## CS5760: Cryptanalysis of DES and DES-like Iterated Cryptosystems

Gautam Singh

Indian Institute of Technology Hyderabad

February 3, 2025

Introduction to Differential Cryptanalysis
Differential Cryptanalysis

## Differential Cryptanalysis

- Chosen plaintext attack.
- Exploit XOR between plaintext pairs to find key bits.

## Differential Cryptanalysis

- Chosen plaintext attack.
- Exploit XOR between plaintext pairs to find key bits.
- Per DES round, XOR is invariant under:
  - Expansion E to get  $S_E$ .
  - Key mixing with subkey S<sub>K</sub> to get S<sub>I</sub> = S<sub>E</sub> ⊕ S<sub>K</sub>.
  - Permutation on S<sub>O</sub> after S boxes.

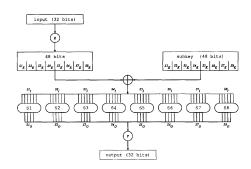


Figure 1: *F* function of DES.

## Differential Cryptanalysis

- Chosen plaintext attack.
- Exploit XOR between plaintext pairs to find key bits.
- Per DES round, XOR is invariant under:
  - Expansion E to get S<sub>E</sub>.
  - Key mixing with subkey S<sub>K</sub> to get S<sub>I</sub> = S<sub>E</sub> ⊕ S<sub>K</sub>.
  - Permutation on S<sub>O</sub> after S boxes.
- S boxes are nonlinear. Probability analysis performed on XOR of S box inputs and outputs.

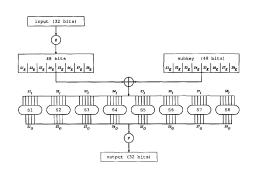


Figure 1: *F* function of DES.