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# DM553/MM850 – Spring 2024 – Weekly Note 10

**Stuff covered at the lectures in Week 15, 2024**

- The proof of the Cook-Levin theorem that SAT is NP-complete. (Video 18)

- I also covered Cormen 35.1-35.2 on approximation algorithms. (Video 19)

**Key points**

- I proved that SAT is NP-complete by showing that given any language $A \in NP$, in the form of a nondeterministic Turing machine $N$ which decides $A$ in polynomial time and a string $w$, we can construct, in polynomial time, an instance $\Phi$ (a boolean formula with conjuctions and disjunctions of literals) of SAT such that $\Phi$ is satisfiable if and only $w \in A$. The important thing about legal windows is that it is possible (and not difficult) to define precisely what a legal windows is and that the number of distinct (legal) windows is bounded by $|C|^6$, where $C$ is the set of symbols that can be in a tableau. Since the Turing machine $N$ is fixed $|C|$ is a constant.

- I showed how to optain a polynomial algorithm which finds a vertex cover of size at most twice the size of an optimum vertex cover and how to obtain a TSP solution-whose cost is no more than twice the optimum, when the cost function satisfies the triangle inequality. I also showed that if we do not assume that the triangle inequality holds, then, unless P=NP, there cannot exist any $\rho(n)$ approximation algorithm for TSP.

**Lectures in Week 16, 2024**
We cover the rest Cormen Chapter 35 on approximation algorithms (Videos 20 and 21).I may also start on lower bounds for finding maximum and mimum element (Video 22).

**Exercises April 18, 2024**
Exercises in Cormen have the same numbers in 3rd and 4th edition.

- Remaining exercises from Weekly note 9.

- Second set of exam problems.

- Cormen 35.3-4

- Cormen 35.4-3

- Cormen 35.4.