FOUNDATION LESSON

WEEK 5 · LESSON 10

Scatter plots, labels and annotations

A scatter plot preserves paired observations; association does not establish a cause.

THE MENTAL MODEL

MENTAL MODEL

The mental model

A scatter plot preserves paired observations; association does not establish a cause.

PAIRED OBSERVATIONS

CODE WALKTHROUGH W05-L10-S03

```
01  import matplotlib
02  matplotlib.use("Agg")
03  import matplotlib.pyplot as plt
04  plt.rcParams.update({"font.size": 16})
05  fig,ax=plt.subplots(figsize=(12,6.75))
06  ax.scatter([10,20,30,40],[50,65,62,90])
07  ax.set(title="Four fictional branches · March",
08         xlabel="Advertising spend (EUR)",ylabel="Sales (units)")
09  fig.tight_layout()
10  fig.savefig("figure.png", dpi=320)
11  plt.close(fig)
12  print("Saved figure.png: 3840 x 2160")
```

WHAT TO TRACK

Paired observations

PREDICT THE RESULT

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

PAIRED OBSERVATIONS · RESULT

CODE WALKTHROUGH W05-L10-S04

```
01  import matplotlib
02  matplotlib.use("Agg")
03  import matplotlib.pyplot as plt
04  plt.rcParams.update({"font.size": 16})
05  fig,ax=plt.subplots(figsize=(12,6.75))
06  ax.scatter([10,20,30,40],[50,65,62,90])
07  ax.set(title="Four fictional branches · March",
08         xlabel="Advertising spend (EUR)",ylabel="Sales (units)")
09  fig.tight_layout()
10  fig.savefig("figure.png", dpi=320)
11  plt.close(fig)
12  print("Saved figure.png: 3840 x 2160")
```

