C36

Collecting, displaying and interpreting data

CHAPTER ASSIGNMENT · 10 MARKS

Name _____ Class _____ No. _____ Date _____

Answer every question in the space given. Use graph paper, a ruler and a protractor where a question asks you to draw. Show your working.

Practice questions from *Cambridge IGCSE Mathematics Core and Extended* (4th edition), Chapter 36 (Collecting, displaying and interpreting data), for classroom use. Where the book shows a chart, the data is given here as a table or described in words, and the table readings are approximate. The Check yourself and Chapter quiz questions are Guru Jazzy's own.

Exercise 36.1 · Pie charts and stem and leaf diagrams

36.1.1 The pie charts below show how a girl (Ayse) and her brother (Ahmet) spent one day. Calculate how many hours they spent on each activity. The diagrams are to scale. (The two pie charts are printed in the book, p. 515. Each has five sectors: Sleep, Meals, Sport, TV, School. Measure each sector angle with a protractor.)

Activity	Sleep	Meals	Sport	TV	School
Ayse (hours)					
Ahmet (hours)					

36.1.2 A survey was carried out among a class of 40 students. The question asked was, 'How would you spend a gift of $15?' The results are shown below. Illustrate these results on a pie chart.

Choice	Music	Books	Clothes	Cinema
Frequency	14	6	18	2

36.1.3 A student works during the holidays. He earns a total of $2400. He estimates that the money earned has been used as follows: clothes, 1/3; transport, 1/5; entertainment, 1/4. He has saved the rest. Calculate how much he has spent on each category, and illustrate this information on a pie chart.

36.1.4 A research project looking at the careers of men and women in Spain produced the following results:

Career	Male (percentage)	Female (percentage)
Clerical	22	38
Professional	16	8
Skilled craft	24	16
Non-skilled craft	12	24
Social	8	10
Managerial	18	4

(a) Illustrate this information on two pie charts, and make two statements that could be supported by the data.

(b) If there are eight million women in employment in Spain, calculate the number in either professional or managerial employment.

36.1.5 A village has two sports clubs. The ages of people in each club are listed below:

Ages in Club 1: 38, 8, 16, 15, 18, 8, 59, 12, 14, 55, 14, 15, 24, 67, 71, 21, 23, 27, 12, 48, 31, 14, 70, 15, 32, 9, 44, 11, 46, 62

Ages in Club 2: 42, 62, 10, 62, 74, 18, 77, 35, 38, 66, 43, 71, 68, 64, 66, 66, 22, 48, 50, 57, 60, 59, 44, 57, 12

(a) Draw a back-to-back stem-and-leaf diagram for the ages of the members of each club.

(b) For each club, calculate: (i) the age range of their members, (ii) the median age.

(c) One of the clubs is the golf club, the other is the athletics club. Which club is likely to be which? Give a reason for your answer.

36.1.6 The heights of boys and girls in one class are plotted as a comparative bar chart (printed in the book, p. 517). The frequencies read from the chart are:

Height (cm)	130 ≤ h < 140	140 ≤ h < 150	150 ≤ h < 160	160 ≤ h < 170	170 ≤ h < 180	180 ≤ h < 190
Girls	2	3	5	3	1	0
Boys	0	2	4	6	4	2

(a) How many girls are there in the class?

(b) How many more boys than girls are there in the height range 160 ≤ h < 170?

(c) Describe the differences in heights between boys and girls in the class

(d) Construct a comparative bar chart for the heights of boys and girls in your own class.

Exercise 36.2 · Surveys

36.2.1 Below are ten statements, some of which you may have heard or read before. Conduct a survey to collect data which will support or disprove one of the statements. Where possible, use pie charts to illustrate your results.

(a) Magazines are full of adverts.

(b) If you go to a football match you are lucky to see more than one goal scored.

(c) Every other car on the road is white.

(d) Girls are not interested in sport.

(e) Children today do nothing but watch TV.

(f) Newspapers have more sport than news in them.

(g) Most girls want to be nurses, teachers or secretaries.

(h) Nobody walks to school any more.

(i) Nearly everybody has a computer at home.

(j) Most of what is on TV comes from America.

36.2.2 Below are some instructions relating to a washing machine in English, French, German, Dutch and Italian. Analyse the data and write a report. You may wish to comment upon: (a) the length of words in each language, (b) the frequency of letters of the alphabet in different languages.

ENGLISH: ATTENTION. Do not interrupt drying during the programme. This machine incorporates a temperature safety thermostat which will cut out the heating element in the event of a water blockage or power failure. In the event of this happening, reset the programme before selecting a further drying time. For further instructions, consult the user manual.

FRENCH: ATTENTION. N'interrompez pas le séchage en cours de programme. Une panne d'électricité ou un manque d'eau momentanés peuvent annuler le programme de séchage en cours. Dans ces cas arrêtez l'appareil, affichez de nouveau le programme et après remettez l'appareil en marche. Pour d'ultérieures informations, rapportez-vous à la notice d'utilisation.

GERMAN: ACHTUNG. Die Trocknung soll nicht nach Anlaufen des Programms unterbrochen werden. Ein kurzer Stromausfall bzw. Wassermangel kann das laufende Trocknungsprogramm annullieren. In diesem Falle Gerät ausschalten, Programm wieder einstellen und Gerät wieder einschalten. Für nähere Angaben beziehen Sie sich auf die Bedienungsanleitung.

DUTCH: BELANGRIJK. Het droogprogramma niet onderbreken wanneer de machine in bedrijf is. Door een korte stroom-of watertoevoeronderbreking kan het droogprogramma geannuleerd worden. Schakel in dit geval de machine uit, maak opnieuw uw programmakeuze en stel onmiddellijk weer in werking. Verdere inlichtingen vindt u in de gebruiksaanwijzing.

