyline



1 + nn(L) + nn(R)

Int Mult



n-digits
m-digits

O(n)
→ O(n)

O(nm)

O(m) rows

adding O((n+m)m)

Poly Mult

$(3x^3 + 2x^2 + 9x + 5)(2x^2 + 7x + 8)$

Int mult special case of poly mult $x = 10$.

$$A = A_H \times 10^k + A_L$$
$$B = B_H \times 10^k + B_L$$

$$A \times B = (A_H \times 10^k + A_L)(B_H \times 10^k + B_L)$$
$$= A_H B_H \times 10^{2k} + (A_L B_H + A_H B_L) \times 10^k + A_L B_L$$

$$T(n) = 4T\left(\frac{n}{2}\right) + O(n)$$

4 ← # rec calls

$O(n)$ → for addition (3 adds)

Master Thm

$$T(n) = AT\left(\frac{n}{B}\right) + O(n^k)$$

if $B^k < A$: $O(n^{\log_B A})$ ✓

if $B^k > A$: $O(n^k)$

if $B^k = A$: $O(n^k \lg n)$

$A = 4$, $k = 1$

$B = 2$

$B^k = 2$

$n^{\log_2 4}$

$= n^2$

Can I reduce # of calls to 3?

3/27/18 (9)

$$A \times B = A_H B_H \times 10^{2k} + (A_L B_H + A_H B_L) 10^{k} + A_L B_L$$

Prod #1 : $(A_H + A_L)(B_H + B_L)$

$= A_H B_H + A_L B_H + B_L A_H + A_L B_L$

Prod #2: $A_H B_H$ $\quad T(n) = 3T(\frac{n}{2}) + O(n)$

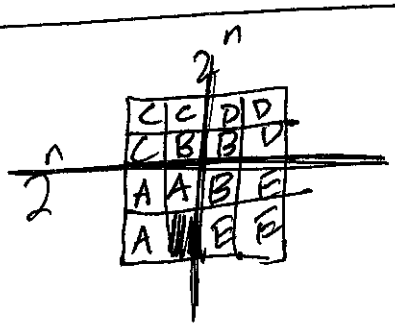
Prod #3 $A_L B_L$

Mid Term = Prod #1 − Prod #2 − Prod #3

new runtime = $O(n^{\log_2 3})$

$\log_2 3 \approx 1.57$

Tromino Tiling



(1) Subdivide ~~the~~ input into 4 quadrants of size $2^{n-1} \times 2^{n-1}$.

(2) One of the four has a hole, recursively tile this square

(3) In the other 3 quadrants, in the middle, place a tile

(4) Recursively tile other 3 quadrants (they now have a "hole")

Longest Common Subsequence

String 1 : A C G C T A C T G A T

subseq: a subset of items in a sequence in the order they appear.

String 2 : G T T A C A G C A T C A T T

A common subsequence is a subsequence that appears in 2 sequences (strings).

Goal: What is the length of the LONGEST common subsequence?

lcs(ACGCTACTGA(T), GTTACAGCATCAT(T)) =

1 + lcs(ACGCTACTGA, GTTACAGCATCAT)

} if match

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lcs(ACGTCAT, CAGGTCA)

= MAX(lcs(ACGTCAT, CAGGTC), lcs(ACGTCA, CAGGTCA))

↳ When letters don't match!