LAB ASSIGNMENT: 02

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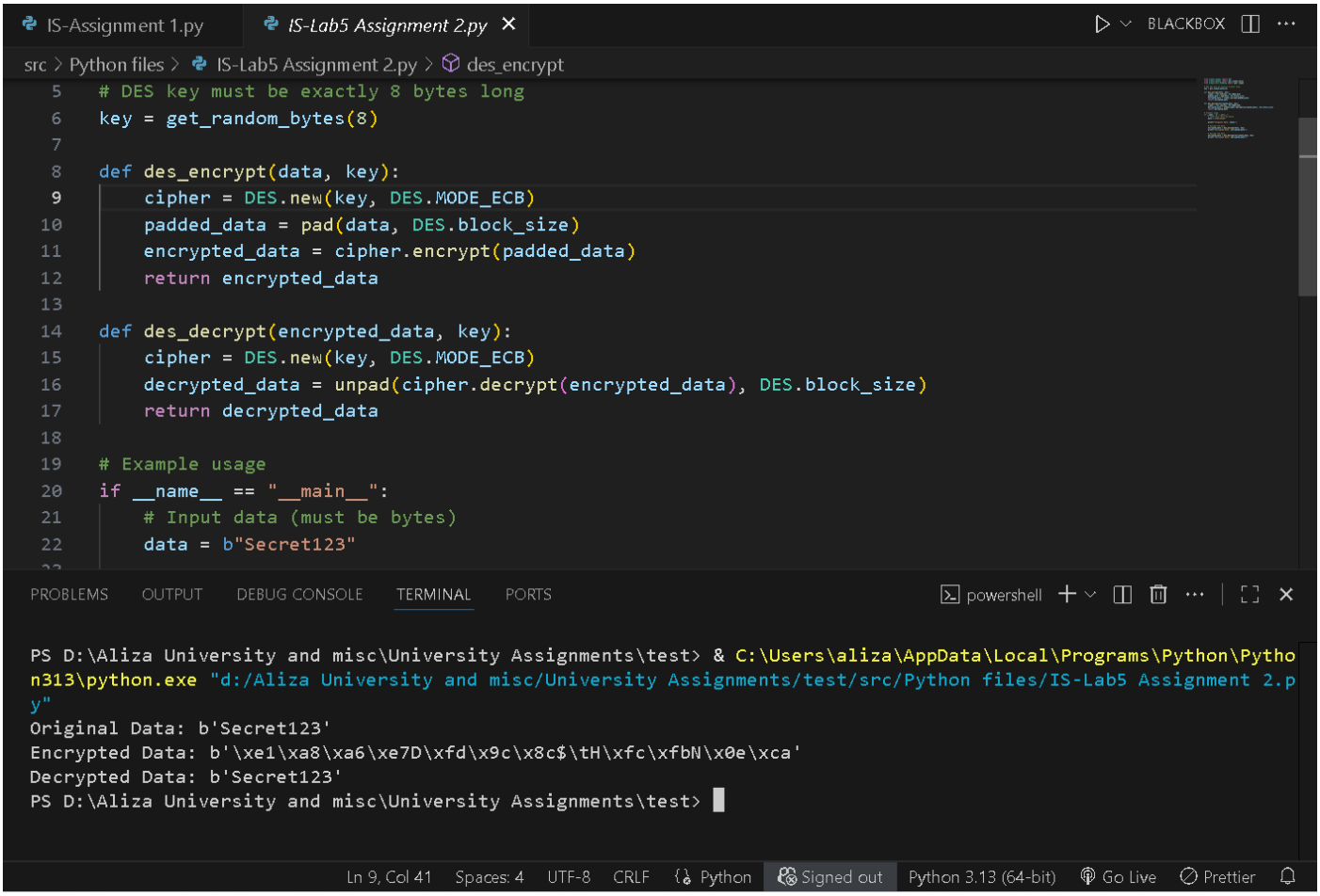
COURSE: Information Security

DES Block Cipher Algorithm

Graded Lab Task 1: You have implemented DES there is built in implemented DES in python in crypto cipher module use it for encryption/decryption and provide output sample example



What This Code Does:

- This code is a **secret message machine** that uses DES encryption. It takes a normal message, turns it into secret code using a password, and then turns it back to the original message.

