1. Operator Overloading

- Operators are symbols like `+`, `-`, `*`, `/` used to perform operations.

By default, they work for numbers:

```
 print(2 + 3)   # 5
print(4 * 2)   # 8
```

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- But in Python, the same operators can be **overloaded** (used differently) depending on the data type.

👉 Example with strings and lists:

```
print("Hello " + "World")   # Concatenates strings → "Hello World"
print([1, 2] + [3, 4])      # Merges lists → [1, 2, 3, 4]
print("Ha" * 3)             # Repeats string → "HaHaHa"
print([1, 2] * 3)           # Repeats list → [1, 2, 1, 2, 1, 2]
```

So:

- `+` doesn't just mean addition — it can also mean **concatenation**.
- `*` doesn't just mean multiplication — it can also mean **repetition**.

That's **operator overloading**.
 The same operator behaves differently based on the data type.

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2. Examples with the Tea Analogy (from your text)

- Base liquids = `["water", "milk"]`
- Extra flavor = `["ginger"]`

```
base_liquid = ["water", "milk"]
extra_flavor = ["ginger"]

liquid_mix = base_liquid + extra_flavor
print(liquid_mix)   # ['water', 'milk', 'ginger']
```

Here, the **+ operator is overloaded** to join two lists.

Another example:

```
strong_brew = ["black tea"] * 3
print(strong_brew)   # ['black tea', 'black tea', 'black tea']
```

If we had multiple ingredients:

```
brew = ["black tea", "water"] * 3
print(brew)
# ['black tea', 'water', 'black tea', 'water', 'black tea', 'water']
```

So `* 3` repeats the entire list while keeping the order.

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3. operator Module

Python has a built-in module called `operator`.
It gives functions for doing operations.

👉 Example with `itemgetter`:

```
from operator import itemgetter

fruits = ["apple", "banana", "cherry"]
get_first = itemgetter(0)   # function to get the first item
print(get_first(fruits))    # apple
```

This looks confusing in docs, but it’s just a shortcut for getting elements without writing `list[0]`.

4. Strings to Lists

If you convert a string directly:

```
spice = "cinnamon"
print(list(spice))
# ['c', 'i', 'n', 'n', 'a', 'm', 'o', 'n']
```

👉 Each character becomes an element in a list.

If you wrap the whole string in a list:

```
print([spice])
# ['cinnamon']
```

👉 The entire word becomes **one element**.

5. Byte Array

A **byte array** stores data as raw bytes (numbers between 0–255).
Useful when dealing with files, encoding, or binary data.

Example:

```
data = bytearray(b"cinnamon")
print(data)
# bytearray(b'cinnamon')

print(list(data))
# [99, 105, 110, 110, 97, 109, 111, 110]
```

Here each number is the **ASCII / UTF-8 code** of each character:

- `c → 99`

- `i → 105`
- `n → 110`
  etc.

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6. Replacing Inside Byte Array

```
data = bytearray(b"cinnamon")
data = data.replace(b"cina", b"carda")
print(data)
# bytearray(b'cardamomon')
```

But notice—it's tricky, because you must always use **bytes** (with a `b""` prefix).

✅ **Summary so far**:

- Operator overloading = Same operators doing different tasks depending on type (`+` = add, concat, etc.).
- Lists can be combined (`+`) or repeated (`*`).
- `operator.itemgetter` helps extract elements easily.
- Strings can turn into lists (`list("cinnamon") → ['c','i','n'...]`).
- Byte arrays = numbers representing characters in raw form.
- Replace works with `b"text"` inside byte arrays.