Exercise 1.7 – Cumulative Frequency for Grouped Data

1 The cumulative frequency curve has been drawn from information about the amount of time spent by 50 people in a supermarket on a particular day.

Use the graph to estimate

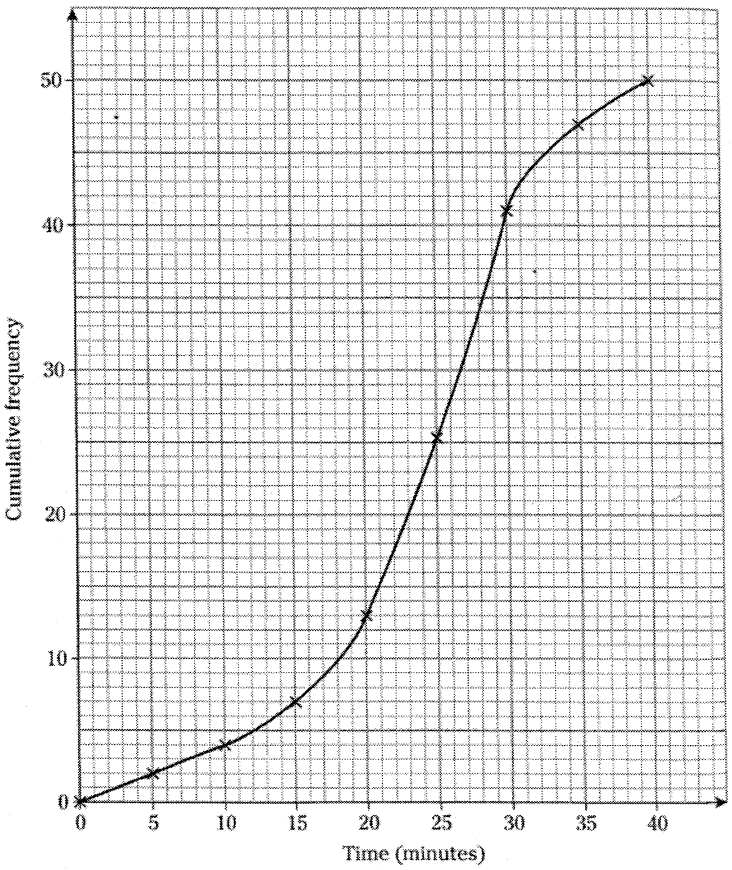
(i) how many people spent at least 17 minutes but less than 27 minutes in the supermarket,

(ii) the value of t, where 60% of the people spent less than t minutes in the supermarket,

(iii) the value of s, where 60% of the people spent at least s minutes in the supermarket,

(iv) the median time,

(v) the interquartile range.



2 Eggs laid at Hill Farm are weighed and the results grouped as shown:

Mass (x grams)	$46 \leqslant x < 50$	$50 \leqslant x < 54$	$54 \leqslant x < 58$	$58 \leqslant x < 62$	$62 \leqslant x < 66$	$66 \leqslant x < 70$	$70 \leqslant x < 74$
Frequency	6	4	10	24	20	12	4

(i) Construct a cumulative frequency table and draw a cumulative frequency graph.

(ii) Estimate the median mass.

(iii) The mass of three-quarters of the eggs was at least m grams. Estimate m from the graph.

3 Fifty soil samples were collected in an area of woodland, and the pH value for each sample was found. The cumulative frequency distribution was constructed as shown in the table.

pH value	< 4.4	< 4.8	< 5.2	< 5.6	< 6.0	< 6.4	< 6.8	< 7.2	< 7.6	< 8.0	< 8.4
Cumulative frequency	0	1	2	5	10	19	38	43	46	49	50

(i) Draw a cumulative frequency curve.

(ii) Estimate the percentage of samples with a pH value less than 7.

(iii) Estimate the median.

(iv) Taking equal width intervals of $4.4 \leqslant x < 4.8$, $4.8 \leqslant x < 5.2$, etc., construct the frequency distribution and draw a histogram. Show the median on the histogram.

4 In a quality-control survey the length of life, measured to the nearest hour, of 100 light bulbs is noted. The results are summarised in the table.

Length of life (to nearest hour)	650–669	670–679	680–689	690–699	700–729
Frequency	6	14	40	34	6

(i) Draw a cumulative frequency graph and use it to estimate the median and interquartile range.

