Tables, charts and stem-and-leaf plots

Junior Cycle · Higher Level

Understand the idea

How to start

Frequency means how often a value or category occurs. A chart turns these counts into a display.

1. Read the title, key, units and axis scales first.
2. Translate the marks or bars into actual values or counts.
3. Use the display that matches the kind of data and label it clearly.

Key terms & definitions

Frequency
The number of observations in a category or interval.

Histogram
A display of grouped numerical data with touching bars.

Key
An explanation of how to read the stem and leaf units.

Key ideas

• A frequency table records how often each category or value occurs. Check the frequencies add to the sample size.

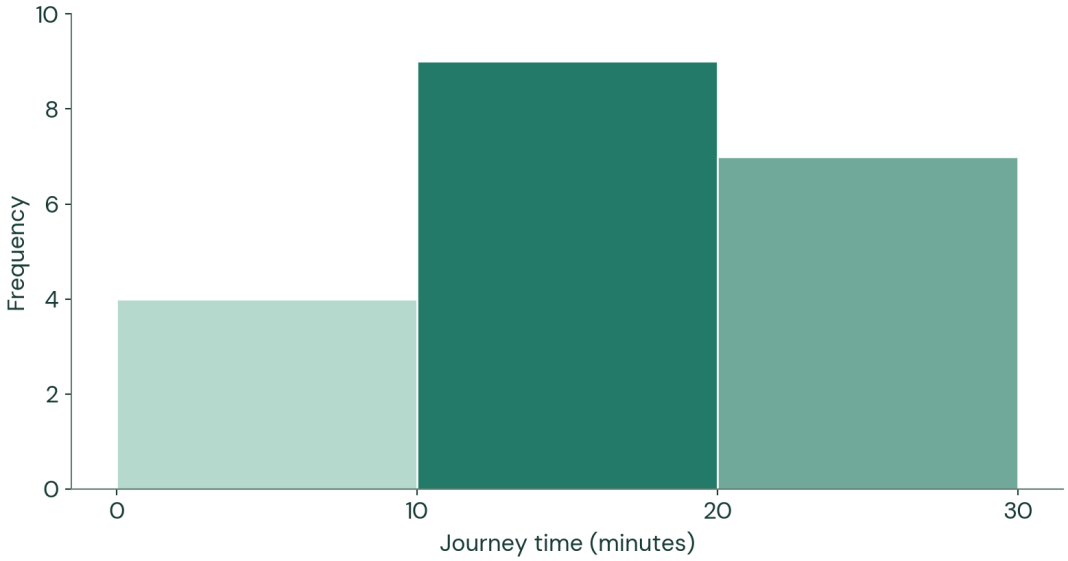
• Bar charts suit categories; bars are separated. A histogram groups numerical data; equal-width intervals use adjoining bars with frequency as height.

• For a pie chart, sector angle is $\frac{\text{frequency}}{\text{total}} \times 360^\circ$.

• A line graph can show change over time. Label both axes, units and scales.

• In a stem-and-leaf plot, order the leaves and provide a key. A back-to-back plot compares two groups using shared stems.

• Check whether an axis is truncated, intervals are inconsistent or area pictures exaggerate a difference.



Equal-width histogram: frequencies are 4, 9 and 7 for adjoining 10 – minute intervals.

Quick reminder

• Read the key and scale first.

• Order stem-and-leaf entries and give a key.

• Compare both a typical value and spread when comparing groups.

Worked examples

Example 01 · Pie chart sector

In a survey of 40 students, 12 walk to school. Find the walking sector angle.

Why this method?

Read the key, units and scales before using a display. Translate the displayed information back into data values.

$\text{walkingfraction} = \frac{12}{40}$	**Step 1** Twelve of the 40 students walk. Put the part over the total.
$\text{angle} = \frac{12}{40} \times 360^\circ$	**Step 2** The whole pie chart is 360°, so take the same fraction of a full turn.

$\text{angle} = 0.3 \times 360^\circ = 108^\circ$	**Step 3** Calculate the fraction first, then multiply.
$108^\circ < 180^\circ$	**Step 4** A check: fewer than half the students walk, so the sector must be less than half a circle.

Example 02 · Equal-width histogram

Journey times are grouped as $0 - < 10$, $10 - < 20$ and $20 - < 30$ minutes, with frequencies 4, 9 and 7. Describe the histogram.

Why this method?

Read the key, units and scales before using a display. Translate the displayed information back into data values.

