IBM models 1-2

Illustration

Wilker Aziz

April 26, 2017

	le 1	chien 2	noir 3
NULL 0			
the 1			
black 2			
dog 3			
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$		
the 1			
black 2			
dog 3			
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$	$a_2 = 0$	
the 1			
black 2			
dog 3			
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$	$a_2 = 0$	$a_3 = 0$
the 1			
black 2			
dog 3			
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$	$a_2 = 0$	$a_3 = 0$
the 1	$a_1 = 1$		
black 2			
dog 3			
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$	$a_2 = 0$	$a_3 = 0$
the 1	$a_1 = 1$	$a_2 = 1$	
black 2			
dog 3			
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$	$a_2 = 0$	$a_3 = 0$
the 1	$a_1 = 1$	$a_2 = 1$	$a_3 = 1$
black 2			
dog 3			
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$	$a_2 = 0$	$a_3 = 0$
the 1	$a_1 = 1$	$a_2 = 1$	$a_3 = 1$
black 2	$a_1 = 2$		
dog 3			
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$	$a_2 = 0$	$a_3 = 0$
the 1	$a_1 = 1$	$a_2 = 1$	$a_3 = 1$
black 2	$a_1 = 2$	$a_2 = 2$	
dog 3			
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$	$a_2 = 0$	$a_3 = 0$
the 1	$a_1 = 1$	$a_2 = 1$	$a_3 = 1$
black 2	$a_1 = 2$	$a_2 = 2$	$a_3 = 2$
dog 3			
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$	$a_2 = 0$	$a_3 = 0$
the 1	$a_1 = 1$	$a_2 = 1$	$a_3 = 1$
black 2	$a_1 = 2$	$a_2 = 2$	$a_3 = 2$
dog 3	$a_1 = 3$		
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$	$a_2 = 0$	$a_3 = 0$
the 1	$a_1 = 1$	$a_2 = 1$	$a_3 = 1$
black 2	$a_1 = 2$	$a_2 = 2$	$a_3 = 2$
dog 3	$a_1 = 3$	$a_2 = 3$	
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$	$a_2 = 0$	$a_3 = 0$
the 1	$a_1 = 1$	$a_2 = 1$	$a_3 = 1$
black 2	$a_1 = 2$	$a_2 = 2$	$a_3 = 2$
dog 3	$a_1 = 3$	$a_2 = 3$	$a_3 = 3$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le	$a_2 = 0$	$a_3 = 0$
the 1	$a_1 = 1$	$a_2 = 1$	$a_3 = 1$
black 2	$a_1 = 2$	$a_2 = 2$	$a_3 = 2$
dog 3	$a_1 = 3$	$a_2 = 3$	$a_3 = 3$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le	$a_2 = 0$ lex: NULL-chien	$a_3 = 0$
the 1	$a_1 = 1$	$a_2 = 1$	$a_3 = 1$
black 2	$a_1 = 2$	$a_2 = 2$	$a_3 = 2$
dog 3	$a_1 = 3$	$a_2 = 3$	$a_3 = 3$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le	$a_2 = 0$ lex: NULL-chien	$a_3 = 0$ lex: NULL-noir
the 1	$a_1 = 1$	$a_2 = 1$	$a_3 = 1$
black 2	$a_1 = 2$	$a_2 = 2$	$a_3 = 2$
dog 3	$a_1 = 3$	$a_2 = 3$	$a_3 = 3$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le	$a_2 = 0$ lex: NULL-chien	$a_3 = 0$ lex: NULL-noir
the 1	$a_1 = 1$ lex: the-le	$a_2 = 1$	$a_3 = 1$
black 2	$a_1 = 2$	$a_2 = 2$	$a_3 = 2$
dog 3	$a_1 = 3$	$a_2 = 3$	$a_3 = 3$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le	$a_2 = 0$ lex: NULL-chien	$a_3 = 0$ lex: NULL-noir
the 1	$a_1 = 1$ lex: the-le	$a_2 = 1$ lex: the-chien	$a_3 = 1$
black 2	$a_1 = 2$	$a_2 = 2$	$a_3 = 2$
dog 3	$a_1 = 3$	$a_2 = 3$	$a_3 = 3$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le	$a_2 = 0$ lex: NULL-chien	$a_3 = 0$ lex: NULL-noir
the 1	$a_1 = 1$ lex: the-le	$a_2 = 1$ lex: the-chien	$a_3 = 1$ lex: the-noir
black 2	$a_1 = 2$	$a_2 = 2$	$a_3 = 2$
dog 3	$a_1 = 3$	$a_2 = 3$	$a_3 = 3$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le	$a_2 = 0$ lex: NULL-chien	$a_3 = 0$ lex: NULL-noir
the 1	$a_1 = 1$ lex: the-le	$a_2 = 1$ lex: the-chien	$a_3 = 1$ lex: the-noir
black 2	$a_1 = 2$ lex: black-le	$a_2 = 2$	$a_3 = 2$
dog 3	$a_1 = 3$	$a_2 = 3$	$a_3 = 3$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le	$a_2 = 0$ lex: NULL-chien	$a_3 = 0$ lex: NULL-noir
the 1	$a_1 = 1$ lex: the-le	$a_2 = 1$ lex: the-chien	$a_3 = 1$ lex: the-noir
black 2	$a_1 = 2$ lex: black-le	$a_2 = 2$ lex: black-chien	$a_3 = 2$
dog 3	$a_1 = 3$	$a_2 = 3$	$a_3 = 3$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le	$a_2 = 0$ lex: NULL-chien	$a_3 = 0$ lex: NULL-noir
