

INTRODUCTION TO ALGORITHMS

ANIRRUDH KRISHNAN

1.1

- An algorithm should be able to take an input of some sort, and produce a well defined output. It is a computational, well defined tool that solves a problem.
- An Algorithm is said to be correct if it can produce a proper & correct solution to a given problem set.
- Algorithms are useful even if they are error ridden if their error rate can be controlled.
- Algorithms can be specified any which way, but must provide a precise description of the computation performed.
- Algorithms can have practical solutions, and can have several solutions.
- Algorithms need to have efficiency.

NP-COMPLETE

- An NP-Complete problem is a problem that does not have a known efficient solution.

Some things about this proof:

- ① NOBODY HAS PROVED THAT AN EFFICIENT ALGO EXISTS.
- ② IF ONE NP-COMPLETE PROBLEM HAS A SOLUTION, ALL OF THEM HAVE A SOLUTION.
- ③ SEVERAL NP-COMPLETE PROBLEMS ARE SIMILAR BUT NOT IDENTICAL TO PROBLEMS THAT DO HAVE AN EFFICIENT SOLUTION.

EXERCISES

① YOU WORK, GO TO SCHOOL, AND NEED TO BE AT A DATE IN THE NIGHT. FIGURING OUT THE SMALLEST DISTANCE TO TRAVEL, x , WITHIN THE SPECIFIED SET REQUIRES MILLS.

② TIME, SPACE

③ ARRAY:- ELEMENTS ACCESSIBLE

- MUST BE INITIALIZED w/ SPACES.

④ BOTH WANT TO OPTIMIZE DISTANCE TRAVELED; SALESMAN IS NP-COMPLETE

⑤ IN REAL LIFE, WHEN LOOKING "APPROXIMATION" IS TYPICALLY OK, BUT

GAMES DEMAND THE BEST POSSIBLE SCORE-

1.2

- Efficiency of an algo is V. important.
- KNOW THAT THE RULES OF POWER AND HOW THEY INCREASE MATTER TO EFFICIENCY
- Algorithms EXIST IN ANYTHING AND EVERYTHING.

EXERCISES

① FINDER AND EXPLORER ON macOS and WINDOWS, RESPECTIVELY, USE THE SEARCH-SORT

ALGORITHM WHICH THEY SORT FILES BASED ON SOME ATTRIBUTE.

② INSERTION SORT: $8n^2$
MERGE SORT: $64n \log n$ } FOR WHAT VALUES OF n does I.S. > M.S.

$$\begin{aligned} 8n^2 &< 64n \log n \\ n^2 &< 8n \log n \\ \frac{n^2}{8n} &< \log n \end{aligned}$$

$n < 8 \log n$
 $n - 8 \log n < 0$
 $\frac{n}{8} = \log n$
 $e^{n/8} = n \leftarrow \text{solving..}$

③ $100n^2 < 2^n$

$$100n^2 - 2^n < 0$$

$$n(100n - 2) < 0$$

$$n=0, n < \sqrt[2]{100} = 10$$

$$0 < n < 10 \quad \text{!}$$

→ FOR PROBLEM SOL, CHECK FOLDER, WROTE GRAPH FOR M.S.