

# XOR Cipher (a.k.a Vernham Cipher)

a modern version of Vigenere

**Use**  $\oplus$  to combine the message and the key

$$E_k(m) = k \oplus m$$

$$D_k(c) = k \oplus c$$

$$D_k(E_k(m)) = k \oplus (k \oplus m) = m$$

**Problem** : known-plaintext attack

$$\text{so } k = (k \oplus m) \oplus m$$

$x \oplus x = 0$
$x \oplus 0 = x$

# Mauborgne Cipher - a modern version of OTP

**Use a random stream** as encryption key

➔ Defeats the know-plaintext attack

**Problem** : Key-reused attack (a.k.a two-time pad)

$$C_1 = k \oplus m_1$$

$$C_2 = k \oplus m_2$$

$$\begin{aligned}\text{so } C_1 \oplus C_2 &= (k \oplus m_1) \oplus (k \oplus m_2) \\ &= (m_1 \oplus m_2) \oplus 0 \\ &= (m_1 \oplus m_2)\end{aligned}$$

$x \oplus x = 0$
$x \oplus 0 = x$