the 1	$a_1 = 1$ lex: the-le	$a_2 = 1$ lex: the-chien	$a_3 = 1$ lex: the-noir
black 2	$a_1 = 2$ lex: black-le	$a_2 = 2$ lex: black-chien	$a_3 = 2$ lex: black-noir
dog 3	$a_1 = 3$	$a_2 = 3$	$a_3 = 3$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le	$a_2 = 0$ lex: NULL-chien	$a_3 = 0$ lex: NULL-noir
the 1	$a_1 = 1$ lex: the-le	$a_2 = 1$ lex: the-chien	$a_3 = 1$ lex: the-noir
black 2	$a_1 = 2$ lex: black-le	$a_2 = 2$ lex: black-chien	$a_3 = 2$ lex: black-noir
dog 3	$a_1 = 3$ lex: dog-le	$a_2 = 3$	$a_3 = 3$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le	$a_2 = 0$ lex: NULL-chien	$a_3 = 0$ lex: NULL-noir
the 1	$a_1 = 1$ lex: the-le	$a_2 = 1$ lex: the-chien	$a_3 = 1$ lex: the-noir
black 2	$a_1 = 2$ lex: black-le	$a_2 = 2$ lex: black-chien	$a_3 = 2$ lex: black-noir
dog 3	$a_1 = 3$ lex: dog-le	$a_2 = 3$ lex: dog-chien	$a_3 = 3$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le	$a_2 = 0$ lex: NULL-chien	$a_3 = 0$ lex: NULL-noir
the 1	$a_1 = 1$ lex: the-le	$a_2 = 1$ lex: the-chien	$a_3 = 1$ lex: the-noir
black 2	$a_1 = 2$ lex: black-le	$a_2 = 2$ lex: black-chien	$a_3 = 2$ lex: black-noir
dog 3	$a_1 = 3$ lex: dog-le	$a_2 = 3$ lex: dog-chien	$a_3 = 3$ lex: dog-noir
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 0$ lex: NULL-chien	$a_3 = 0$ lex: NULL-noir
the 1	$a_1 = 1$ lex: the-le	$a_2 = 1$ lex: the-chien	$a_3 = 1$ lex: the-noir
black 2	$a_1 = 2$ lex: black-le	$a_2 = 2$ lex: black-chien	$a_3 = 2$ lex: black-noir
dog 3	$a_1 = 3$ lex: dog-le	$a_2 = 3$ lex: dog-chien	$a_3 = 3$ lex: dog-noir
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 0$ lex: NULL-noir
the 1	$a_1 = 1$ lex: the-le	$a_2 = 1$ lex: the-chien	$a_3 = 1$ lex: the-noir
black 2	$a_1 = 2$ lex: black-le	$a_2 = 2$ lex: black-chien	$a_3 = 2$ lex: black-noir
dog 3	$a_1 = 3$ lex: dog-le	$a_2 = 3$ lex: dog-chien	$a_3 = 3$ lex: dog-noir
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$
the 1	$a_1 = 1$ lex: the-le	$a_2 = 1$ lex: the-chien	$a_3 = 1$ lex: the-noir
black 2	$a_1 = 2$ lex: black-le	$a_2 = 2$ lex: black-chien	$a_3 = 2$ lex: black-noir
dog 3	$a_1 = 3$ lex: dog-le	$a_2 = 3$ lex: dog-chien	$a_3 = 3$ lex: dog-noir
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 1$ lex: the-chien	$a_3 = 1$ lex: the-noir
black 2	$a_1 = 2$ lex: black-le	$a_2 = 2$ lex: black-chien	$a_3 = 2$ lex: black-noir
dog 3	$a_1 = 3$ lex: dog-le	$a_2 = 3$ lex: dog-chien	$a_3 = 3$ lex: dog-noir
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 1$ lex: the-noir
black 2	$a_1 = 2$ lex: black-le	$a_2 = 2$ lex: black-chien	$a_3 = 2$ lex: black-noir
dog 3	$a_1 = 3$ lex: dog-le	$a_2 = 3$ lex: dog-chien	$a_3 = 3$ lex: dog-noir
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$
black 2	$a_1 = 2$ lex: black-le	$a_2 = 2$ lex: black-chien	$a_3 = 2$ lex: black-noir
dog 3	$a_1 = 3$ lex: dog-le	$a_2 = 3$ lex: dog-chien	$a_3 = 3$ lex: dog-noir
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 2$ lex: black-chien	$a_3 = 2$ lex: black-noir
dog 3	$a_1 = 3$ lex: dog-le	$a_2 = 3$ lex: dog-chien	$a_3 = 3$ lex: dog-noir
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 2$ lex: black-noir
dog 3	$a_1 = 3$ lex: dog-le	$a_2 = 3$ lex: dog-chien	$a_3 = 3$ lex: dog-noir
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$
dog 3	$a_1 = 3$ lex: dog-le	$a_2 = 3$ lex: dog-chien	$a_3 = 3$ lex: dog-noir
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 3$ lex: dog-chien	$a_3 = 3$ lex: dog-noir
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 3$ lex: dog-noir
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_{1}$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_{1}$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_{0}$
Marginal			

