8 Data Handling

8.1 Tables and Timetables

1. In a factory there are 79 male and 74 female managers.

   Managers can be either junior or senior. There are 28 male senior managers.

   There is a total of 93 junior managers.

   (a) Construct a two-way table to show the number of male and female managers in junior and senior management.

   (b) Comment on the proportion of women in junior and senior management.

	Male	*Female*
Junior management		
Senior management		

(LON)

2. The timetable summarises part of the Intercity East Coast line trains from King's Cross to Edinburgh.

London, King's Cross	0800	0830	0900	–	1000
Peterborough	–	0915	–	–	1045
Doncaster	0930	1015	–	1130	1145
York	1005	1055	1100	1205	1220
Darlington	1035	1125	1130	1235	1250
Durham	1050	1145	–	1300	1315
Newcastle	1105	1205	1200	1315	1330
Berwick	–	1250	–	–	1415
Edinburgh	1235	1340	1330	–	1505

   (a) What is the shortest journey time from Newcastle to Edinburgh?

   (b) If you arrive at London King's Cross at 0745, what is the earliest time that you can reach Berwick?

   (c) If you just miss the 1015 train from Doncaster to Edinburgh, what is your new arrival time in Edinburgh?

   (d) What is the shortest travel time from London to Edinburgh?

3. The table shows the distances, in miles, between major cities in Scotland.

Aberdeen	Dumfries	Dundee	Edinburgh	Glasgow	Inverness	Perth	Stirling
210							
67	140						
125	75	57					
147	73	78	46				
106	239	124	158	173			
86	119	21	42	61	114		
116	89	51	38	31	140	30	

(a) What is the distance between

(i) Aberdeen and Stirling,

(ii) Aberdeen and Glasgow

(iii Edinburgh and Perth,

(iv) Dumfries and Glasgow?

(b) You are planning a cycling tour of Scotland, starting and finishing in Dumfries, and visiting, in order,

Dumfries – Edinburgh – Stirling – Perth – Inverness – Glasgow – Dumfries.

What is the total distance that you will travel?

4. Here is some information about Year 11 students in a school.

No.	*Name*	*Date of birth*	*Form*	*Village*	*Stays school lunch*
1	Bright. M	12/2/77	11W	Swinton	Yes
2	Patel. D	24/4/77	11L	Bolton	Yes
3	Learson. M	5/11/76	11L	Bolton	No
4	Thompson. A	30/09/76	11W	Bolton	Yes
5	Williams. C	15/7/77	11P	Bolton	No
6	Yip. D	21/10/76	11R	Goldthorpe	No
7					

(a) Gillian Reed, in form 11L, stays for school lunches. She lives in Bolton and was born on 17 January 1977. Add this information to the list.

(b) What is the name of the oldest student on the list?

(c) Which students live in the village of Bolton *and* do not stay for school lunch?

(NEAB)

5. Four hockey teams play each other in a competition.

The results are

ROUND 1	Ramblers	3	Wanderers	2
	Rovers	0	Nomads	0
ROUND 2	Wanderers	2	Rovers	2
	Nomads	0	Ramblers	1
ROUND 3	Wanderers	3	Nomads	1
	Ramblers	0	Rovers	2

Using the above table of results, suggest a reason why

(a) Ramblers could say they are the best team,

(b) Wanderers could say they are the best team,

(c) Rovers could say they are the best team.

(MEG)

6. The London Police fitted cameras on traffic lights.

The table shows the number of accidents that occurred before and after the cameras were fitted.

Type of accident	*Number of accidents before cameras*	*Number of accidents after cameras*
Minor	685	532
Serious	914	707
Very serious	146	103

(a) Calculate the total number of accidents which happened *before* the cameras were fitted.

Write this answer to the nearest hundred.

(b) Without using a calculator, estimate the number of accidents that occurred *after* the cameras had been fitted.

Show how you made your estimate.

(c) A spokesman for the police said:

"The total number of accidents has been reduced by almost 25%."

Use the information in the table above to decide if you agree with this statement.

Show all your working.

Give a clear reason for your decision.

(LON)

7. The following table gives the distances, in km, between major cities and towns in Finland to which the national airline, *Finnair*, operates flights.

