AARHUS UNIVERSITY, COMPUTER SCIENCE

dKomp Assignment 1

Peter Burgaard - 201209175

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1 PROOF OF PROPOSITION 1

If π_1 and π_2 are good representations that are polynomially equicalent, then $L_1 \in \mathbf{P} \iff L_2 \in \mathbf{P}$.

We will only show $\Rightarrow$ part, because the $\Leftarrow$ is equivalent.
Let

$$\begin{aligned}
&\pi_i : S \rightarrow \{0,1\}^* && \text{for } i = 1,2 \\
&L_1 = \{x | f(\pi_1^{-1}(x)) = yes\} \\
&L_2 = \{x | f(\pi_2^{-1}(x)) = yes\}
\end{aligned}$$

π_1 being a good representation means $\pi_1(S) \in \mathbf{P}$, i.e., it can be decided efficiently if a given string is a valid representation of an object. π_1 and π_2 being polynomial equivalent implies $\exists r_1, r_2$ translations between π_i, i.e., $\forall x \in S$, $\pi_1(x) = r_1(\pi_2(x))$ and $\pi_2(x) = r_2(\pi_1(x))$.

So π_1 being a good representation and the existens of and r_1, due to π_1 and π_2 being polynomial equivalent, means that we can translate any $\pi_2(x) \forall x \in S$ to an $\pi_1(x)$ representation, which can be decided in polynomial time. Which means $L_1 \in \mathbf{P} \Rightarrow L_2 \in$ P.

The same argument can be applied to get $\Leftarrow$. $\square$