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_{1}$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_{0}$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$		

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_{1}$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_{0}$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_{1}$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_{0}$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_1=0)}{\text{marginal(le)}}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_0$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_1$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_0$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_2$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_1$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_0$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_1=0)}{\text{marginal(le)}}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_2=0)}{\text{marginal(chien)}}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_0$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_1$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_0$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_2$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_1$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_0$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_1=0)}{\text{marginal(le)}}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_2=0)}{\text{marginal(chien)}}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$ post: $\frac{\text{joint}(a_3=0)}{\text{marginal(noir)}}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_0$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_1$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_0$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_2$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_1$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_0$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_1=0)}{\text{marginal(le)}}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_2=0)}{\text{marginal(chien)}}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$ post: $\frac{\text{joint}(a_3=0)}{\text{marginal(noir)}}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_0$ post: $\frac{\text{joint}(a_1=1)}{\text{marginal(le)}}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_1$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_0$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_2$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_1$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_0$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_1=0)}{\text{marginal(le)}}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_2=0)}{\text{marginal(chien)}}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$ post: $\frac{\text{joint}(a_3=0)}{\text{marginal(noir)}}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_0$ post: $\frac{\text{joint}(a_1=1)}{\text{marginal(le)}}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_2=1)}{\text{marginal(chien)}}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_1$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_0$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_2$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_1$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_0$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_1=0)}{\text{marginal(le)}}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_2=0)}{\text{marginal(chien)}}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$ post: $\frac{\text{joint}(a_3=0)}{\text{marginal(noir)}}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$ post: $\frac{\text{joint}(a_1=1)}{\text{marginal(le)}}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_2=1)}{\text{marginal(chien)}}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_3=1)}{\text{marginal(noir)}}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_{1}$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_{0}$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_1=0)}{\text{marginal(le)}}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_2=0)}{\text{marginal(chien)}}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$ post: $\frac{\text{joint}(a_3=0)}{\text{marginal(noir)}}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$ post: $\frac{\text{joint}(a_1=1)}{\text{marginal(le)}}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_2=1)}{\text{marginal(chien)}}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_3=1)}{\text{marginal(noir)}}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$ post: $\frac{\text{joint}(a_1=2)}{\text{marginal(le)}}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_{1}$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_{0}$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_1=0)}{\text{marginal(le)}}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_2=0)}{\text{marginal(chien)}}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$ post: $\frac{\text{joint}(a_3=0)}{\text{marginal(noir)}}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$ post: $\frac{\text{joint}(a_1=1)}{\text{marginal(le)}}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_2=1)}{\text{marginal(chien)}}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_3=1)}{\text{marginal(noir)}}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$ post: $\frac{\text{joint}(a_1=2)}{\text{marginal(le)}}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$ post: $\frac{\text{joint}(a_2=2)}{\text{marginal(chien)}}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_{1}$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_{0}$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_1=0)}{\text{marginal(le)}}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_2=0)}{\text{marginal(chien)}}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$ post: $\frac{\text{joint}(a_3=0)}{\text{marginal(noir)}}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$ post: $\frac{\text{joint}(a_1=1)}{\text{marginal(le)}}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_2=1)}{\text{marginal(chien)}}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_3=1)}{\text{marginal(noir)}}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$ post: $\frac{\text{joint}(a_1=2)}{\text{marginal(le)}}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$ post: $\frac{\text{joint}(a_2=2)}{\text{marginal(chien)}}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_3=2)}{\text{marginal(noir)}}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_{1}$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_{0}$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_1=0)}{\text{marginal(le)}}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_2=0)}{\text{marginal(chien)}}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$ post: $\frac{\text{joint}(a_3=0)}{\text{marginal(noir)}}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$ post: $\frac{\text{joint}(a_1=1)}{\text{marginal(le)}}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_2=1)}{\text{marginal(chien)}}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_3=1)}{\text{marginal(noir)}}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$ post: $\frac{\text{joint}(a_1=2)}{\text{marginal(le)}}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$ post: $\frac{\text{joint}(a_2=2)}{\text{marginal(chien)}}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_3=2)}{\text{marginal(noir)}}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$ post: $\frac{\text{joint}(a_1=3)}{\text{marginal(le)}}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_{1}$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_{0}$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_1=0)}{\text{marginal(le)}}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_2=0)}{\text{marginal(chien)}}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$ post: $\frac{\text{joint}(a_3=0)}{\text{marginal(noir)}}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$ post: $\frac{\text{joint}(a_1=1)}{\text{marginal(le)}}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_2=1)}{\text{marginal(chien)}}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_3=1)}{\text{marginal(noir)}}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$ post: $\frac{\text{joint}(a_1=2)}{\text{marginal(le)}}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$ post: $\frac{\text{joint}(a_2=2)}{\text{marginal(chien)}}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_3=2)}{\text{marginal(noir)}}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$ post: $\frac{\text{joint}(a_1=3)}{\text{marginal(le)}}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_{1}$ post: $\frac{\text{joint}(a_2=3)}{\text{marginal(chien)}}$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_{0}$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$