(ii) Estimate the mean and standard deviation.

5 The weekly maximum temperatures in a certain town were recorded, to the nearest °C, over a period of two years and grouped in the following table.

Temperature (x °C)	−5 to −1	0–4	5–9	10–14	15–19	20–24	25–29
Frequency	8	12	17	31	23	9	4

(i) State the boundaries and width of the interval 0–4.

(ii) Draw the cumulative frequency graph.

(iii) Use your graph to estimate the median temperature.

(iv) A week is classified as 'extremely warm' when the weekly maximum is at least 21 °C. Use your graph to estimate the percentage of weeks that are classified as 'extremely warm'.

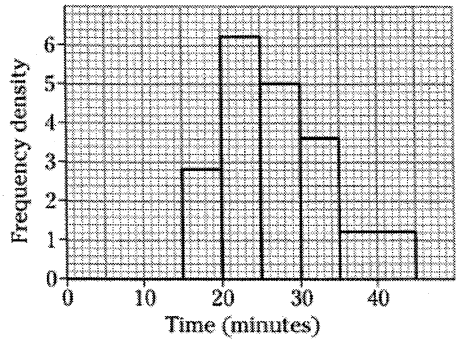
6 The distribution of the times taken when a certain task was performed by a large group of people was noted. It was found that 20% performed the task in less than 30 minutes, 40% in less than 38 minutes, 60% in less than 45 minutes and 80% in less than 53 minutes. The shortest time was 10 minutes and the greatest time was 69 minutes.

(i) Draw a cumulative frequency graph to illustrate the data.

(ii) Estimate the median time.

(iii) Estimate the percentage of people who performed the task in less than 50 minutes.

7 A survey was made of the times taken by a group of people to complete an assault course. The results are shown in the histogram.



(i) Copy and complete the frequency table.

Time (x minutes)	$15 \leqslant x < 20$	$20 \leqslant x < 25$	$25 \leqslant x < 30$	$30 \leqslant x < 35$	$35 \leqslant x < 45$
Frequency		31			

(ii) Which interval does the median lie in?

(iii) Draw a cumulative frequency graph.

(iv) Use your graph to estimate the median and interquartile range.

8 Each of 200 sportsmen was asked to state the distance, x km, he needs to travel to obtain access to suitable training facilities. The results are summarised in the table below.

Distance (x km)	$0 \leqslant x < 4$	$4 \leqslant x < 10$	$10 \leqslant x < 20$	$20 \leqslant x < 35$	$35 \leqslant x < 60$
Frequency	5	10	39	95	51

(a) (i) Construct a cumulative frequency table and draw a cumulative frequency graph.

Use your graph to estimate

(ii) the median distance,

(iii) the interquartile range of the distances,

(iv) the percentage of sportsmen who need to travel 30 km or more.

(b) (i) Draw a histogram to represent the data.

(ii) Estimate the mean and standard deviation of the distances travelled.

9 In a survey, two groups of 200 students were asked to keep a record of the number of text messages they sent during a certain period of time.

The results are as follows.

Number of text messages sent	1–5	6–10	11–15	16–25	26–34	35–40
Group 1: Frequency	4	8	11	35	104	38
Group 2: Frequency	11	17	27	87	50	8

(i) On the same diagram, draw two cumulative frequency graphs to represent the data.

(ii) For each group, estimate the median and the interquartile range.

(iii) Compare the two groups.

10 In a recent survey, 640 people were asked about the length of time each week that they spent watching television. The median time was found to be 20 hours, and the lower and upper quartiles were 15 hours and 35 hours respectively. The least amount of time that anyone spent was 3 hours, and the greatest amount was 60 hours.

(i) On graph paper, show these results using a fully labelled cumulative frequency graph.

(ii) Use your graph to estimate how many people watched more than 50 hours of television each week.

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11 The manager of a company noted the times spent in 80 meetings. The results were as follows.

Time (t minutes)	$0 < t \leqslant 15$	$15 < t \leqslant 30$	$30 < t \leqslant 60$	$60 < t \leqslant 90$	$90 < t \leqslant 120$
Frequency	4	7	24	38	7

Draw a cumulative frequency graph and use this to estimate the median time and the interquartile range.

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