Lecture 2

Formalising Problems



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Examples:

PRIMES: Given an integer x, decide if x is a prime. $f_{PRIMES}: \{0,1\}^* \to \{0,1\}^*$ such that

$$f_{PRIMES}(x) = \begin{cases} 1, & \text{if } dec \\ 0, & \text{if } dec \end{cases}$$



- A problem for us would always mean computing a function $f: \{0,1\}^* \rightarrow \{0,1\}^*$, whose

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- Getting p from $\langle p \rangle$ must be "easy".
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- $\langle p \rangle$ shouldn't be too long.



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DEC_PATH: Given a graph G and vertices $u, v \in G$, decide if a path from u to v exist.



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- Lower bounds for decision problems implies lower bounds for search problems.





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Observation: If **DEC_PATH** is not polynomial-time solvable, then so is **SEARCH_PATH**.

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FACTOR: Given integers a and b, decide if a is a factor of b. $f_{FACTOR}: \{0,1\}^* \to \{0,1\}$ such that ... $FACTOR = \{ \langle a, b \rangle \mid a \text{ is a factor of } b \}$