1) a) $P(A,B|X) = P(B|X)\,P(A|B,X)$

$$\frac{P(A,B,X)}{P(X)} = \frac{P(A|B,X)\,P(B|X)\,P(X)}{P(X)} = P(A|B,X)\,P(B|X)$$

b) $P(A,B,C,D) = P(A|B,C,D)\,P(B|C,D)\,P(C|D)\,P(D)$

The general form of the chain rule is $P(A_1, A_2, \ldots, A_n) = P(A_1|A_2, \ldots A_n)\,P(A_2|A_3, \ldots A_1)\,P(A_{n-1}|A_n)\,P(A_n)$, therefore $P(A,B,C,D) = P(A|B,C,D)\,P(B|C,D)\,P(C|D)\,P(D)$.

c) Yes because the chain rule deals with multiplication, it doesn't matter what variables are put where.

2) a) $P(A)\,P(B|A) = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$

b) $P(C|A)\,P(C|\neg A) = \frac{1}{2} \cdot 1 = \frac{1}{2}$

c) 0 because you can never have B and C at the same time

3) 

	yellow 50%	green 20%
was green	1/4	2/3
not green	3/4	1/3

	yellow	green
was green	0.2	0.13333
not green	0.6	0.06660

$0.2 + 0.13333 = \frac{1}{3}$

$\frac{0.13333}{\frac{1}{3}} = 0.4$

4) a) It would be difficult because the variation would be too high. The odds of documents starting the same way and having words in the same positions is very slim