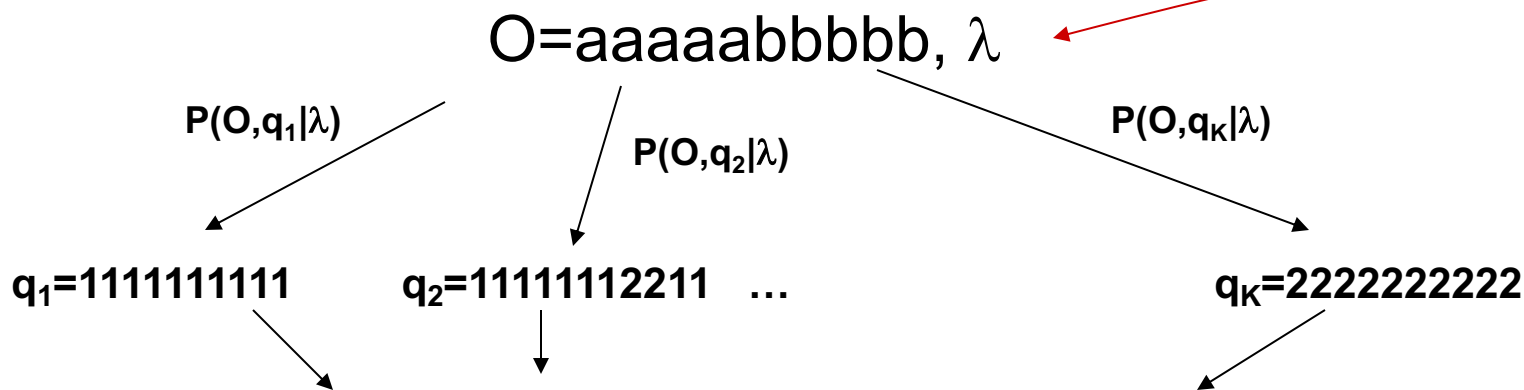


# Intuition



$$\pi_i = \frac{\sum_{k=1}^K p(O, q_k | \lambda) \delta[q_k(1) = 1]}{\sum_{k=1}^K p(O, q_k | \lambda)}$$

$$a_{ij} = \frac{\sum_{t=1}^{T-1} \sum_{k=1}^K p(O, q_k | \lambda) \delta[q_k(t) = i, q_k(t+1) = j]}{\sum_{t=1}^{T-1} \sum_{k=1}^K p(O, q_k | \lambda) \delta[q_k(t) = i]}$$

$$b_i(v_j) = \frac{\sum_{t=1}^{T-1} \sum_{k=1}^K p(O, q_k | \lambda) \delta[q_k(t) = i, o_t = v_j]}{\sum_{t=1}^{T-1} \sum_{k=1}^K p(O, q_k | \lambda) \delta[q_k(t) = i]}$$

New  $\lambda'$

**Computation of  $P(O, q_k | \lambda)$  is expensive ...**