Lecture 25

CSE 331

Oct 28, 2019

Mid-term temp grade

Out by tomorrow night

HW 5 grading

Hopefully by tonight

Lecture on Friday

note

0 views

Ashish Tyagi from Goldman Sachs this Friday lecture

A gentle reminder from @960 about Ashish Tyagi speaking for the first 10 mins of the lecture on Friday. Ashish was a TA for 331 in Fall 16 and now works at Goldman Sachs. Ashish's presentation/chat will **not** be recorded so you'll have to come to class if you want to listen to him :-)

logistics lectures

edit · good note | 0

Updated Just now by Atri Rudra

Course next semester

note

stop following **167 views**

Actions

Algorithms are here. What's next?

Next semester I am teaching a CSE 410 special topics with title above. A description is at the end of the post. Let me know if you have any Qs on this [and before you ask, no, this is not a proof based course :-)] My replies might be a bit delayed for the rest of the week but in worst-case I'll reply back next week.

If you are interested, you should register for Section A1. Also see Shelly's email for details on how to force register etc.

CSE 410: Title: Algorithms Have Arrived - What's next? (Section A1)
Topic: Algorithms make decisions in all parts of our lives, starting from the mundane (e.g. Netflix recommending us movies/TV shows), to the somewhat more relevant (e.g. algorithms deciding which ads Google shows you) to the downright worrisome (e.g. algorithms deciding the risk of a person who is arrested committing a crime in the future). Whether we like it or not, algorithms are here to stay due to the economic benefit of automation provided by algorithms.
Professor Atri Rudra

Prerequisites
Section A1 (which is for CSE majors) has a pre-requisite of CSE 331 OR CSE 474. Secti … l pre-requisites (besides being a junior in their major). For both sections, willingness to think beyond your usual boxes …

Description: While the benefits of using algorithm to make automated decisions … seen harmful effects.

This class will look into various algorithms in use in real life and go into depth … technologically inclined, the hope is that this course will open their eyes to societal implications of techn… see why claiming "But algorithms/math cannot be biased" is at best a cop-out). For students who are … that this class will give them a better understanding of the technical/mathematical underpinnings of these a… l level, how these algorithms work you cannot accurately judge the societal impacts of an algorithm).
Overall the hope is that students who will build the technology of the future will be equipp… work (note that we are not saying that folks building technology need to be activists but when presented with two viable technical options … at has more societal benefits) and students who will be the future decision-makers can make more informed decisions on how algorithms can impact othe… te that we are not saying that decision makers should create algorithm themselves but they should be able to understand how algorithms interacts with real life data).
CSE majors should register in Section A1.
#pin

