Nachtrag: Cook reduction

$\neq$ Karp reduction

10| Idea: full enumeration of $\alpha' \in \Sigma^w$

Inputs:
- alph. Σ of size $|\Sigma| = c$
- seq $P \in \Sigma^m$
- seed length $w \in \mathbb{N}$ (const!)
- alignment scoring $\delta : \Sigma^2 \to \mathbb{Q}$
- seed similarity threshold $S \in \mathbb{Q}$ (ass: min!)

Output: $A = \{ \alpha' \mid \delta(\alpha', \alpha) \leq S \wedge |\alpha'| = |\alpha| \wedge \alpha \text{ substr. } P \}$
$\subseteq \Sigma^w$

Alg: For each $\alpha' \in \Sigma^w$ {

1. For $j = 1, \dots, m - w + 1$

1.1. $t := \delta(P_{j, j+w-1}, \alpha')$
$= \sum_{i=1}^{w} \delta(P_{j+i-1}, \alpha'_i)$

1.2 If $t \leq S$ then

$A := A \cup \{\alpha'\}$
break;

}

Correctness:
- terminates since Σ finite
  (• outer loop via any enum. of Σ^w)
- considers all comb. of α, α' – clear.
- only adds elem. α' to A if α' is "good".

Runtime: $\leq \underbrace{|\Sigma^w|}_{\text{outer loop}} \cdot \underbrace{|P|}_{\substack{1. \\ \# \text{Iter}}} \cdot (\underbrace{w}_{\substack{\text{comp. } t \\ (1.1)}} + \underbrace{d}_{\substack{\in O(1) \\ (1.2)}})$

$= O(c^w \cdot m \cdot w)$

$\overset{c, w \text{ const}}{=} O(m)$

Justification: for DNA/RNA: $c = 4$,
$m \approx 10^6$ (DNA),

$u \approx 10$ (3)

— may vary!

11| Relevant:

- which DB(s)
- which algorithm with which parameters?
- relative scores (for comparison & "termin. justification)
- other results (if applicable)

Goal: robust result/claim

12| Symbolic method: (allowed, since X_i iid)

$$\underbrace{\mathcal{E}}_{\text{excursions}} = \underbrace{Z_0}_{\text{exc. of length } 0} + \underbrace{Z_\uparrow}_{\text{up}} \underbrace{\times}_{\text{seq./cart. prod.}} W \times \underbrace{Z_\downarrow}_{\text{down}}$$

$$\underbrace{W}_{\text{walks}} = \underbrace{\varepsilon}_{\text{empty walk}} + Z_\uparrow \times W \times Z_\downarrow \times W$$

Adding probabilities & translating (counting steps)

$$\rightsquigarrow \quad E(z) = (1-p) \cdot z^0 + pz \cdot W(z) \cdot (1-p) z$$

$$W(z) = \underbrace{1}_{?} + p(1-p)z^2 \cdot W(z)^2$$

solv. $\rightsquigarrow$

$$E(z) = (1-p) + \frac{1 - \sqrt{1 - 4p(1-p)z^2}}{2}$$

PGF for L

$\rightsquigarrow$

$$\mathbb{E}L = E'(1) = p\left(1 + \frac{1}{1-2p}\right)$$