$$PP = \sqrt[N]{\frac{1}{\prod_{i=1}^{N} p(w_i / w_0, w_1, \ldots w_{i-1})}}$$

taking log on both sides

$$\Rightarrow \exp\left(\frac{1}{N}\sum_{i=1}^{N} \log\left(\frac{1}{p_i}\right)\right)$$

expanding the contents of log gives $\Rightarrow -\log(P_i) = \mathcal{L}_i$

Thus $\boxed{sum_{\mathcal{L}_i} = \mathcal{L}_{total}}$

hence $\boxed{PP = \exp(\mathcal{L}_{total}/N)}$