	Ke	R	O	T	V	Ku	J
Helsinki (H)	1050	1200	900	300	700	600	650
Joensuu (J)	750	850	600	900	700	200	
Kuopio (Ku)	600	700	500	700	600		
Vaasa (V)	600	750	550	500			
Turku (T)	1200	1300	1050				
Oulu (O)	200	300					
Rovaniemi (R)	150						
Kemi (Ke)							

(a) Which is the place furthest away from Helsinki?

(b) Which is the place closest to Oulu?

(c) If you fly from Oulu to Helsinki, via Rovaniemi and Kemi, how much further do you travel than flying direct from Oulu to Helsinki?

(d) A plane makes the following journey:

Helsinki to Oulu

Oulu to Kemi

Kemi to Helsinki

Helsinki to Rovaniemi

Rovanieme to Kuopio

Kuopio to Helsinki

What is the total distance flown by this plane?

8.5 Questionnaires and Surveys

1. Criticise the following questions for bias.

   (a) "Animal Hospital *was a super TV programme, wasn't it?"*

   (b) *"Shouldn't the Queen pay income tax?"*

   (c) *"Do you think that butter tastes much better than margarine?"*

   (d) *"Shouldn't the Government spend more on education than on defence?"*

2. Provide suitable multiple responses for these questions.

   (a) *"Do you like watching* Eastenders*?"*

   (b) *"How often do you play football?"*

   (c) *"Do you enjoy listening to music?"*

   (d) *"What sort of holiday do you like?"*

3. Angela and Sanjay organise a school trip.

   They can go to Chester Zoo, Alton Towers or Blackpool.

   Angela and Sanjay ask each pupil where they would like to go.

   Here is one page of their notebook.

Chester Zoo	*Blackpool*
Alton Towers	*Blackpool*
Alton Towers	*Chester Zoo*
Chester Zoo	*Chester Zoo*
Blackpool	*Chester Zoo*
Chester Zoo	*Blackpool*
Alton Towers	*Alton Towers*
Chester Zoo	*Alton Towers*
Chester Zoo	*Alton Towers*

   (a) Think about the way you have recorded answers when you have done a survey.

   Show how you would improve Angela and Sanjay's method.

   (b) The trip is arranged for Chester Zoo.

   246 pupils and 22 teachers are going on the trip.

   Angela and Sanjay are hiring buses. Each bus holds 63 people.

   How many buses will they need?

(NEAB)

4. A teacher wants to find out how his 32 pupils travelled to school today.

   (a) Design a suitable observation sheet to get this information.

   (b) Fill in your observation sheet as if you had carried out this survey.

   (You should invent suitable replies for all 32 pupils and collect the information together.)

5. A school is considering whether to abolish all or part of its school uniform, but wants to find out the views of all pupils. Design a suitable questionnaire for this purpose.

6. Your school is conducting a survey of its staff to find out how the school day should be divided up between teaching periods, breaks and lunch. Design a suitable questionnaire for this.

7. Design a survey to find out what sort of films your school friends most enjoy.

8. Design a survey to find out what type of holidays pupils in your class most enjoy.

8.6 Frequency Graphs

1. A company claims that it produces matches in boxes of 50 sticks. Forty boxes were selected from a large number of boxes manufactured by the company and their contents counted, giving the following results.

53	50	48	52	52	50	49	51	50	52
49	49	50	51	48	51	50	52	52	49
50	50	51	52	49	53	50	52	49	52
51	49	50	53	52	50	49	50	48	50

   (a) Construct a frequency distribution table for the results.

   (b) Draw a bar chart to represent the data.

   (c) What percentage of the boxes contain exactly 50 matches?

2. The lengths, x , in mm, of 50 hummingbirds were measured and the results are given below.

45	49	45	45	49	52	46	49	41	46
50	48	42	48	52	45	48	49	48	47
54	46	49	49	48	49	48	43	52	43
51	54	51	50	41	52	42	43	45	44
47	48	48	43	47	48	46	43	54	49

Copy and complete the following table.

