$$PP(S) = \left( \prod_{i=1}^{T} P(w_i | w_{i-1}) \right)^{-1/T}$$

$$\log(PP(S)) = \log\left( \left( \prod_{i=1}^{T} P(w_i | w_{i-1}) \right)^{-1/T} \right)$$

$\log(a^b) = b \cdot \log(a)$

$$= -\frac{1}{T} \log\left( \prod_{i=1}^{T} P(w_i | w_{i-1}) \right)$$

$\log(ab) = \log(a) + \log(b)$

$$= -\frac{1}{T} \sum_{i=1}^{T} \log(P(w_i | w_{i-1}))$$

$$\rightsquigarrow PP(S) = \exp\left[ -\frac{1}{T} \sum_{i=1}^{T} \log(P(w_i | w_{i-1})) \right]$$