How It Works:

Step 1 - Make a Password:

- Creates a random 8-character password (this is the DES key)

Step 2 - Hide the Message (Encryption):

- Takes your message and the password
- Adds some extra characters to make it the right size (called padding)

- Scrambles it into secret code that looks like random numbers

Step 3 - Get Back Message (Decryption):

- Takes the secret code and the same password
- Unscrambles the secret code
- Removes the extra characters
- Returns your original message

Graded Lab Task 2:

1. Simple Step-by-Step Explanation

Step 1: The Attacker's Starting Point

- **Attacker has:** A known message + its encrypted version
- **Example:**
  - Plaintext: "HELLO"
  - Ciphertext: "XJ9#L"

Step 2: Split the Problem

- DES uses 56-bit key (HUGE number: 72,057,594,037,927,936)
- Instead of trying all keys, split into two parts:
  - **K1** = First 28 bits
  - **K2** = Last 28 bits

Step 3: Forward Attack (From Start)

For each possible K1:

P → [Encrypt with K1] → I1

Store (I1, K1) in a table

What happens: Try all first-half keys and see where they lead

Step 4: Backward Attack (From End)

For each possible K2:

C → [Decrypt with K2] → I2

Check if I2 exists in table

What happens: Try all second-half keys and see where they come from

Step 5: The "Meet" Moment

When I1 == I2:

SUCCESS! Full Key = K1 + K2

The magic: Both paths meet at the same middle point!

2. Real Example

Let's say DES encryption works like this:

"HELLO" → [FIRST HALF] → "MID123" → [SECOND HALF] → "XJ9#L"

Attack Process:

ATTACKER TRIES:

K1 = "ABC" → "HELLO" → Encrypt → Gets "MID111"

K1 = "SEC" → "HELLO" → Encrypt → Gets "MID123"

K2 = "XYZ" → "XJ9#L" → Decrypt → Gets "MID999"

K2 = "RET" → "XJ9#L" → Decrypt → Gets "MID123"

MATCH FOUND! Both reached "MID123"

FULL KEY = "SEC" + "RET" = "SECRET"

3. Why This is So Powerful

Normal Brute Force:

Try all 56-bit keys one by one:

2^{56} = 72,057,594,037,927,936 attempts

Time: YEARS!

MITM Attack:

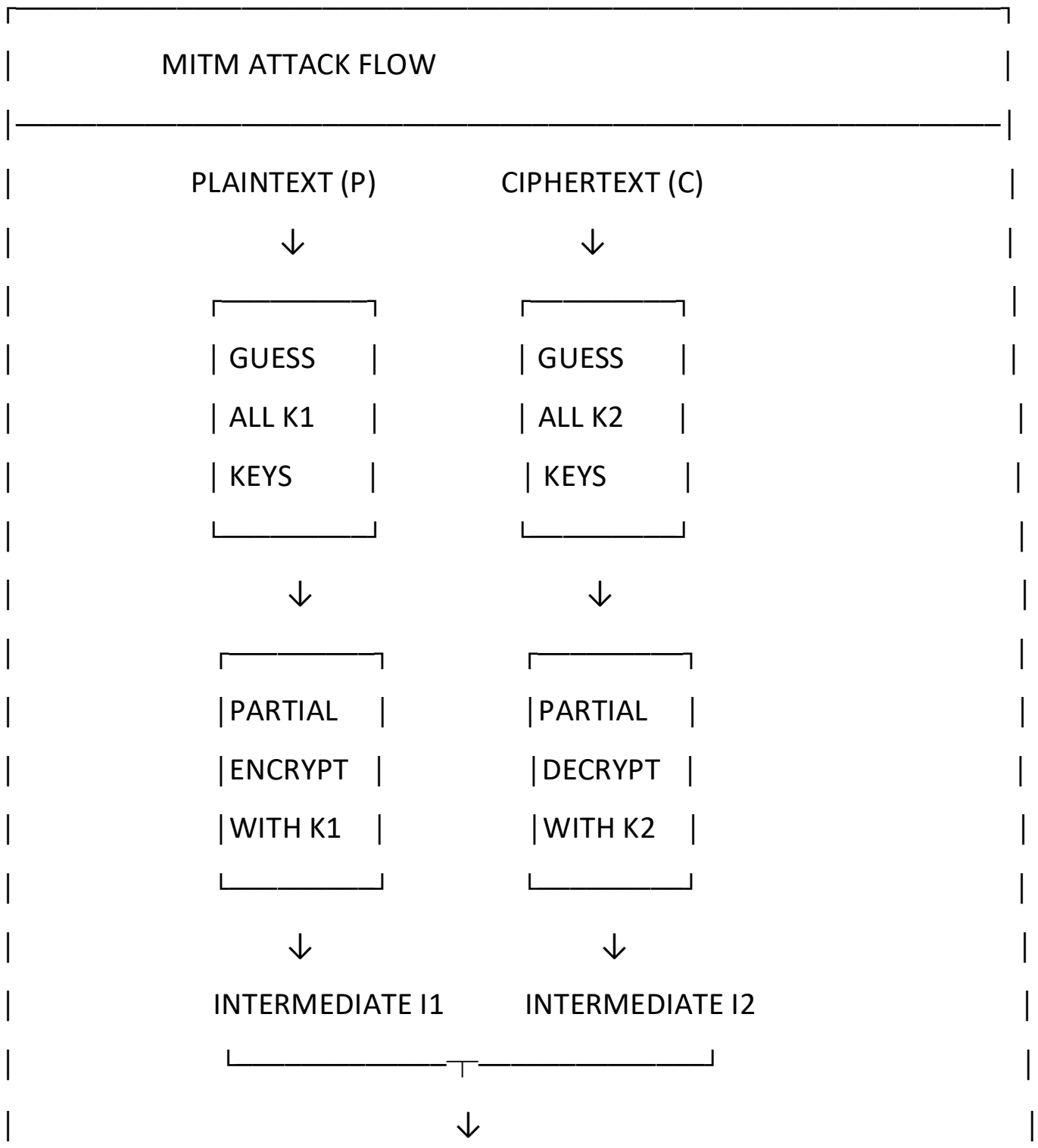
Try all 28-bit K1 keys: 2^{28} = 268,435,456 attempts

