The Difference

NP ⇒ is the class of all search problems ⇒ some of which seem solvable only by Brute-force.
P ⇒ is the class of all tractable search problems ⇒ solvable in poly-time.

- All P problems are also NP problems.

Point

- Search problem ⇒ find a solution.
- Decision problem ⇒ does there exist a solution?
- Optimization problem ⇒ find the best solution.

Is p = NP?

P != NP

- Intractable search problems exist.
- Brute force search may be the best we can do.
- Nondeterministic machines would admit efficient algorithms.

P = NP

- All search problems are tractable,
- And there exist efficient algorithms for them.
- Nondeterministic machines would be of no help!

Point

No one has been able to prove that creating a solution to a problem is more difficult than checking that it is correct.

Definition

Problem **X** poly-time reduces to **Y** if you can use an efficient solution to **Y** to develop an efficient solution to **X**.

Definition

An **NB** problem is **NB**-complete if all problems in **NB** poly-time reduce to it.

Theorem

- SAT is NP-complete.
- All problems in NP poly-time reduce to SAT.
