CPSC 421/501 Oct 29

Chapter 7:

- Big-O, the classes $TIME(t(n))$, $NTIME(t(n))$
- P and NP
- Reductions, Poly time functions and NP-completeness
- Start on Cook-Levin Theorem

Breakout Room Questions:

① Show that

$$\mathrm{SAT} = \left\{ \langle f \rangle \;\middle|\; \begin{array}{l} f \text{ is a satisfiable} \\ \text{Boolean formula, i.e.} \\ \text{for some } x_1, \dots, x_n \in \{T, F\} \\ f(x_1, \dots, x_n) = T \end{array} \right\}$$

is in NP

② Show that

$$\mathrm{3COLOUR} = \left\{ \langle G \rangle \;\middle|\; \begin{array}{l} G \text{ is a graph that can} \\ \text{be 3 coloured, i.e.} \\ \exists \text{ map } V \to \{1,2,3\} \text{ s.t.} \\ \text{no edge is monochromatic} \end{array} \right\}$$

is in NP

3. Show that

$$\text{SUBSET-SUM} = \left\{ \langle x_1, \ldots, x_k, t \rangle \text{ s.t. } \begin{array}{l} x_1, \ldots, x_k, t \in \mathbb{N} \text{ and} \\ \text{for some } I \subset \{1, \ldots, k\} \\ \displaystyle\sum_{i \in I} x_i = t \end{array} \right\}$$

is in NP-complete

4. If $f : \Sigma_1^* \to \Sigma_2^*$ is poly time computable, and $g : \Sigma_2^* \to \Sigma_3^*$ is as well, is

$$g \circ f : \Sigma_1^* \to \Sigma_3^*$$

also poly-time computable?