# Predicate Encryption from LWE

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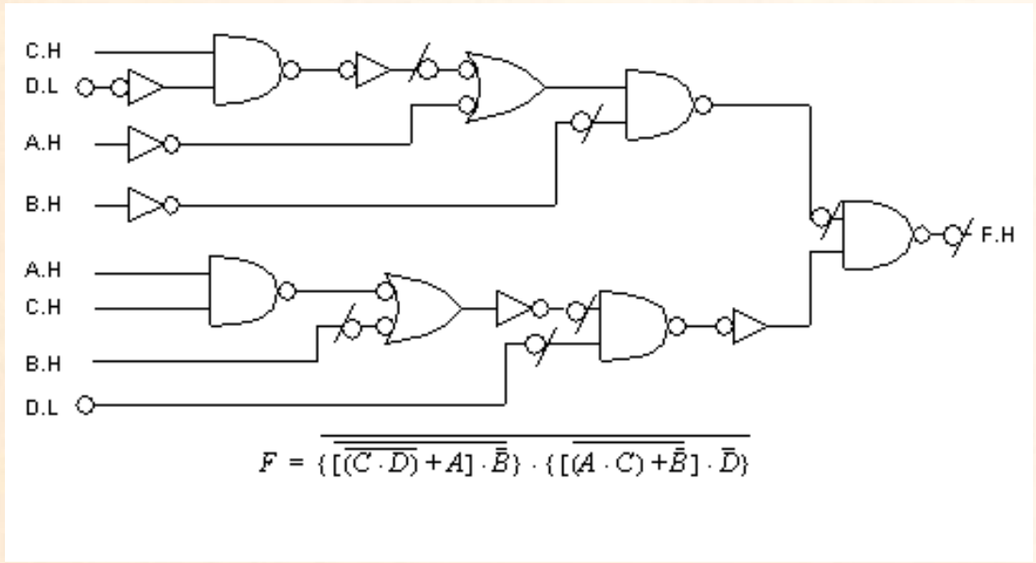
# Predicate Encryption

[KSW08, OT09, LOSTW10]

## Secret Keys

for functions $F$

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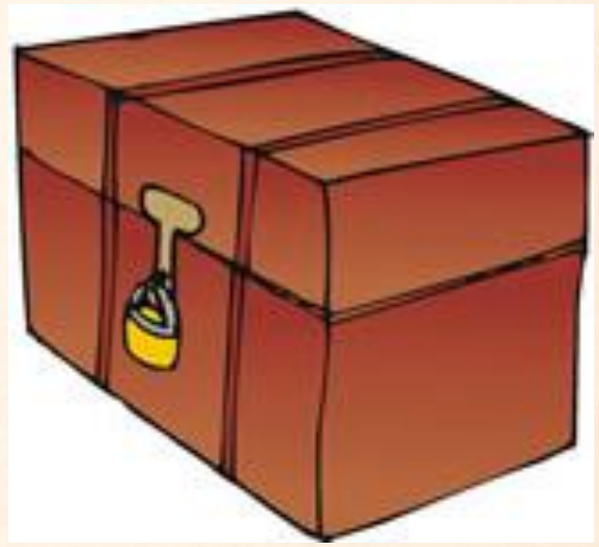
## Ciphertexts

for inputs $x$ & msg $m$



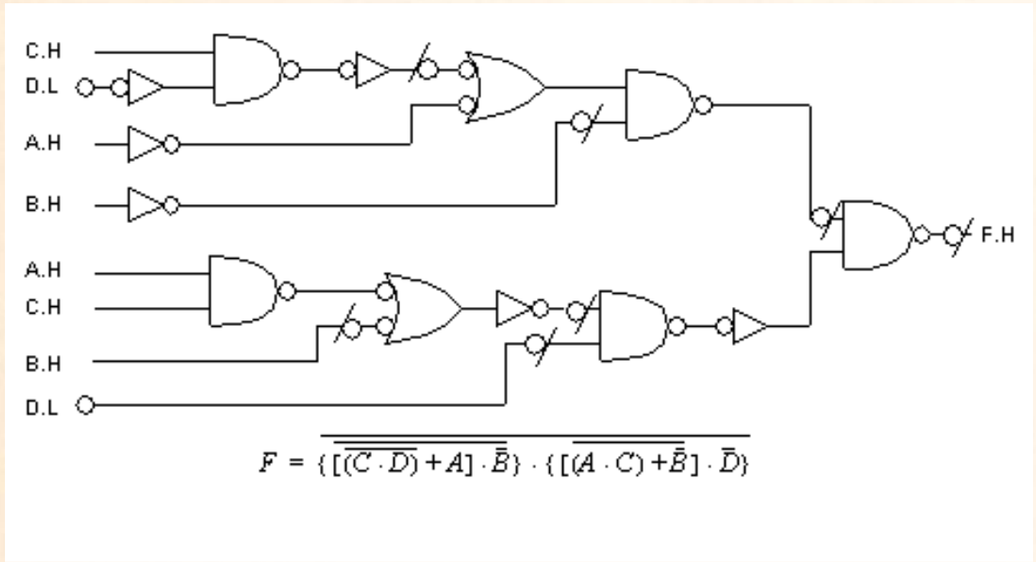
**Decrypt iff $F(x) = 1$**

# PE for Inner Products

[KSW08, OT09, LOSTW10]

## Secret Key

for vector **v**

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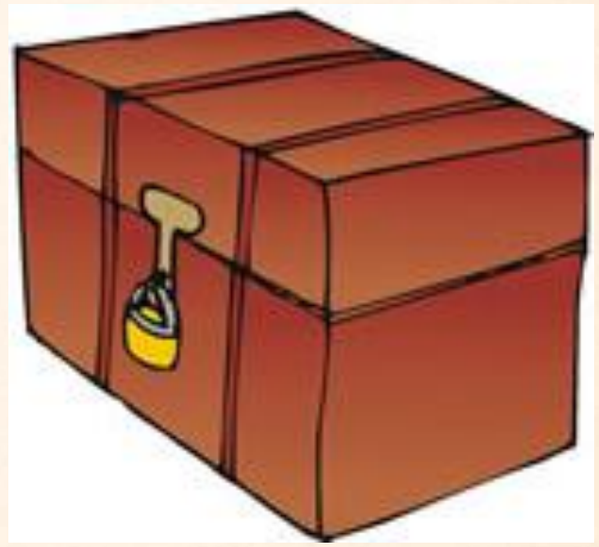
## Ciphertexts

for vector **w** & msg *m*



**Decrypt iff <v,w>=0**

# Predicate Encryption

[KSW08, OT09, LOSTW10]

Theorem [AFV11]: Predicate Encryption for Inner Products from Learning with Errors (LWE).

Main Difficulty:

- Bilinear world : same group for all keys/CT
- Lattices : Different lattice for every key/CT

# Predicate Encryption

[KSW08,OT09, LOSTW10

Solution: New algebraic technique (built on ABB10a IBE) that *"matches"* key lattice $L_v$ to ciphertext lattice $L_w$ iff $\langle \mathbf{v},\mathbf{w} \rangle = 0$.

However, only *weakly attribute hiding*
(as in OT09, LOSTW10 ; not as in KSW08)

# Why Lattices?

**The Usual:** Worst-case reduction, quantum security

**The New:** Inner products over small fields

**The Future:** More complex predicates?

Three wise men said:

*"For predicate encryption…the inability to move beyond inner products stems from the 'bi' in Bilinear maps"* - Boneh, Sahai, Waters, 2011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