Assignment 4 - 18343763

Polynomial Problems

Definition

A polynomial problem (known better as P) is a problem that takes a number of steps to complete. These algorithms are known as deterministic, which means that the algorithm is not random or stochastic, the outcome is predetermined and the problem can be solved with a worst-case polynomial time-complexity. The complexity of the algorithm is O(p^k) where k is any non-negative integer.

Example

A palindrome checker is a perfect example of a P problem. All the algorithm has to do is check if an input is equal to any palindromes in forward and reverse.

Non-deterministic Polynomial Problems

Definition

A non-deterministic polynomial (known better as NP) are problems that do not have a predetermined answer. To solve these problems, algorithms must generate random answers and verify if they are correct. Only finishing once the correct answer is found. The generation and verification of the solution is polynomial, but the overall time taken is not.

Example

Present a set of non-zero elements and see if that set adds up to zero.

NP-Hard Problems

Definition

NP-Hard problems are intrinsically harder than those that can be solved by a nondeterministic Turing machine in polynomial time. When a NP-Complete problem is optimised, it is said to be NP-Hard. These problems are as hard as any NP problem.

Example

The halting problem. Given a program P and input I to P, will P halt based on input I?

NP-Complete Problems

Definition

An NP-Complete problem is considered to be NP-Complete if it is NP and NP-Hard.

Example

The traveling salesman. A problem in graph theory requiring the most efficient (shortest distance) Hamiltonian cycle can make through n nodes.

“P versus NP” Problem

The P versus NP problem is an unsolvable problem in computer science. The idea behind this is that somehow P = NP. Behind every problem, there is a solution that is easily solved and easily verifiable in polynomial time; every problem contains a hidden solution.

References

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