Horizontal axis: time in minutes. Vertical axis: frequency.	**Step 1** Set the axes
Use intervals of width 10 and bar heights 4, 9 and 7.	**Step 2** Draw equal-width adjoining bars
The modal class is $10 - < 20$ minutes. There are 20 students in total; the exact individual times are unknown.	**Step 3** Read the bar heights as frequencies, then interpret the most frequent interval in the context of the question.

Example 03 · Median from a back-to-back stem and leaf plot

Plot 1 : The back-to-back stem and leaf plot shows two groups of seven values. What is the median of Group B?

```
Group A | Stem | Group B
       7 5 1 | 1 | 1 4 7
             | 2 | 3
           8 | 3 | 0
         7 5 | 4 | 2
           5 | 5 | 9
Key: stems = tens; leaves = units.
```

Group A | Stem | Group B
751 | 1 | 147
| 2 | 3
8 | 3 | 0
75 | 4 | 2
5 | 5 | 9
Key: stems = tens; leaves = units.

Why this method?

Read the key, units and scales before using a display. Translate the displayed information back into data values.

11, 14, 17, 23, 30, 42, 59	**Step 1** Order the values of Group B from smallest to largest
23	**Step 2** The median is the 4th of the 7 values

Think about it: Before moving on: why do the leaves of Group A run to the left of the stems, and those of Group B to the right?

Example 04 · Median from a back-to-back stem and leaf plot — another example

Plot 2 : The back-to-back stem and leaf plot shows two groups of seven values. What is the median of Group B?

```
Group A | Stem | Group B
          9 | 1 | 5
        8 7 3 | 2 |
          4 | 3 | 1 6 8
            | 4 |
        7 1 | 5 | 2 3 6
Key: stems = tens; leaves = units.
```

Group A | Stem | Group B
9 | 1 | 5
873 | 2 |
4 | 3 | 168
| 4 |
71 | 5 | 236
Key: stems = tens; leaves = units.

Why this method?

Read the key, units and scales before using a display. Translate the displayed information back into data values.

15, 31, 36, 38, 52, 53, 56	**Step 1** Order the values of Group B from smallest to largest
38	**Step 2** The median is the 4th of the 7 values

Example 05 · Constructing and comparing back-to-back plots

Data A : 73, 73, 75, 63, 84. Data B : 71, 77, 62, 87, 87, 88. Key : 2 | 7 means 27. Complete the row for stem 7 in the ordered back-to-back plot.

A	Stem	B
3	6	2
?	7	?
4	8	7 7 8

Key: 2 | 7 means 27. Repeated leaves are retained.

Ordered back-to-back plot for the two data lists in the question. Left A, shared stems, right B. Key : 2 | 7 means 27.

Why this method?

Read the key, units and scales before using a display. Translate the displayed information back into data values.

A leaves, ascending : 335. B leaves, ascending : 17.	**Step 1** Convert using the key and select the requested stem
A : 533 | 7 | B : 17	**Step 2** Place each side in its correct order

Think about it: Why should the smallest leaf on each side be closest to the stem?

Example 06 · Constructing and comparing back-to-back plots — another example

Data A : 2.2, 2.2, 2.7, 1.3, 3.5. Data B : 2.3, 2.9, 1.4, 3.2, 3.8, 3.6. Key : 2 | 7 means 2.7. Compare the centre and spread of the two groups using the plot. Which statement about median and range is supported?

A	Stem	B
3	1	4
7 2 2	2	3 9
5	3	2 6 8

Key: 2 | 7 means 2.7. Repeated leaves are retained.

Ordered back-to-back plot for the two data lists in the question. Left A, shared stems, right B. Key : 2 | 7 means 2.7.

Why this method?

Read the key, units and scales before using a display. Translate the displayed information back into data values.

Medians : $A = 2.2$; $B = 3.05$.	**Step 1** Read the centre of each ordered group
Ranges : $A = 2.2$; $B = 2.4$.	**Step 2** Use the extreme values for spread
Higher median: B. Larger range: B.	**Step 3** Compare both measures

Example 07 · Range from back-to-back stem and leaf plots

Survey 1 : The ordered back-to-back stem and leaf plot shows students' journey times in minutes. What is the range of Group A?

```
Group A | Stem | Group B
        | 1 | 8 8
    4 1 | 2 | 7
      3 | 3 | 0
        | 4 | 3 8 9
  9 9 2 | 5 | 7
        | 6 | 2Key: 3 | 2 | 7 means 23 in Group A and 27 in Group B. St
```

Group A | Stem | Group B
| 1 | 88
41 | 2 | 7
3 | 3 | 0
| 4 | 389
992 | 5 | 7
| 6 | 2Key : 3 | 2 | 7 means 23 in Group A and 27 in Group B. Stems are tens; leaves are units.