Length (x mm)	$40 < x \leq 42$	$42 < x \leq 44$	$44 < x \leq 46$	$46 < x \leq 48$	$48 < x \leq 50$	$50 < x \leq 52$	$52 < x \leq 54$
Frequency							

(a) Draw a histogram for the above frequency distribution.

(b) Using a separate diagram, draw a frequency polygon to represent the results.

(c) Find

(i) the fraction of birds whose length is greater than 48 mm,

(ii) the percentage of birds whose length is at most 44 mm.

3. The lengths, x in cm, of 40 pencils were measured and the results are given below.

8.5	10.8	9.8	13.0	13.1	11.3	8.4	12.5	9.0	8.8
9.0	11.0	9.2	8.7	15.0	8.5	10.1	11.7	9.4	11.2
9.7	12.0	14.0	10.5	16.7	9.4	10.9	10.5	9.9	10.1
10.3	12.4	17.0	10.7	12.8	10.0	16.0	10.3	10.0	9.5

(a) Copy and complete the following table.

Length of pencil (x cm)	$8 < x \leq 9$	$9 < x \leq 10$	$10 < x \leq 11$	$11 < x \leq 13$	$13 < x \leq 17$
Number of pencils					
Frequency density					

(b) Draw a histogram which represents the information given above.

(c) Find

(i) the percentage of pencils whose length is greater than 10 cm and less than or equal to 13 cm,

(ii) the proportion of pencils whose length is at most 11 cm.

4. The following are measurements of the breaking strength (x g) of a sample of 50 threads.

721	574	562	568	596	490	460	542	470	690
743	696	650	538	678	389	580	544	654	438
670	584	304	692	493	578	566	584	588	462
582	472	708	596	593	620	528	500	493	506
472	518	426	480	404	424	748	674	487	668

(a) Construct a frequency table using class intervals of $300 < x \leq 350$, $350 < x \leq 400$, ..., $750 < x \leq 800$.

(b) Draw a histogram for the above frequency distribution

(c) Using a separate diagram, draw a frequency polygon to illustrate the above data.

5. The following statistics were obtained for the ages (x years) of 35 diabetics.

48	61	54	64	10	41	38
23	45	60	57	48	47	53
43	83	79	56	82	76	41
75	79	68	21	55	77	68
38	65	59	7	61	70	47

(a) Construct a grouped frequency table for these ages using classes of equal width, beginning with the class $0 < x \leq 10$.

(b) Draw a histogram to illustrate this information.

6. The recommended daily intake of iron is 18 milligrams for adult females below the age of 51. The amounts of iron intake during a 24-hour period for a sample of 45 women are given below.

15.0	18.1	16.0	12.6	15.3	9.4	14.6	11.9	17.0
6.3	14.4	16.6	19.5	12.5	16.8	14.6	20.7	18.3
18.6	12.5	10.9	19.8	14.5	13.1	16.3	18.1	11.6
16.6	12.1	14.7	18.2	12.8	11.5	10.7	12.7	18.3
15.6	16.4	17.3	16.3	15.0	11.0	12.5	12.4	11.5

(a) Construct a grouped frequency table for the above information using classes of equal width, beginning with the class $6 \leq x < 8$.

(b) Draw a histogram to display the above results.

7. The marks scored by a group of 50 pupils in an examination are given below.

52	22	24	30	64	47	23	27	47	17
39	21	30	42	35	44	36	19	32	58
22	45	66	38	44	36	29	37	33	33
44	53	57	28	11	40	49	56	5	48
13	25	40	33	63	23	40	51	59	33

(a) Construct a frequency table using class intervals of 0-9, 10-19, 20-29 and so on.

(b) Draw a bar chart to represent this information.

(c) Using a separate diagram, draw a frequency polygon to illustrate this data.

8. The daily wages of 50 workers, in pounds per day to the nearest pound, are given below. Construct the frequency table with class intervals

10-14, 15-19, 20-24 and so on.

Draw a histogram to represent the data.

