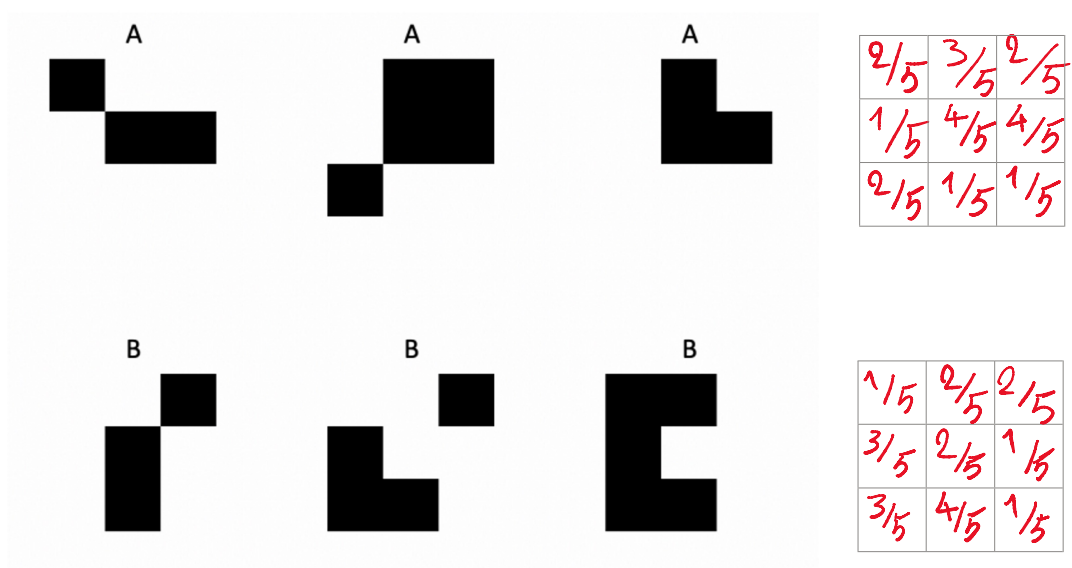
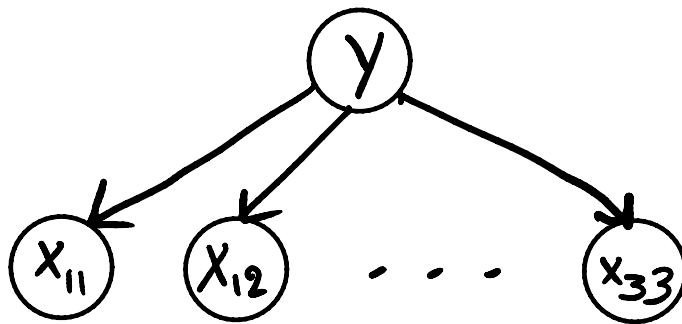


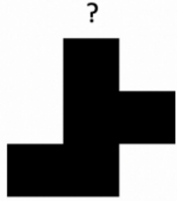
a) I used pixel values as features.

Consider every alphabet as an 3×3

square which pixels can have 2 possible

values (black/white).





$$P(Y=y | X) \propto P(y=y) \times \underbrace{P(X | Y=y)}_{\prod_{i,j} P(X_{ij} | Y=y)}$$

$$\begin{aligned} P(Y=A | X) &\propto \frac{3}{6} \times \frac{3}{5} \times \frac{3}{5} \times \frac{3}{5} \\ &\quad \times \frac{4}{5} \times \frac{4}{5} \times \frac{4}{5} \\ &\quad \times \frac{2}{5} \times \frac{1}{5} \times \frac{4}{5} \\ &= \frac{3^4 \times 4^4 \times 2}{6 \times 5^6} \end{aligned}$$

$$\begin{aligned} P(Y=B | X) &\propto \frac{3}{6} \times \frac{4}{5} \times \frac{2}{5} \times \frac{3}{5} \\ &\quad \times \frac{2}{5} \times \frac{2}{5} \times \frac{1}{5} \\ &\quad \times \frac{3}{5} \times \frac{4}{5} \times \frac{4}{5} \\ &= \frac{3^3 \times 4^3 \times 2}{6 \times 5^6} \end{aligned}$$

$$P(Y=A | X) > P(Y=B | X) \Rightarrow \underline{\underline{X \text{ is } A}}$$

As you can see I also used Laplace Smoothing

because if I do not, X_{32} gets Zero and

$P(Y=A | X)$ gets Zero and prediction is wrong.