FOUNDATION LESSON

WEEK 4 · LESSON 6

Summarise arrays along an axis

A reduction removes the selected axis and retains the others

THE IDEA BEHIND THE OPERATION

MENTAL MODEL

The idea behind the operation

A reduction removes the selected axis and retains the others

TOTALS WITH EXPLICIT OUTPUT SHAPES

CODE WALKTHROUGH W04-L06-S03

```
01  import numpy as np
02  sales = np.array([[20, 60, 5], [40, 0, 10]])
03  print("Product totals:", sales.sum(axis=0))
04  print("Store totals:", sales.sum(axis=1))
05  print("Grand total:", sales.sum())
```

WHAT TO TRACK

Rows: two stores. Columns: three products.

PREDICT THE RESULT

Predict the output.
Explain each operation.
Pause before continuing.

TOTALS WITH EXPLICIT OUTPUT SHAPES — RESULT

CODE WALKTHROUGH W04-L06-S04

```
01  import numpy as np
02  sales = np.array([[20, 60, 5], [40, 0, 10]])
03  print("Product totals:", sales.sum(axis=0))
04  print("Store totals:", sales.sum(axis=1))
05  print("Grand total:", sales.sum())
```

WHAT TO TRACK

Rows: two stores. Columns: three products.

VALIDATE THE RESULT

```
Product totals: [60 60 15]
Store totals: [85 50]
Grand total: 135
```

SUPPLIED ONE-PERIOD RETURNS

CODE WALKTHROUGH W04-L06-S05

```
01  import numpy as np
02  returns = np.array([0.02, -0.01, 0.03])
03  print("Count:", returns.size)
04  print("Mean:", round(float(returns.mean()), 4))
05  print("Min:", float(returns.min()))
06  print("Max:", float(returns.max()))
07  print("Population SD:", round(float(returns.std(ddof=0)), 4))
```

WHAT TO TRACK

Three fictional same-period decimal returns; describe this supplied set.

PREDICT THE RESULT

Predict the output.
Explain each operation.
Pause before continuing.

SUPPLIED ONE-PERIOD RETURNS — RESULT

CODE WALKTHROUGH W04-L06-S06

```
01  import numpy as np
02  returns = np.array([0.02, -0.01, 0.03])
03  print("Count:", returns.size)
04  print("Mean:", round(float(returns.mean()), 4))
05  print("Min:", float(returns.min()))
06  print("Max:", float(returns.max()))
07  print("Population SD:", round(float(returns.std(ddof=0)), 4))
```

WHAT TO TRACK

Three fictional same-period decimal returns; describe this supplied set.

VALIDATE THE RESULT

```
Count: 3
Mean: 0.0133
Min: -0.01
Max: 0.03
Population SD: 0.017
```

AN EMPTY BATCH HAS NO MEAN HERE

CODE WALKTHROUGH W04-L06-S07

```
01  import numpy as np
02  values = np.array([])
03  print("Empty total:", values.sum())
04  if values.size == 0:
05      raise ValueError("at least one observation is required")
06  print(values.mean())
```

WHAT TO TRACK

Empty sum is zero; an average requires observations.

PREDICT THE RESULT

Predict the output.
Explain each operation.
Pause before continuing.

AN EMPTY BATCH HAS NO MEAN HERE — RESULT

CODE WALKTHROUGH W04-L06-S08

```
01  import numpy as np
02  values = np.array([])
03  print("Empty total:", values.sum())
04  if values.size == 0:
05      raise ValueError("at least one observation is required")
06  print(values.mean())
```

WHAT TO TRACK

Empty sum is zero; an average requires observations.

VALIDATE THE RESULT

```
Empty total: 0.0
ValueError: at least one
observation is required
```

GUIDED MODIFICATION

LEARNER PRACTICE

Guided modification

For [[10, 20], [30, 40]], print axis-zero totals, axis-one totals and the grand total. Reconcile both summary arrays with the same grand total.

PREDICT · MODIFY · RUN

01 Restate the supplied rules.

02 Predict the result.

03 Modify and run the code.

04 Compare actual output.

05 Explain any difference.

INDEPENDENT APPLICATION

LEARNER PRACTICE

Independent application

For [10.0, NaN, 30.0], report the valid count, ordinary mean and nanmean. The supplied policy permits omitting missing observations only when the count is reported. Explain the denominator.

PREDICT · MODIFY · RUN

01 Restate the supplied rules.

02 Predict the result.

03 Modify and run the code.

04 Compare actual output.

05 Explain any difference.

RECAP AND NEXT STEP

Recap and next step

Predict the shape remaining after a reduction and reconcile totals. State policies for empty and missing inputs. One-period summaries stay separate from compounding. Next, pandas adds labels to our numerical data.

UNDERSTAND APPLY VALIDATE EXPLAIN