

FORWARD STEP

from $\underset{\uparrow}{b}bba$ to $bb\underset{\uparrow}{b}a \xrightarrow{\quad}$

$\alpha_q(\underset{\uparrow}{b}bba) = \text{prob. of every path ending in } q \text{ after reading "bb"}$

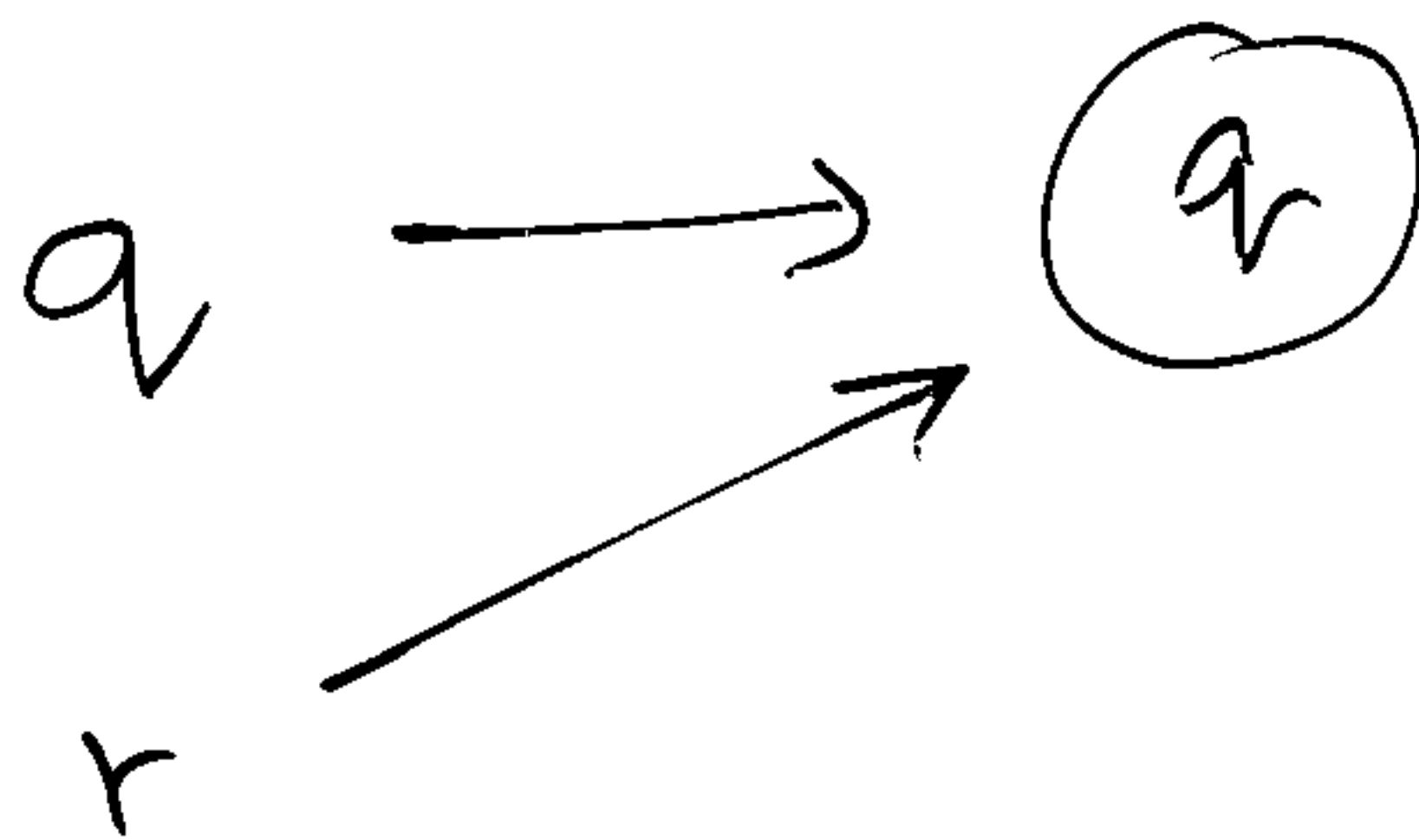
We want to compute prob. of every path ending in q after reading "bbb"

This is equal to $\alpha_q(\underset{\uparrow}{b}bb a)$

FORWARD STEP

Compute $\alpha_q(bbb \underset{\uparrow}{a})$ using
 $\alpha_q(\underset{\uparrow}{bb}ba)$ and $\alpha_r(\underset{\uparrow}{bb}ba)$

reaching q : two ways



$$\alpha_q(\underset{\uparrow}{bb}ba) * P(b, q | q) \\ + \alpha_r(\underset{\uparrow}{bb}ba) * P(b, q | r)$$

$$= \alpha_q(bbb \underset{\uparrow}{a})$$

BACKWARD STEP

from $bbba$ to $bbba$
 ↑ ↑
 ←

$\beta_q(bbba)$ = prob. of every
path starting from q and
recognizing "a"