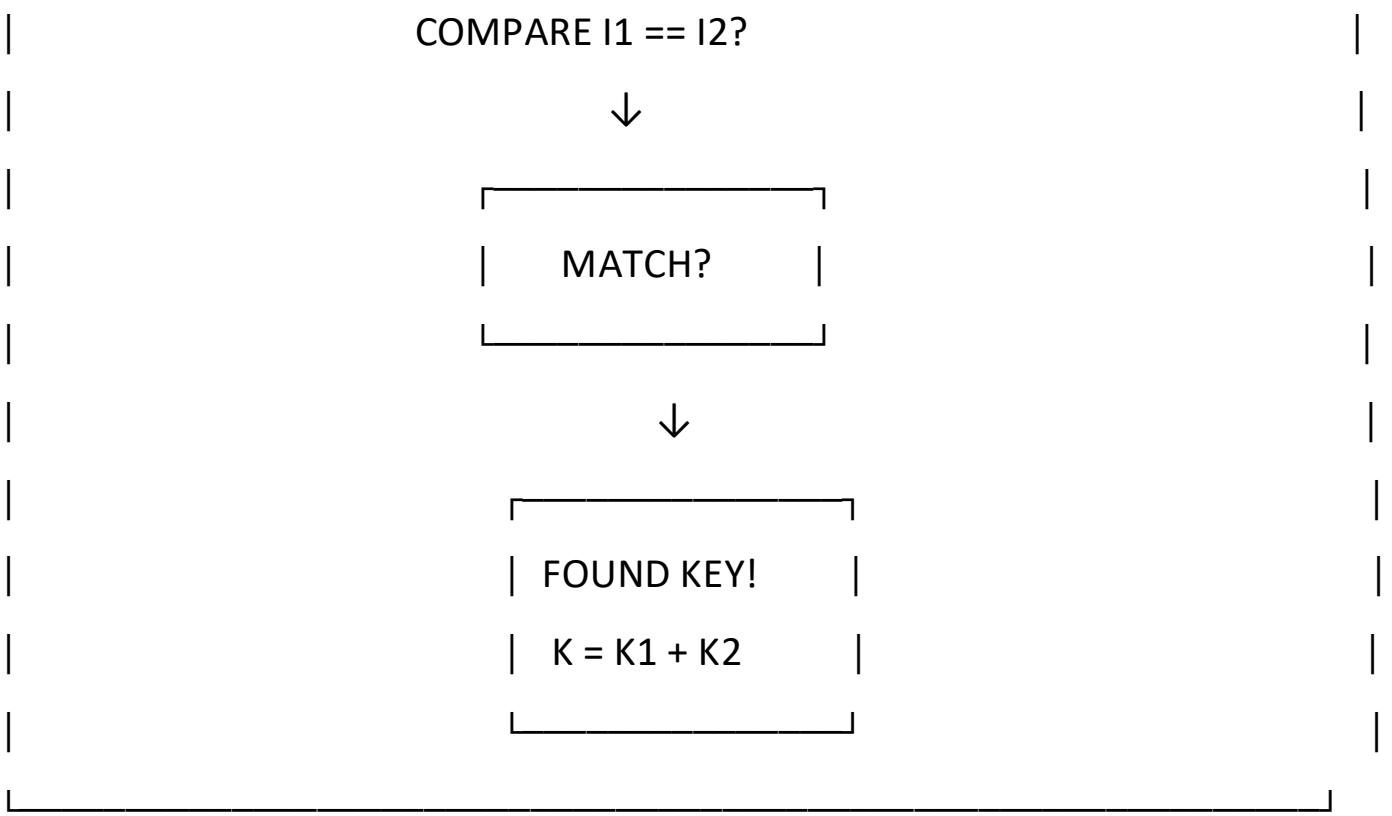
Try all 28-bit K2 keys: 2^{28} = 268,435,456 attempts

Total: 536,870,912 attempts

Time: HOURS/DAYS!

Speed Improvement: About **134 million times faster!**




COMPARE I1 == I2?
MATCH?
FOUND KEY!
K = K1 + K2