12	21	13	17	29	33	26	47	10	17
36	31	32	27	25	16	36	29	22	24
21	25	45	18	37	42	35	28	20	44
34	32	22	36	34	20	15	26	17	21
25	30	27	32	26	28	30	38	19	26

9. The waiting times, to the nearest minute, for 60 patients at a certain clinic are as follows.

25	12	53	8	26	5	19	73	67	18
87	42	6	21	14	19	12	15	13	36
36	16	72	36	13	37	11	51	39	32
30	47	6	22	68	25	98	23	45	22
7	9	26	35	27	48	58	56	29	20
32	62	80	41	58	17	54	15	14	74

(a) Construct a frequency table using class intervals

0-9, 10-19, 20-29 and so on.

(b) Draw a histogram for the frequency distribution.

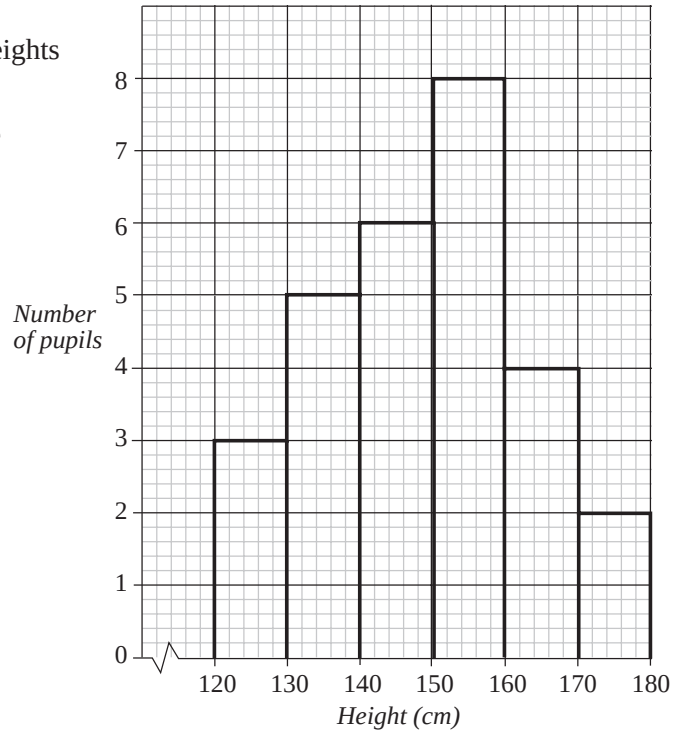
(c) Using a separate diagram, draw a frequency polygon to illustrate the data.

10. The histogram shows the heights of pupils in a class.

(a) How many pupils are in the class?

(b) How many are taller than 150 cm.

What percentage is this?



8.7 Histograms with Unequal Class Intervals

1. The frequency table below shows the time (in seconds) taken by 100 athletes to run a distance of 400 metres.

Time (x seconds)	$50 \le x < 56$	$56 \le x < 59$	$59 \le x < 62$	$62 \le x < 65$	$65 \le x < 70$
Frequency	21	18	30	15	16

Draw a histogram to display this data.

2. The table below gives the number of shoots produced by 60 plants in a botanical research establishment.

Number of shoots (x)	$0 \le x < 20$	$20 \le x < 25$	$25 \le x < 30$	$30 \le x < 40$	$40 \le x < 55$
Frequency	10	17	15	9	9

Draw a histogram to illustrate these results.

3. The amount of money collected by each of 308 students involved in a charity walk was recorded below.

Amount collected	$10 < x \le 20$	$20 < x \le 50$	$50 < x \le 100$	$100 < x \le 150$	$150 < x \le 250$
Number of students	10	17	15	9	9

Draw a histogram to represent these data.

4. The following table shows the weekly earnings of 100 employees of Baywind Pte. Ltd.

Weekly earnings (£)	*Number of workers*
80 – 85	2
85 – 90	3
90 – 100	8
100 – 110	20
110 – 130	32
130 – 180	15
180 – 250	12
250 – 350	5
350 – 500	2
500 – 750	1

Draw a histogram representing this information.

5. On a particular day, the length of stay of each car at a car park, measured to the nearest minute, was recorded.

Length of stay (min)	*Number of cars*
5 – 24	60
25 – 59	70
60 – 79	86
80 – 104	150
105 – 114	55
115 – 149	105
150 – 199	45
200 – 299	30

(a) Find the total number of cars parked in the car park that day,

(b) Draw a histogram representing the information.

