Question 1a

(adog, dog)
(adog, the dog)
(aswims, swims)
(adog aswims, dog swims)
(adog aswims, the dog swims)

Question 1b

$f =$ adog
$e =$ the dog swims
$A_{1,2} = 1$, all other $A_{i,j}$ values equal to 0.

Question 1c

(1, 1, the dog) (2, 2, swims)

(1, 1, dog) (2, 2, swims)

(2, 2, swims) (1, 1, the dog)

(2, 2, swims) (1, 1, dog)

(1, 2, dog swims)

(1, 2, the dog swims)

Question 2

$y_1 =$ (1, 3, we must also), (7, 7, take), (4, 5, this criticism), (6, 6, seriously)

$y_2 =$ (1, 3, we must also), (4, 5, this criticism), (6, 6, seriously), (7, 7, take)

$$
\begin{aligned}
& f(y_1) - f(y_2) \\
= \; & \log q(\text{take}|\text{must, also}) + \log q(\text{this}|\text{also, take}) \\
& + \log q(\text{criticism}|\text{take, this}) + \log q(\text{STOP}|\text{criticism, seriously}) \\
& + 7 \times \eta \\
& - \log q(\text{this}|\text{must, also}) - \log q(\text{criticism}|\text{also, this}) \\
& - \log q(\text{take}|\text{criticism, seriously}) - \log q(\text{STOP}|\text{seriously, take}) \\
& - 0 \times \eta
\end{aligned}
$$

Question 3

(*, cat, 10, 1, α)
(the, cat, 10, 1, α)
(*, barks, 01, 2, α)
(cat, barks, 11, 2, α)
(barks, cat, 11, 1, α)
(the, cat, 11, 1, α)