CS F364
Design & Analysis of Algorithms

ALGORITHMS - COMPLEXITY

Complexity Classes

- $P \stackrel{?}{=} NP$

Complexity Classes $\mathbb{P} \stackrel{?}{=} \mathbb{NP}$

- $\mathbb{P} \subseteq \mathbb{NP}$
  - Why?
  - Is $\mathbb{P} \subset \mathbb{NP}$ or is $\mathbb{P} = \mathbb{NP}$?
    - The question is often referred to as the $\mathbb{P} \stackrel{?}{=} \mathbb{NP}$ problem

Complexity Classes $\mathbb{P} \stackrel{?}{=} \mathbb{NP}$

- Arguments:
  - $\mathbb{P} \subset \mathbb{NP}$
    - There is a long list of problems known to be in $\mathbb{NP}$ (i.e. certificates can be verified in polynomial time)

      but not known to be in $\mathbb{P}$ (i.e. no one has found a polynomial time algorithm for solving them)
      - Examples: ISO, KNAPSACK, TSP
  - $\mathbb{P} = \mathbb{NP}$
    - No problem has been proved to be in $\mathbb{NP} - \mathbb{P}$

Complexity Classes $\mathbb{P}$, $\mathbb{NP}$, and $\mathbb{EXP}$

- In fact we know that:
  - $\mathbb{P} \subseteq \mathbb{NP} \subseteq \mathbb{EXP}$
- and we know that
  - $\mathbb{P} \subset \mathbb{EXP}$