**List Comprehension in Python**

List comprehension is a concise and efficient way to create lists in Python. It provides a shorter syntax for generating a new list by applying an expression to each item in an iterable (like a list, tuple, or range).

**Basic Syntax**

new\_list = [expression for item in iterable if condition]

* **expression** → The operation to perform on each item.
* **item** → Each element from the iterable.
* **iterable** → The source of elements (e.g., list, range, string).
* **condition (optional)** → A filter to include only certain elements.

**Examples**

**1. Create a List from a Range**

squares = [x\*\*2 for x in range(5)]

print(squares) # Output: [0, 1, 4, 9, 16]

🔹 This generates a list of squares of numbers from 0 to 4.

**2. Using a Condition (Filtering)**

even\_numbers = [x for x in range(10) if x % 2 == 0]

print(even\_numbers) # Output: [0, 2, 4, 6, 8]

🔹 Only even numbers are included.

**3. Transform Elements**

words = ["hello", "world", "python"]

uppercased\_words = [word.upper() for word in words]

print(uppercased\_words) # Output: ['HELLO', 'WORLD', 'PYTHON']

🔹 Converts all words to uppercase.

**4. Nested List Comprehension (Flattening a List)**

matrix = [[1, 2, 3], [4, 5, 6], [7, 8, 9]]

flat\_list = [num for row in matrix for num in row]

print(flat\_list) # Output: [1, 2, 3, 4, 5, 6, 7, 8, 9]

🔹 Flattens a 2D list into a 1D list.

**5. Using Functions Inside List Comprehension**

def square(x):

return x \* x

squared\_numbers = [square(x) for x in range(5)]

print(squared\_numbers) # Output: [0, 1, 4, 9, 16]

🔹 Applies the square() function to each element.

**List Comprehension vs. Traditional Loop**

**Without List Comprehension:**

squares = []

for x in range(5):

squares.append(x\*\*2)

**With List Comprehension:**

squares = [x\*\*2 for x in range(5)]

✅ List comprehension is **shorter and more readable**.

**Key Benefits**

✔ **More concise and readable**  
✔ **Faster execution** compared to traditional loops  
✔ **Less code, fewer errors**