

Exercise walk-through

4.3

Averages, quartiles and percentiles

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1. Unit 3.4 at a glance

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Core S1-S5: data types, table extraction, two-way tables, the chart bank and the basic averages. Extension additions: histograms with UNEQUAL class intervals, cumulative frequency diagrams, box plots, quartiles, inter-quartile range and percentiles.

Must-know: frequency density = frequency over width, area is frequency; cumulative totals plot at UPPER boundaries; median at $n/2$, quartiles at $n/4$ and $3n/4$; grouped mean via midpoints.

3. Extension diagrams

Extension diagrams

Unequal histograms: height is frequency density (widths 2, 3, 5, 10, 15 holding 5, 12, 18, 14, 9 give heights 2.5, 4, 3.6, 1.4, 0.6) and the AREA is the frequency - the 1E specimen marks exactly this.

Cumulative frequency plots at UPPER boundaries (the 1E correction); box plots show the five-number summary with the box spanning the IQR. 60 workers with totals 6, 17, 27, 42, 60 at 10-30 hours: median 21, quartiles 14.1 and 25.8, IQR 11.7.

4. Averages, quartiles, percentiles

Averages, quartiles, percentiles

Mean via midpoints for grouped data; median by ordering; mode and modal class (by density when widths differ). For 3, 7, 8, 10, 12: mean 8, median 8, range 9.

Quartiles: order, halve, halve again - $IQR = Q3 - Q1$. Percentiles read at $p/100$ of n : the 90th percentile of 60 values is the 54th value; the 2E specimen's 38% family reads 19 of 50.

Exercises 2.1·2.3

2.1 Find the mean, median and mode of 2, 4, 4, 6, 9 [3]

2.2 Classes 0–10, 10–20, 20–30 hold frequencies 5, 8, 7. Estimate the mean. [3]

2.3 Find Q_1 , Q_3 and the IQR of 4, 6, 7, 9, 10, 12, 14, 15 [3]

Exercises 2.1·2.3

2.1 Find the mean, median and mode of 2, 4, 4, 6, 9 [3]

2.1 Mean 5, median 4, mode 4.

2.2 Classes 0–10, 10–20, 20–30 hold frequencies 5, 8, 7. Estimate the mean. [3]

2.2 Midpoints 5, 15, 25: $(25 + 120 + 175)/20 = 16$.

2.3 Find Q_1 , Q_3 and the IQR of 4, 6, 7, 9, 10, 12, 14, 15 [3]

2.3 Median 9.5; lower half 4, 6, 7, 9 gives $Q_1 = 6.5$; upper half 10, 12, 14, 15 gives $Q_3 = 13$; IQR 6.5.

Exercises 2.4·3.2

2.4 For 200 values, at which ordered position does the 90th percentile read? [2]

3.1 (*Original.*) Ten bags of rice (kg): 12, 15, 15, 18, 20, 20, 20, 22, 25, 33. (a) Find the mean, median and mode. (b) The 33 is recorded in error as 73: state which averages change and which stays most representative. [5]

3.2 (*Original.*) Times are grouped 0–4, 4–8, 8–12, 12–20 minutes with frequencies 6, 10, 16, 8. (a) Estimate the mean. (b) State the modal class and compare its density with the last class's. [5]

Exercises 2.4·3.2

2.4 For 200 values, at which ordered position does the 90th percentile read? [2]

2.4 The 180th value.

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3.1 (a) Mean $200/10 = 20$; median 20; mode 20. (b) With 73: the mean rises to 24 (sum 240), the median and mode stay 20 – the median is most representative because the outlier inflates the mean.

3.2 (*Original.*) Times are grouped 0–4, 4–8, 8–12, 12–20 minutes with frequencies 6, 10, 16, 8. (a) Estimate the mean. (b) State the modal class and compare its density with the last class's. [5]

3.2 (a) Midpoints 2, 6, 10, 16: $(12 + 60 + 160 + 128)/40 = 9$ minutes. (b) Modal class 8–12 (frequency 16); its density is 4 versus the last class's 1 – even more clearly modal by density.

Exercise 3.3

3.3 (*Original, 2E 38% family.*) Of 50 people surveyed, 19 chose option A. (a) What percentage is this? (b) On a CF curve of 50 values, at which positions do the median, Q_1 , Q_3 and the 38th percentile read? [4]

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3.3 (a) $19/50 = 38\%$. (b) Median at 25; Q_1 at 12.5 (12th–13th values); Q_3 at 37.5 (37th–38th); the 38th percentile at the 19th value.

Local review guidance: midpoint products before dividing; exact values; percentile positions stated on the ordered list or curve. This is authored classroom guidance.