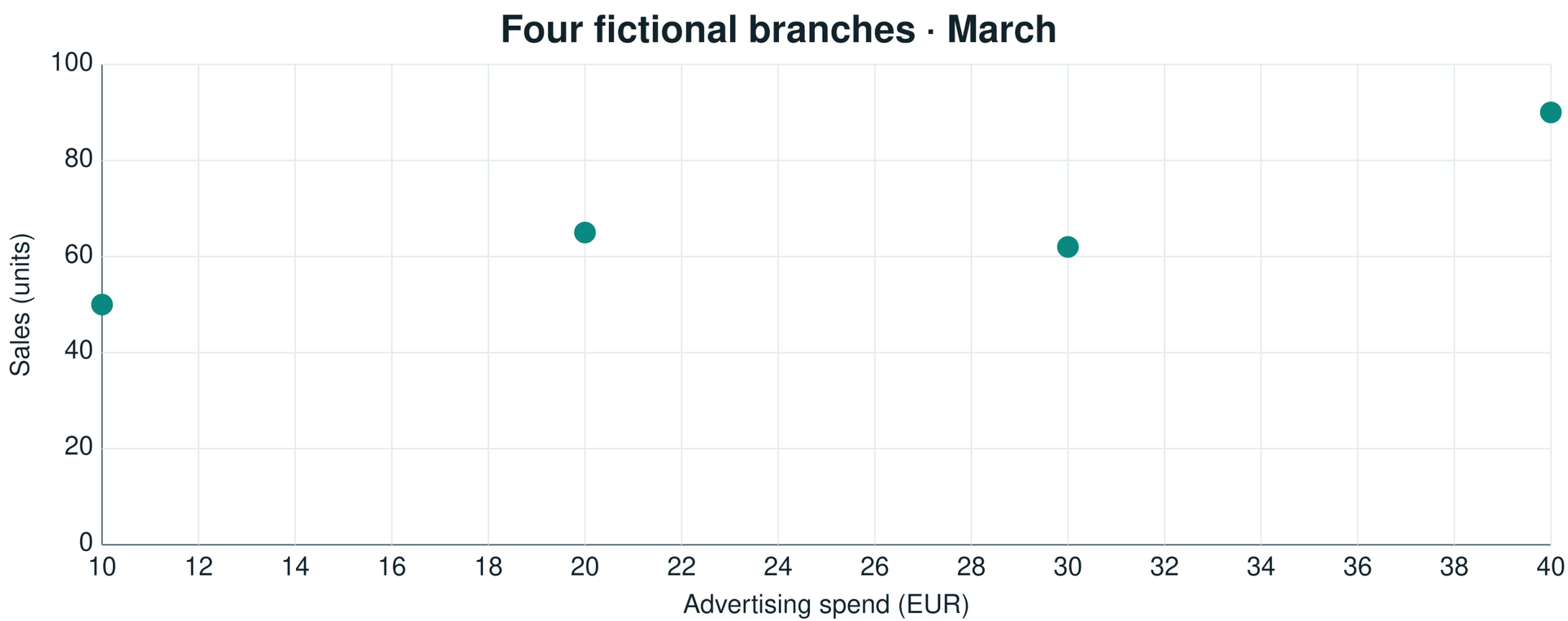
WHAT TO TRACK

Paired observations

VALIDATE THE RESULT

```
Saved figure.png: 3840 x
2160
```

VISIBLE CHART RESULT



ANNOTATE A KNOWN OBSERVATION

CODE WALKTHROUGH W05-L10-S06

```
01  import matplotlib
02  matplotlib.use("Agg")
03  import matplotlib.pyplot as plt
04  plt.rcParams.update({"font.size": 16})
05  fig,ax=plt.subplots(figsize=(12,6.75))
06  ax.scatter([10,20,30],[50,65,62])
07  ax.annotate("Branch C",xy=(30,62),xytext=(24,52),
08              arrowprops={"arrowstyle":"->"})
09  ax.set(title="Observed branch comparison · March",
10         xlabel="Spend (EUR)",ylabel="Sales (units)")
11  fig.tight_layout()
12  fig.savefig("figure.png", dpi=320)
13  plt.close(fig)
14  print("Saved figure.png: 3840 x 2160")
```

WHAT TO TRACK

Annotate a known observation

PREDICT THE RESULT

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

ANNOTATE A KNOWN OBSERVATION · RESULT

CODE WALKTHROUGH W05-L10-S07

```
01 import matplotlib
02 matplotlib.use("Agg")
03 import matplotlib.pyplot as plt
04 plt.rcParams.update({"font.size": 16})
05 fig,ax=plt.subplots(figsize=(12,6.75))
06 ax.scatter([10,20,30],[50,65,62])
07 ax.annotate("Branch C",xy=(30,62),xytext=(24,52),
08             arrowprops={"arrowstyle":"->"})
09 ax.set(title="Observed branch comparison · March",
10        xlabel="Spend (EUR)",ylabel="Sales (units)")
11 fig.tight_layout()
12 fig.savefig("figure.png", dpi=320)
13 plt.close(fig)
14 print("Saved figure.png: 3840 x 2160")
```