6. The following list shows the maximum daily temperature, in °F, throughout the month of April.

56.1	49.4	63.7	56.7	55.3	53.5	52.4	57.6	59.8	52.1
45.8	55.1	42.6	61.0	61.9	60.2	57.1	48.9	63.2	68.4
55.5	65.2	47.3	59.1	53.6	52.3	46.9	51.3	56.7	64.3

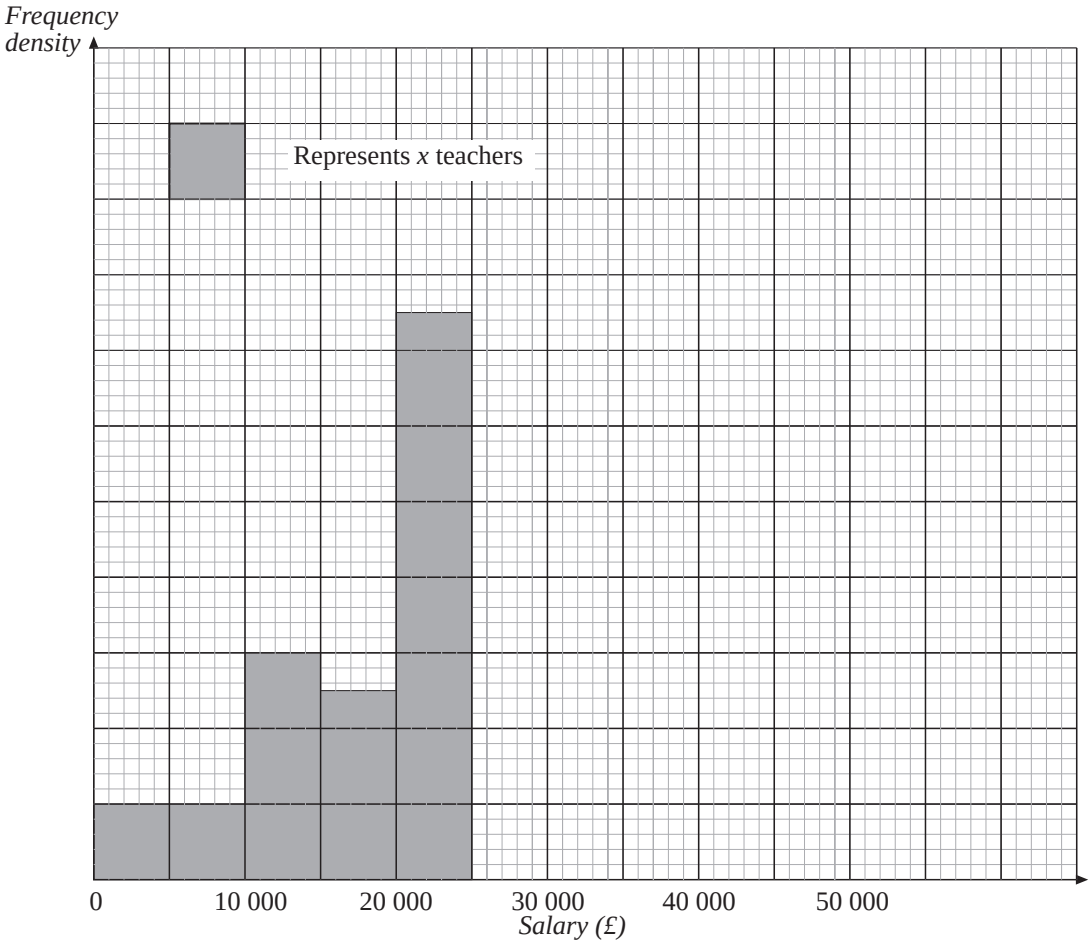
(a) Copy and complete the grouped frequency table below.

Temperature, T		*Frequency*
$40 < T \leq 50$		
$50 < T \leq 54$		
$54 < T \leq 58$		
$58 < T \leq 62$		
$62 < T \leq 70$		

(b) Draw a histogram to represent your distribution in part (a).

