

SNS College of Engineering Coimbatore - 641107



Multiplication of large integers and strassen matrix



Multiplication of large integers



- Over 100 Decimal digits long required manipulation of Integers
- ➤ Such Integers are too long to fit in single word of modern computers, they required special treatment
- ➤ So, we are using classic method Pen and Pencil algorithm for multiplying to n-digit integers



Formula



Pair of 2 digit integers

a = a1 a0

b = b1 b0

Their product is c.

 $c= a * b = C2 10^{2}+c1 10^{1}+c0$, where

c2 = a1 * b1 -> Product of 1st digit

c0 = a0 * b0 -> Product of 2nd digit

c1 = (a1 + a0) * (b1 + b0) - (c2 + c0) -> product of sum of a's digit and sum of b's digit minus sum of c2 and c0



Formula

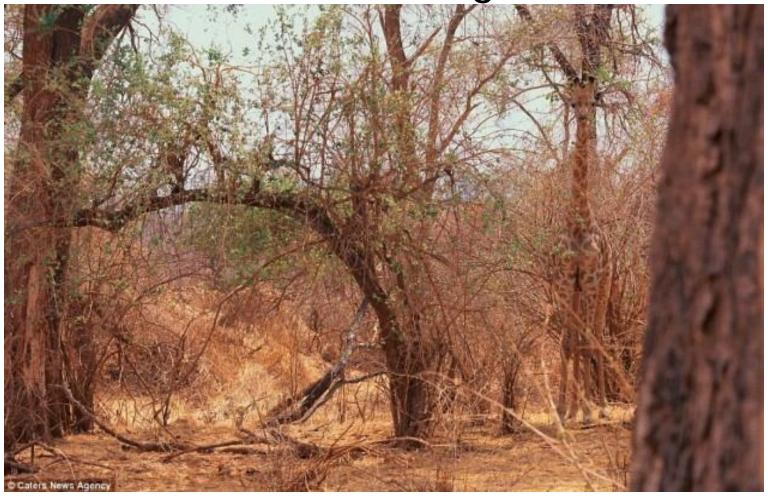


- Apply Divide and Conquer technique
- First half of a's digit is a1 and second half by a0. Same as this for b, b1 and b0
- Using c= a * b = C2 10 2 +c1 10 1 +c0 this formula, c = a*b = (a1 10 $^{n/2}$ +a0) * (b1 10 $^{n/2}$ +b0)
- \Rightarrow (a1*b1)10ⁿ + (a1*b0 + a1*b1) 10^{n/2} + (a0*b0)
- \Rightarrow C2 10 ²+c1 10¹ +c0

ak Event: Can you find the ani



in the image





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Analysis of Multiplication of large Integers

>T(n) = 3 T(n/2)

Therefore, time complexity for all the cases, $3\log_2 n$



trassen's algorithm for two 2x2 matrices:



$$\begin{split} & m_1 = (a_{00} + a_{11}) * (b_{00} + b_{11}) \\ & m_2 = (a_{10} + a_{11}) * b_{00} \\ & m_3 = a_{00} * (b_{01} - b_{11}) \\ & m_4 = a_{11} * (b_{10} - b_{00}) \\ & m_5 = (a_{00} + a_{01}) * b_{11} \\ & m_6 = (a_{10} - a_{00}) * (b_{00} + b_{01}) \\ & m_7 = (a_{01} - a_{11}) * (b_{10} + b_{11}) \end{split}$$