What class can a problem (note, not an algorithm) be in?

- What is the definition of the class of problems P?
- What is the definition of the class of problems NP?
- What is the definition of the class of problems NPC?
Subset-Sum Problem

Given a set of positive integers and an integer target \( t > 0 \) we ask whether there is a subset \( S' \subseteq S \) whose elements sum to \( t \).

For example, if \( S = 1, 2, 5, 7, 11 \) and \( t = 17 \), then what is the solution?
What is the language definition of this problem?
What is the language definition of this problem?

\[ \text{SUMSET-SUM} = \{ <S, t>: \text{there exists a subset } S' \subseteq S \text{ such that } t = \sum_{s \in S'} s \} \]
What set is this problem in?

• Is this problem in P?
• Is this problem in NP?
• Is this problem in NPC?
How can we prove a problem is in NP?

- Produce a Non-deterministic polynomial time algorithm
- Show we can verify a witness
- Show we can verify the formal language in P time
How can we prove Subset-sum is in NP?

Produce a Non-deterministic polynomial time algorithm.
How can we prove Subset-sum is in NP?

Show we can verify a witness
How can we prove Subset-sum is in NP?

Show we can verify the formal language in P time
Note: this is very similar to the last version