(MEG)

7. The unfinished histogram and table show information about the salaries, in pounds, of the teachers at Mathstown High School.



Salary (s) in pounds	*Frequency*
$0 \leq s < 10\,000$	4
$10\,000 \leq s < 15\,000$	6
$15\,000 \leq s < 20\,000$	5
$20\,000 \leq s < 25\,000$	. . . .
$25\,000 \leq s < 30\,000$	8
$30\,000 \leq s < 50\,000$	4

1 cm^2 represents x teachers

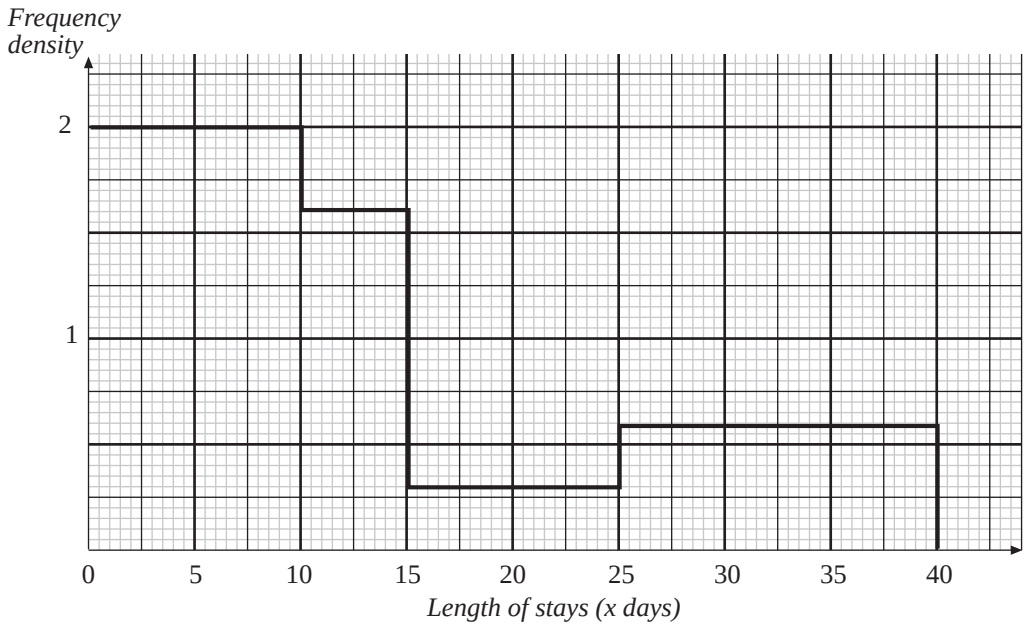
(a) Calculate the value of x.

(b) Use the information in the histogram to complete the table.

(c) Use the information in the table to complete the histogram.

(LON)

8. The histogram illustrates the lengths of stay in Australia of a group of Singaporean tourists this year.



(a) Copy and complete the following table.

Length of stay (x days)	$0 < x \leq 5$	$5 < x \leq 10$	$10 < x \leq 15$	$15 < x \leq 25$	$25 < x \leq 40$
Number of tourists	10	10			

(b) Find the number of Singaporean tourists in the group.

(c) Calculate the fraction of tourists who stayed in Australia longer than 15 days.

