$$\theta_{c,k} = \frac{\sum_{i=1}^{m} 1^{x_{ck}^i}}{\sum_{k=1}^{n} \sum_{i=1}^{m} 1^{x_{ck}^i}}$$

→ this says count all word k in the category c

→ this says count all words from all sentences with category c

$$\theta_{0,1} = \frac{3}{9\,(\delta=0)} = \frac{1}{3} \qquad \theta_{1,1} = \frac{1}{15}$$

$$\theta_{0,7} = \frac{1}{9} \qquad \theta_{1,15} = \frac{1}{15}$$

(d) $P(\text{today is secret} \mid \text{spam}) = P((1,0,0,0,0,0,1,0,0,0,1,0,0,0,0) \mid \text{spam})$

$= \frac{3}{9} \times (1-\frac{2}{9}) \times 1 \times 1 \times 1 \times 1 \times \frac{1}{9} \times (1-\frac{1}{9}) \times (1-\frac{1}{9}) \times 1 \times \frac{1}{9} \times 1 \times 1 \times 1 \times 1$

$= 0.0025$

	spam	ham
secret	3/9	1/15
after	2/9	0
Low	0	2/15
Price	0	2/15
Valued	0	1/15
customer	0	1/15
today	1/9	1/15
dollar	1/9	0
million	1/9	0
sports	0	2/15
is	1/9	1/15
for	0	1/15
play	0	1/15
healty	0	1/15
pizza	0	1/15

$P(\text{today is secret} \mid \text{ham}) = \frac{1}{15} \times 1 \times (1-\frac{2}{15}) \times (1-\frac{2}{15}) \times (1-\frac{1}{15}) \times (1-\frac{1}{13}) \times \frac{1}{15} \times 1 \times 1 \times (1-\frac{2}{15}) \times \frac{1}{15} \times (1-\frac{1}{15}) \times (1-\frac{1}{13}) \times (1-\frac{1}{15})(1-\frac{1}{15}) = 0.00013$

$P(\text{spam} \mid \text{today is secret}) = \frac{0.0025 \times 4/7}{0.0025 \times 4/7 + 0.00013 \times 3/7} = \frac{0.00121}{0.001449} = 0.967$

$P(\text{ham} \mid \text{today is secret}) = \frac{0.00005571}{0.001447} = 0.03$

It is Spam