Lecture 31

CSE 331

Nov 14, 2022

Homework 6 reminder

Homework 6

- Part **(b)**: Present a divide and conquer algorithm that given non-negative integers a and n computes `Power` (a, n) in $O(\log n)$ time.

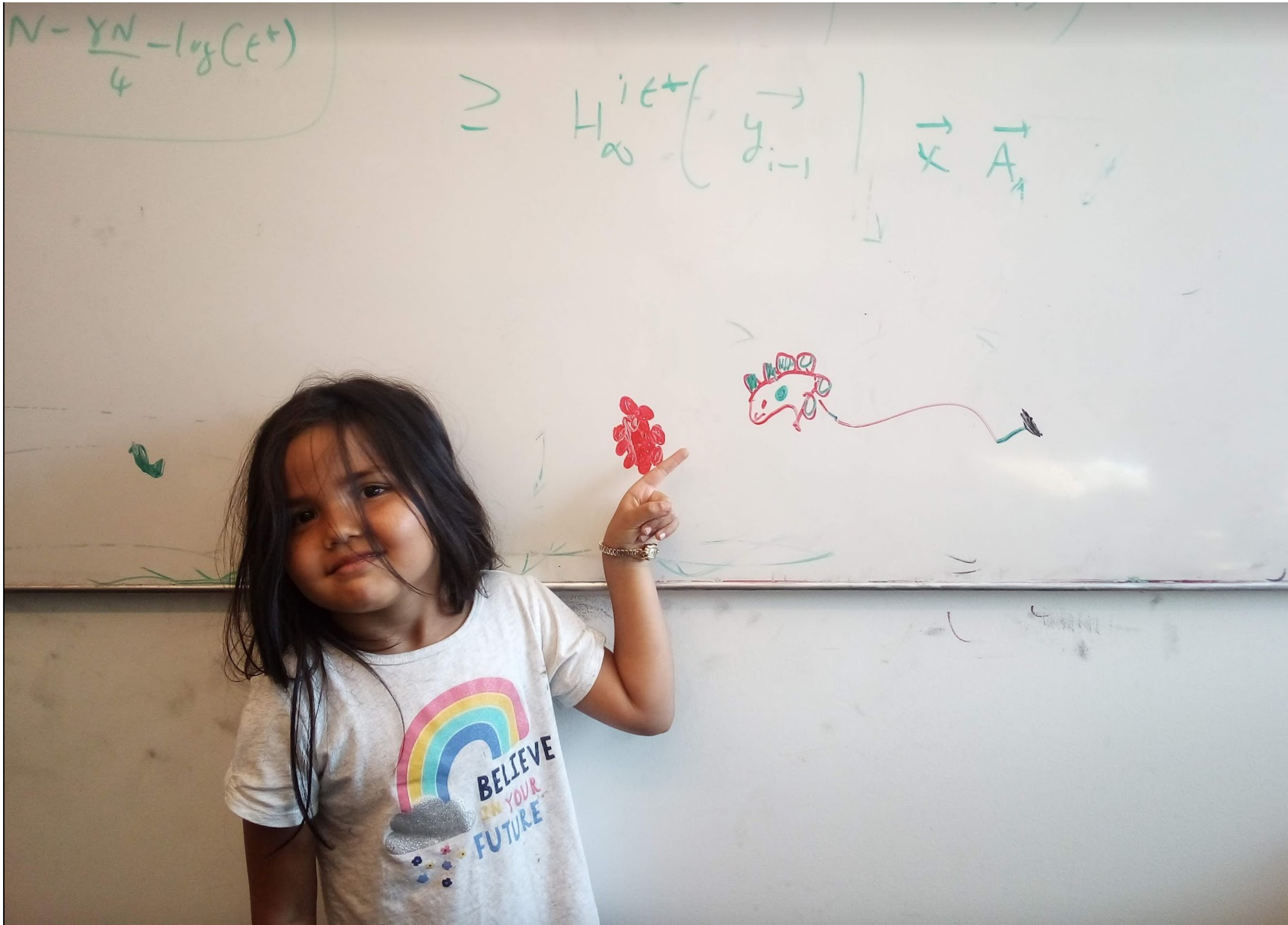
> **Important Note**
>
> **To get credit you must present a recursive divide and conquer algorithm and then analyze its running time by solving a recurrence relation. If you present an algorithm that is not a divide and conquer algorithm you will get a level 0 on this entire part.**

Question 1 (Exponentiation) [50 points]

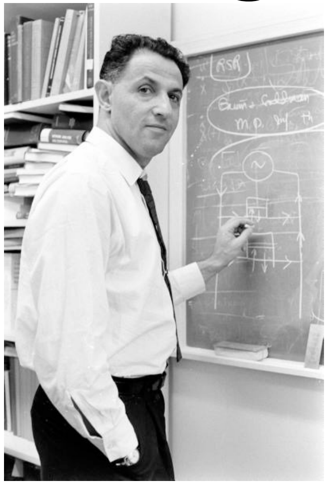
> **The Problem**
>
> We will consider the problem of exponentiating an integer to another. In particular, for non-negative integers a and n, define `Power` (a, n) be the number a^n. (For this problem assume that you can multiply two integers in $O(1)$ time.) Here are the two parts of the problem:
>
> - Part **(a)**: Present a naive algorithm that given non-negative integers a and n computes `Power` (a, n) in time $O(n)$.
>
>   > **Note**
>   >
>   > For this part, there is no need to prove correctness of the naive algorithm but you do need a runtime analysis.
>
> - Part **(b)**: Present a divide and conquer algorithm that given non-negative integers a and n computes `Power` (a, n) in $O(\log n)$ time.

A dope panel TOMORROW!

Questions/Comments?



When to use Dynamic Programming



Richard Bellman

There are polynomially many sub-problems

OPT(1), …, OPT(n)

Optimal solution can be computed from solutions to sub-problems

$$OPT(j) = \max \{ v_j + OPT(p(j)), OPT(j-1) \}$$

There is an ordering among sub-problem that allows for iterative solution

OPT (j) only depends on OPT(j-1), …, OPT(1)

Scheduling to min idle cycles

n jobs, i^{th} job takes w_i cycles

You have W cycles on the cloud

What is the maximum number of cycles you can schedule?

Subset sum problem

Input: n integers $w_1, w_2, \ldots, w_n$

bound W

Output: subset S of $[n]$ such that

(1) sum of w_i for all i in S is at most W

(2) $w(S)$ is maximized

Questions?

Today’s agenda

Dynamic Program for Subset Sum problem

Algo on the board…