Why this method?

Read the key, units and scales before using a display. Translate the displayed information back into data values.

Smallest 21; largest 59.	**Step 1** Use the key to turn the extreme stem-and-leaf entries into full values for Group A. The leaf alone is not the value.
$59 - 21 = 38$ minutes.	**Step 2** Range is largest minus smallest
Group B has range $62 - 18 = 44$ minutes.	**Step 3** Keep the two samples separate

Think about it: Why can the largest value alone not tell you the range, and why must both endpoints come from the same group?

Example 08 · Range from back-to-back stem and leaf plots — another example

Survey 2 : The ordered back-to-back stem and leaf plot shows students' journey times in minutes. What is the range of Group B?

```
Group A | Stem | Group B
        |  1   |
    1 1 1 |  2   | 7
      9 4 |  3   | 5 7
          |  4   | 4 5 6 6 6
        8 |  5   | 2
        5 |  6   | 6Key: 3 | 2 | 7 means 23 in Group A and 27 in Group B. St
```

Group A | Stem | Group B
| 1 |
111 | 2 | 7
94 | 3 | 57
| 4 | 45666
8 | 5 | 2
5 | 6 | 6Key : 3 | 2 | 7 means 23 in Group A and 27 in Group B. Stems are tens; leaves are units.

Why this method?

Read the key, units and scales before using a display. Translate the displayed information back into data values.

Smallest 27; largest 66.	**Step 1** Use the key to turn the extreme stem-and-leaf entries into full values for Group B. The leaf alone is not the value.
66 − 27 = 39 minutes.	**Step 2** Range is largest minus smallest
Group A has range 65 − 21 = 44 minutes.	**Step 3** Keep the two samples separate

Common mistake

Reading left-hand leaves in a back-to-back stem-and-leaf plot as though it were a right-hand plot. With key 2|3 = 23, the row 8 5 1 | 2 on the left represents 28, 25 and 21; read outwards from the stem to list them in increasing order.

Exam technique

Compare two groups using both a typical value and spread, with the units.

Try it yourself

Work on paper before checking the answers at the end. These questions are for self-checking, not submitted homework.

Question 1

The back-to-back stem and leaf plot shows two groups of seven values. What is the median of Group B?

```
Group A | Stem | Group B
         5 2 | 1 | 3 8
         7 2 | 2 | 4 6
         8 1 | 3 | 3 6
           4 | 4 | 9
             | 5 |
Key: stems = tens; leaves = units.
```

Group A | Stem | Group B
52 | 1 | 38
72 | 2 | 46
81 | 3 | 36
4 | 4 | 9
| 5 |
Key: stems = tens; leaves = units.

A. 27

B. 28

C. 26

D. 2

Question 2

Data A : 7.1, 7.1, 7.5, 6.1, 8.2. Data B : 7.3, 7.7, 6.8, 8.7, 8.8, 8.3. Key : 6 | 1 means 6.1. Compare the centre and spread of the two groups using the plot. Which statement about median and range is supported?

A	Stem	B
1	6	8
5 1 1	7	3 7
2	8	3 7 8

Key: 2 | 7 means 2.7. Repeated leaves are retained.

Ordered back-to-back plot for the two data lists in the question. Left A, shared stems, right B. Key : 2 | 7 means 2.7.

A. Higher median: B. Larger range: A.

B. Higher median: A. Larger range: A.

C. Higher median: B. Larger range: B.

D. Higher median: A. Larger range: B.

Question 3

Survey 13 : The ordered back-to-back stem and leaf plot shows students' journey times in minutes. What is the range of Group A?

```
Group A | Stem | Group B
            9 | 1 | 4
            0 | 2 |
            1 | 3 | 0 8
            1 | 4 | 0 3 3 7 7
          8 8 | 5 |
              | 6 | 5Key: 3 | 2 | 7 means 23 in Group A and 27 in Group B. St
```

Group A | Stem | Group B
9 | 1 | 4
0 | 2 |
1 | 3 | 08
1 | 4 | 03377
88 | 5 |
| 6 | 5Key : 3 | 2 | 7 means 23 in Group A and 27 in Group B. Stems are tens; leaves are units.

A. 39

B. 77

C. 58

D. 51

Watch an explanation

Cognito — Pie Charts

Corbettmaths — Graphs: stem and leaf (draw)

Open the website chapter to load the embedded players. Use the rates and rules in your question for financial examples.

Self-check answers

Question 1

26

Question 2

Higher median: B. Larger range: A.

Question 3

39

Open the full chapter online