Simplified IBM 1
computation by hand:

* Initialisation step:

$t(la \mid the) = \frac{1}{2}$

$t(maison \mid the) = \frac{1}{2}$

$t(la \mid house) = \frac{1}{2}$

$t(maison \mid house) = \frac{1}{2}$

⎤ derived from a uniform distribution
⎦ based on the source vocabulary

ITER 1

* counts.

$c(la \mid the) = \frac{1/2}{1/2 + 1/2} = \frac{1}{2} \cdot 1 = \frac{1}{2}$

$c(maison \mid the) = \frac{1/2}{1/2 + 1/2} = \frac{1}{2}$

$c(la \mid house) = \frac{\frac{1}{2}}{\frac{1}{2} + \frac{1}{2}} = \frac{1}{2}$

$c(maison \mid house) = \frac{\frac{1}{2}}{\frac{1}{2}} + \frac{1/2}{1/2 + 1/2} = \frac{3}{2}$

↑ from sent. 1   ↖ from sent. 2

* translation probabilities:

$t(la \mid the) = \frac{1/2}{1/2 + 1/2} = 1/2$

$t(maison \mid the) = \frac{1/2}{1/2 + 1/2} = \frac{1}{2}$

$t(la \mid house) = \frac{1/2}{1/2 + 3/2} = \frac{1}{2} \times \frac{2}{4} = \frac{1}{4}$

$t(\overset{maison}{\cancel{la}} \mid house) = \frac{\frac{3}{2}}{\frac{1}{2} + \frac{3}{2}} = \frac{3}{2} \times \frac{2}{4} = \frac{3}{4}$

①

ITER 2:

* counts

$$c(la \mid the) = \frac{\frac{1}{2}}{\frac{1}{2} + \frac{1}{4}} = \frac{1}{2} \times \frac{4}{3} = \frac{2}{3}$$

$$c(maison \mid the) = \frac{\frac{1}{2}}{\frac{1}{2} + \frac{3}{4}} = \frac{1}{2} \times \frac{4}{5} = \frac{2}{5}$$

$$c(la \mid house) = \frac{\frac{1}{4}}{\frac{1}{4} + \frac{1}{2}} = \frac{1}{4} \times \frac{4}{3} = \frac{1}{3}$$

$$c(maison \mid house) = \frac{\frac{3}{4}}{\frac{1}{2} + \frac{3}{4}} + \frac{\frac{3}{4}}{\frac{3}{4}} = \frac{3}{5} + 1 = \frac{8}{5}$$

from sent.1 ↗   ↖ from sent 2.

This step combines all counts as is in the cond formula
$\sum_{(e,f)} c(e \mid f; e, f)$

/e, f - words,
e, f - sentences. /

* translation probabilities

$$t(la \mid the) = \frac{\frac{2}{3}}{\frac{2}{3} + \frac{2}{5}} = \frac{\frac{2}{3}}{\frac{16}{15}} = \frac{2}{3} \times \frac{15}{16} = \frac{5}{8} = 0,625$$

$$t(maison \mid the) = \frac{\frac{2}{5}}{\frac{2}{3} + \frac{2}{5}} = \frac{2}{5} \times \frac{15}{16} = \frac{3}{8} = 0,375$$

$$t(la \mid house) = \frac{\frac{1}{3}}{\frac{1}{3} + \frac{8}{5}} = \frac{\frac{1}{3}}{\frac{5}{15} + \frac{24}{15}} = \frac{1}{3} \times \frac{15}{29} = \frac{5}{29} \cong 0,172$$

$$t(maison \mid house) = \frac{\frac{8}{5}}{\frac{1}{3} + \frac{8}{5}} = \frac{8}{5} \times \frac{15}{29} = \frac{24}{29} \cong 0,828$$