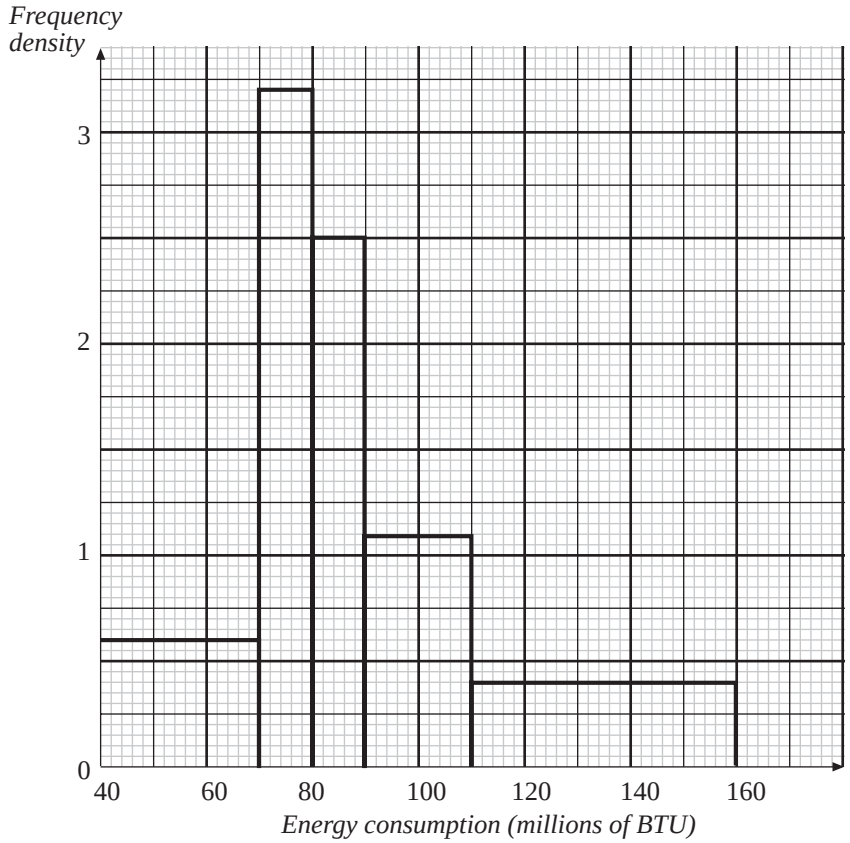
9. The histogram displays the energy consumptions for a representative sample of households in a city in 1993.

(a) Copy and complete the following table.

Energy consumption (x millions of BTU)	$40 \leq x < 70$	$70 \leq x < 80$	$80 \leq x < 90$	$90 \leq x < 110$	$110 \leq x < 160$
Number of households					

(b) Find the number of households in the group.

(c) Calculate the percentage of households whose energy consumption is at least 80 millions of BTU, giving your answer correct to the nearest whole number.



8.8 Sampling

1. In an experiment, a shampoo manufacturing company wants to test the strength of hair. The available volunteers have the following distribution of hair colour.

Natural hair colour	*Number*
Blond	6
Fair	10
Auburn	3
Brown	27
Grey	5
Black	9

The company wish to test a stratified sample of size 20. How many of each colour should be tested?

2. Sam was making a survey of pupils in his school. He wanted to find out their opinions on noise pollution by motor bikes. The size of each year group is shown below.

Year Group	*Boys*	*Girls*	*Total*
8	85	65	150
9	72	75	147
10	74	78	152
11	77	72	149
6th Form	93	107	200
			798

Sam took a sample of 80 pupils.

(a) Explain whether or not he should have sampled equal numbers of boys and girls in Year 8.

(b) Calculate the number of pupils he should have sampled in Year 8.

(LON)

3. You wish to find a representative sample of size 10 from all the 400 houses in a village.

(a) Use a table of random numbers to find a sample of this size.

(b) Explain why the sample might not be representative.

(c) Explain how you could design a systematic sample.

(d) Which sample would be more representative?

4, Some Year 11 pupils investigate the amount of time pupils in their school spend on homework. They conduct a survey and ask 30 pupils the following question:

"How many minutes homework did you do last night?"

Here are their results.

25	120	55	10	40
60	75	75	45	65
45	90	45	110	75
90	45	90	60	45
15	25	45	35	55
75	20	30	45	100

(a) Draw a frequency table, with equal class intervals, to show this information.

The first interval should be 'thirty minutes or less'.

(b) The pupils conducted this survey on a Thursday morning.

They asked each person in their Maths set how long they had spent on their homework the previous night.

Suggest three reasons why their sample might not have been typical.

(c) Describe two ways in which they could improve their sample.

(NEAB)

5. A college has four faculties with the following numbers of members of staff.

Faculty	*Staff Numbers*
Arts	22
Maths and Science	47
Languages	17
Social Sciences	14

The governing body of the college includes 20 representatives from the staff. How many staff members *should* represent each faculty, so that each faculty is fairly represented?