We want to compute the prob.
of starting in state q and
recognizing "ba"

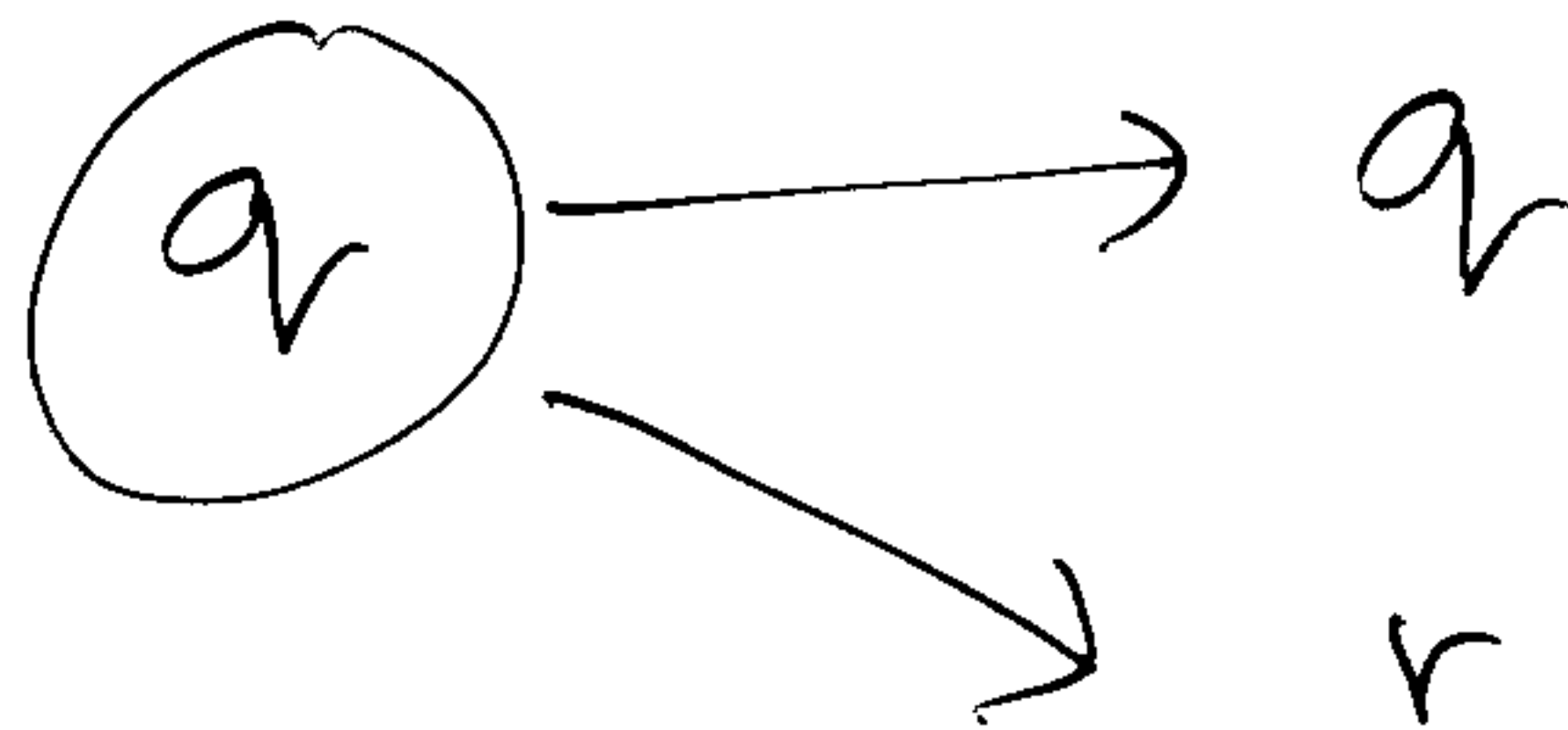
This is equal to $\beta_q(bbba)$
 ↑

BACKWARD STEP

Compute $\beta_q(bbb\underset{\uparrow}{a})$ using

$\beta_q(bbb\underset{\uparrow}{a})$ and $\beta_r(bbb\underset{\uparrow}{a})$

Starting from q : two ways



$$P(b, q | q) * \beta_q(bbb\underset{\uparrow}{a}) + P(b, r | q) * \beta_r(bbb\underset{\uparrow}{a})$$

$$= \beta_q(bbb\underset{\uparrow}{a})$$