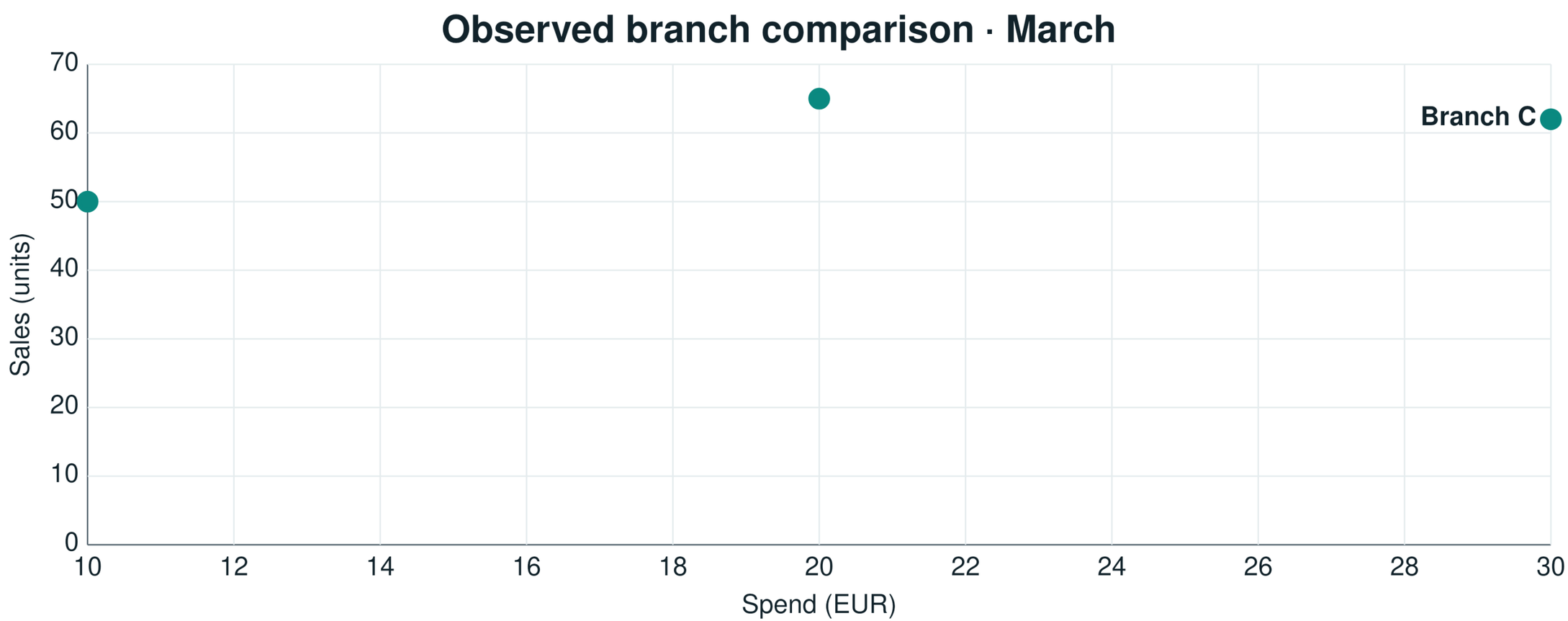
WHAT TO TRACK

Annotate a known observation

VALIDATE THE RESULT

```
Saved figure.png: 3840 x
2160
```

VISIBLE CHART RESULT



INDEPENDENTLY SORTED PAIRS ARE WRONG

CODE WALKTHROUGH W05-L10-S09

```
01  pairs=[(20,65),(10,50),(30,62)]
02  print("Correct paired sort:",sorted(pairs))
03  print("Incorrect recombination:",list(zip(
04      sorted(x for x,y in pairs),
05      sorted(y for x,y in pairs))))
```

WHAT TO TRACK

Independently sorted pairs are wrong

PREDICT THE RESULT

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

INDEPENDENTLY SORTED PAIRS ARE WRONG · RESULT

CODE WALKTHROUGH W05-L10-S10

```
01  pairs=[(20,65),(10,50),(30,62)]
02  print("Correct paired sort:",sorted(pairs))
03  print("Incorrect recombination:",list(zip(
04      sorted(x for x,y in pairs),
05      sorted(y for x,y in pairs))))
```

WHAT TO TRACK

Independently sorted pairs are wrong

VALIDATE THE RESULT

```
Correct paired sort: [(10,
50), (20, 65), (30, 62)]
Incorrect recombination:
[(10, 50), (20, 62), (30,
65)]
```

GUIDED PRACTICE

LEARNER PRACTICE

Guided practice

Plot paired quantities [(1,4),(2,3),(3,8)] with horizontal hours and vertical units. Preserve each pair.

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 PRACTICE

LEARNER PRACTICE

Independent practice

Annotate the point (3,8) as Trial C. State that these three observations do not establish causation.

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.

CHECK YOUR UNDERSTANDING

MENTAL MODEL

Check your understanding

Diagnostic: Does independently sorting both columns preserve their relationship? No.
It can attach one entity’s value to another entity’s value.

RECAP AND NEXT STEP

Recap and next step

Preserve pairs, label units and coverage, and use annotations to identify observations. Describe association cautiously.

UNDERSTAND APPLY VALIDATE EXPLAIN