

22.2.4

NP: Definition

Nondeterministic Polynomial Time

Definition 22.3.

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Example 22.4.

Independent Set, **Vertex Cover**, **Set Cover**, **SAT**, **3SAT**, and **Composite** are all examples of problems in **NP**.

Why is it called...

Nondeterministic Polynomial Time

A certifier is an algorithm $C(I, c)$ with two inputs:

- 1 I : instance.
- 2 c : proof/certificate that the instance is indeed a YES instance of the given problem.

One can think about C as an algorithm for the original problem, if:

- 1 Given I , the algorithm guesses (non-deterministically, and who knows how) a certificate c .
- 2 The algorithm now verifies the certificate c for the instance I .

NP can be equivalently described using Turing machines.

Asymmetry in Definition of NP

Note that only YES instances have a short proof/certificate. NO instances need not have a short certificate.

Example 22.5.

SAT formula φ . No easy way to prove that φ is NOT satisfiable!

More on this and **co-NP** later on.

THE END

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(for now)