Lists

Create, access, and modify ordered collections.

```
panels = ["SunPower", "Jinko", "LONGi"]
panels[0]          # "SunPower" (first)
panels[-1]         # "LONGi" (last)
len(panels)        # 3
```

Method	Effect
`append(x)`	Add `x` to end
`insert(i, x)`	Insert `x` at index `i`
`remove(x)`	Remove first occurrence of `x`
`pop()`	Remove & return last item
`pop(i)`	Remove & return item at index `i`

Iterating Lists

```
for panel in panels:
    print(panel)

for i, panel in enumerate(panels):
    print(f"{i}: {panel}")
```

Dictionaries

Store key-value pairs. Keys must be unique.

```
panel = {
    "brand": "SunPower",
    "watts": 440,
    "price": 450
}
panel["brand"]           # "SunPower"
panel.get("warranty")    # None (no error)
panel["warranty"] = 25   # Add new key
```

Iterating Dictionaries

```
for key in panel:              # keys only
for value in panel.values():   # values only
for k, v in panel.items():     # both
    print(f"{k}: {v}")
```

List of Dictionaries

The most common pattern for structured data:

```
panels = [
    {"brand": "SunPower", "watts": 440},
    {"brand": "Jinko", "watts": 420},
]
for p in panels:
    print(p["brand"], p["watts"])
```

Auto-Incrementing IDs

```
next_id = max(p["panel_id"]
              for p in panels) + 1
```

Reading Text Files

```
with open("data.txt", "r") as f:
    content = f.read()       # whole file
    # OR
    lines = f.readlines()    # list of lines
```

Always use `with` – it closes the file automatically.

Writing Text Files

Mode	Effect
`"r"`	Read (default)
`"w"`	Write (overwrites!)
`"a"`	Append (adds to end)

```
with open("quote.txt", "w") as f:
    f.write("System: 6.6 kW\n")
    f.write(f"Cost: ${cost:.2f}\n")
```

Reading CSV Files

```
import csv

with open("panels.csv", "r") as f:
    reader = csv.DictReader(f)
    for row in reader:
        brand = row["brand"]
        watts = int(row["watts"])
```

`DictReader` uses the header row as keys. All values are strings — convert with `int()` / `float()`.

Writing CSV Files

```
import csv

with open("out.csv", "w", newline="") as f:
    fields = ["brand", "watts", "price"]
    writer = csv.DictWriter(f,
                            fieldnames=fields)
    writer.writeheader()
    for panel in panels:
        writer.writerow(panel)
```

Common Errors

KeyError – accessing a key that doesn't exist.
Use `dict.get("key")` or check `if "key" in dict`.

IndexError – accessing index beyond list length.
A list of 3 items has indices 0, 1, 2 only.

Forgetting `newline=""` in `csv.writer` on Windows.
Without it you get blank lines between rows.

CSV values are strings – `row["watts"]` is `"440"` not `440`.
Always convert: `int(row["watts"])`.