	le 1	chien 2	noir 3
NULL 0	$a_1 = 0$ lex: NULL-le jump: $0 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{Null}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_1=0)}{\text{marginal(le)}}$	$a_2 = 0$ lex: NULL-chien jump: $0 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{Null}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_2=0)}{\text{marginal(chien)}}$	$a_3 = 0$ lex: NULL-noir jump: $0 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{Null}} \times \delta_{-3}$ post: $\frac{\text{joint}(a_3=0)}{\text{marginal(noir)}}$
the 1	$a_1 = 1$ lex: the-le jump: $1 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{the}} \times \delta_{0}$ post: $\frac{\text{joint}(a_1=1)}{\text{marginal(le)}}$	$a_2 = 1$ lex: the-chien jump: $1 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{the}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_2=1)}{\text{marginal(chien)}}$	$a_3 = 1$ lex: the-noir jump: $1 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{the}} \times \delta_{-2}$ post: $\frac{\text{joint}(a_3=1)}{\text{marginal(noir)}}$
black 2	$a_1 = 2$ lex: black-le jump: $2 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{black}} \times \delta_{1}$ post: $\frac{\text{joint}(a_1=2)}{\text{marginal(le)}}$	$a_2 = 2$ lex: black-chien jump: $2 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{black}} \times \delta_{0}$ post: $\frac{\text{joint}(a_2=2)}{\text{marginal(chien)}}$	$a_3 = 2$ lex: black-noir jump: $2 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{black}} \times \delta_{-1}$ post: $\frac{\text{joint}(a_3=2)}{\text{marginal(noir)}}$
dog 3	$a_1 = 3$ lex: dog-le jump: $3 - \lfloor 1 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{le}\mid\text{dog}} \times \delta_{2}$ post: $\frac{\text{joint}(a_1=3)}{\text{marginal(le)}}$	$a_2 = 3$ lex: dog-chien jump: $3 - \lfloor 2 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{chien}\mid\text{dog}} \times \delta_{1}$ post: $\frac{\text{joint}(a_2=3)}{\text{marginal(chien)}}$	$a_3 = 3$ lex: dog-noir jump: $3 - \lfloor 3 \times \frac{3}{3} \rfloor$ joint: $\theta_{\text{noir}\mid\text{dog}} \times \delta_{0}$ post: $\frac{\text{joint}(a_3=3)}{\text{marginal(noir)}}$
Marginal	$\sum_{a_1=0}^{m} \text{joint}(a_1)$	$\sum_{a_2=0}^{m} \text{joint}(a_2)$	$\sum_{a_3=0}^{m} \text{joint}(a_3)$