algorithms society

~ An instructor (Elijah Einstein) thinks this is a good note ~

Potentially research project on use of AI in foster care system

Divide and Conquer

Divide up the problem into at least two sub-problems

Recursively solve the sub-problems

"Patch up" the solutions to the sub-problems for the final solution

Improvements on a smaller scale

Greedy algorithms: exponential → poly time

(Typical) Divide and Conquer: $O(n^2)$ → asymptotically smaller running time

Multiplying two numbers

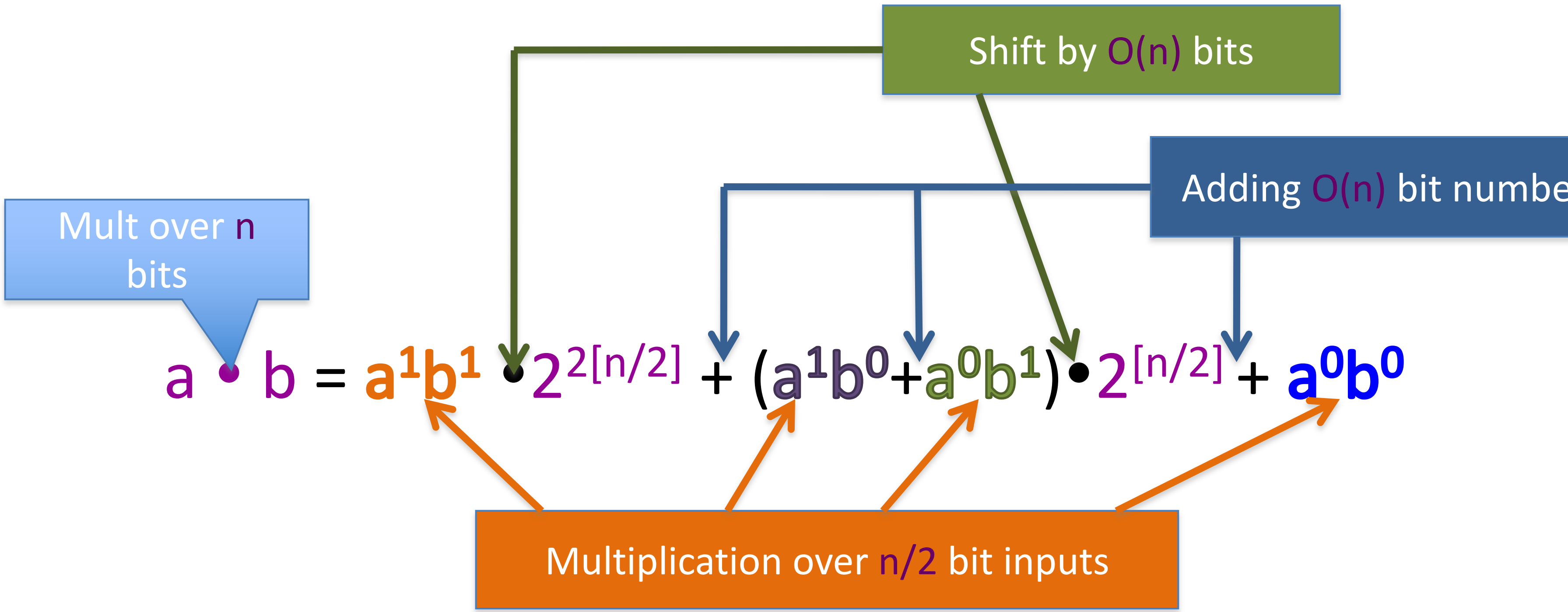
Given two numbers a and b in binary

$a=(a_{n-1},..,a_0)$ and $b = (b_{n-1},...,b_0)$

Compute $c = a \times b$

Elementary school algorithm is $O(n^2)$

The current algorithm scheme



$$a \bullet b = a^1b^1 \bullet 2^{2[n/2]} + (a^1b^0 + a^0b^1) \bullet 2^{[n/2]} + a^0b^0$$

$T(n) \leq 4T(n/2) + cn$

$T(1) \leq c$

$T(n)$ is $O(n^2)$

The key identity

$$a^1b^0+a^0b^1= (a^1+a^0)(b^1+b^0) - a^1b^1 - a^0b^0$$

The final algorithm

Input: $a = (a_{n-1},..,a_0)$ and $b = (b_{n-1},...,b_0)$

Mult (a, b)

If $n = 1$ return $a_0 b_0$

$a^1 = a_{n-1},...,a_{[n/2]}$ and $a^0 = a_{[n/2]-1},..., a_0$

Compute b^1 and b^0 from b

$x = a^1 + a^0$ and $y = b^1 + b^0$

Let p = Mult (x, y), D = Mult (a^1, b^1), E = Mult (a^0, b^0)

$F = p - D - E$

return $D \bullet 2^{2[n/2]} + F \bullet 2^{[n/2]} + E$

$T(1) \leq c$

$T(n) \leq 3T(n/2) + cn$

$O(n^{\log_2 3}) = O(n^{1.59})$ run time

All green operations are O(n) time

$$a \bullet b = a^1b^1 \bullet 2^{2[n/2]} + ((a^1+a^0)(b^1+b^0) - a^1b^1 - a^0b^0) \bullet 2^{[n/2]} + a^0b^0$$