Design and Analysis of Algorithm

RCA 352: Session 2020-21

DAA Lab

Scheduled Date:	Compiled Date:	Submitted Date:
17-12-2020	17-12-2020	17-12-2020

COOK'S THEOREM

COOK'S THEOREM STATES THAT,

Any NP Problem can be converted to SAT in polynomial time.

Stephen cook presented four theorems in his paper "The complexity of theorem proving procedures". These theorems are stated below. We do understand that many unknown terms are being used in this chapter , but we don't have any scope to discuss everything in detail.

Following are the four theorems by Stephen cook:-

THEOREM-1

If a set S of strings is accepted by some non-deterministic turing machine within polynomial time,then S is P-reducible to{DNF tautologies}.suppose we buy a guessing module peripheral for turing machine,which looks at a turing machine program and problem instance and in polynomial time writes something it says is an answer.to convince ourselves it really is an answer we can run another program to checks it.

THEOREM-2

The following sets are P-reducible to each other in pairs(and hence each has the same polynomial degree of difficulty): {tautologies},{DNF tautologies},D3,{sub-graph pairs}.a decision problem is NP- hard if the time

complexity on a deterministic machine is within a polynomial factor of the complexity of any problem in NP.

THEOREM-3

→ **For any Q TQ(k) √k (log k)2 Q TQ(k) ? 2 k(log k)**

→ **There is a T (k) of type Q such t Q TQ(k) ? 2 k(log k)**

THEOREM-4

If the set S of strings is accepted by a non-deterministic machine within time T(n) = 2 , and if T (k) is an honest (i.e. real-time countable) function of type Q, then there is a constant K, so S can be recognized by a deterministic machine within time T (K8).

→ **First, he emphasized the significance of polynomial time reducibility. It means that if we have a polynomial time reduction from one problem to another, this ensures that any polynomial time algorithm from the second problem can be converted into a corresponding polynomial time algorithm for the first problem.**

→ **Second, he focused attention on the class NP of decision problems that can be solved in polynomial time by a non-deterministic computer. Most of the intractable problems belong to this class, NP**

→ **Third, he proved that one particular problem in NP has the property that every other problem in NP can be polynomial reduced to it. If the satisfiability problem can be solved with a polynomial time algorithm, then every problem in NP can also be solved in polynomial time. If any problem in NP is intractable, then satisfiability problem must be intractable. Thus, satisfiability problem is the hardest problem in NP.**

→ Fourth, Cook suggested that other problems in NP might share with the satisfiability problem this property of being the hardest member of NP.