Covariance

- Let us say that we have

$$\mathbb{P}(X = 1 \wedge Y = 1) = \mathbb{P}(X = 0 \wedge Y = 0) = \alpha,$$
$$\mathbb{P}(X = 1 \wedge Y = 0) = \mathbb{P}(X = 0 \wedge Y = 1) = \frac{1}{2} - \alpha,$$

- What is covariance?

$$\mathrm{cov}(X, Y) = \mathbb{E}[XY] - \mathbb{E}[X]\mathbb{E}[Y].$$

- Note that $XY = 1$ only if $X = 1$ and $Y = 1$, so this gives

$$\mathrm{cov}(X, Y) = \alpha - 1/4.$$