ITALIAN: ATTENZIONE. Non interrompere l'asciugatura quando il programma è avviato. La macchina è munita di un dispositivo di sicurezza che può annullare il programma di asciugaturea in corso quando si verifica una temporanea mancanza di acqua o di tensione. In questi casi si dovrà spegnere la macchina, reimpostare il programma e poi riavviare la macchina. Per ulteriori indicazioni, leggere il libretto istruzioni.

Exercise 36.3 · Scatter diagrams and correlation

36.3.1 State what type of correlation you might expect, if any, if the following data was collected and plotted on a scatter diagram. Give reasons for your answer.

(a) A student's score in a maths exam and their score in a science exam.

(b) A student's hair colour and the distance they have to travel to school.

(c) The outdoor temperature and the number of cold drinks sold by a shop.

(d) The age of a motorcycle and its second-hand selling price.

(e) The number of people living in a house and the number of rooms the house has.

(f) The number of goals your opponents score and the number of times you win.

(g) A child's height and the child's age.

(h) A car's engine size and its fuel consumption.

36.3.2 A website gives average monthly readings for the number of hours of sunshine and the amount of rainfall in millimetres for several cities in Europe. The table below is a summary for July.

Place	Hours of sunshine	Rainfall (mm)
Athens	12	6
Belgrade	10	61
Copenhagen	8	71
Dubrovnik	12	26
Edinburgh	5	83
Frankfurt	7	70
Geneva	10	64
Helsinki	9	68
Innsbruck	7	134
Krakow	7	111
Lisbon	12	3
Marseilles	11	11
Naples	10	19
Oslo	7	82
Plovdiv	11	37
Reykjavik	6	50
Sofia	10	68
Tallinn	10	68
Valletta	12	0
York	6	62
Zurich	8	136

(a) Plot a scatter diagram of the number of hours of sunshine against the amount of rainfall. Use a spreadsheet if possible.

(b) What type of correlation, if any, is there between the two variables? Comment on whether this is what you would expect.

36.3.3 The United Nations keeps an up-to-date database of statistical information on its member countries. The table below shows some of the information available.

Country	Life expectancy at birth, female (years, 2005–2010)	Life expectancy at birth, male (years, 2005–2010)	Adult illiteracy rate (%, 2009)	Infant mortality rate (per 1000 births, 2005–2010)
Australia	84	79	1	5
Barbados	80	74	0.3	10
Brazil	76	69	10	24
Chad	50	47	68.2	130
China	75	71	6.7	23
Colombia	77	69	7.2	19
Congo	55	53	18.9	79
Cuba	81	77	0.2	5
Egypt	72	68	33	35
France	85	78	1	4
Germany	82	77	1	4
India	65	62	34	55
Israel	83	79	2.9	5
Japan	86	79	1	3
Kenya	55	54	26.4	64
Mexico	79	74	7.2	17
Nepal	67	66	43.5	42
Portugal	82	75	5.1	4
Russian Federation	73	60	0.5	12
Saudi Arabia	75	71	15	19
South Africa	53	50	12	49
United Kingdom	82	77	1	5
United States of America	81	77	1	6

(a) By plotting a scatter diagram, decide if there is a correlation between the adult illiteracy rate and the infant mortality rate.

(b) Are your findings in part a) what you expected? Explain your answer.

(c) Without plotting a graph, decide if you think there is likely to be a correlation between male and female life expectancy at birth. Explain your reasons.

(d) Plot a scatter diagram to test if your predictions for part c) were correct.

36.3.4 A gardener plants 10 tomato plants. He wants to see if there is a relationship between the number of tomatoes the plant produces and its height in centimetres. The results are presented in a scatter diagram (printed in the book, p. 524) with the line of best fit also drawn. The points read from the diagram are approximately:

Height (cm)	65	67	68	72	75	80	80	88	91	97
Tomatoes	10	14	30	26	22	22	38	33	42	34

The line of best fit runs from about (50, 8) to (100, 42).

(a) Describe the correlation (if any) between the height of a plant and the number of tomatoes it produced.

(b) The gardener has another plant grown in the same conditions as the others. If the height is 85 cm, estimate from the graph the number of tomatoes he can expect it to produce.

(c) Another plant only produces 15 tomatoes. Deduce its height from the graph.

(d) The gardener thinks he will be able to make more predictions if the height axis starts at 0 cm rather than 50 cm and if the line of best fit is then extended. By re-plotting the data on a new scatter graph and extending the line of best fit, explain whether the gardener's idea is correct.

36.3.5 The table shows the 15 countries that won the most medals at the 2016 Rio Olympics. In addition, statistics relating to each of those countries' population, wealth, percentage of people with higher education and percentage who are overweight are also given.

Country	Gold	Silver	Bronze	Population (million)	Average wealth per person in 1000's $	% with a Higher Education Qualification	% Adult population overweight (male)	% Adult population overweight (female)
USA	46	37	38	322	345	45	73	63
UK	27	23	17	65	289	44	68	59
China	26	18	26	1376	23	10	39	33
Russia	19	18	19	143	10	54	60	55
Germany	17	10	15	81	185	28	64	49
Japan	12	8	21	127	231	50	29	19
France	10	18	14	664	244	34	67	52
S. Korea	9	3	9	50	160	45	38	30
Italy	8	12	8	60	202	18	66	53
Australia	8	11	10	24	376	43	70	58
Holland	8	7	4	17	184	35	63	49
Hungary	8	3	4	10	34	24	67	49
Brazil	7	6	6	208	18	14	55	53
Spain	7	4	6	46	116	35	67	55
Kenya	6	6	1	46	2	11	17	34

A student wants to see if there is a correlation between the number of medals a country won and the percentage of overweight people in that country. To obtain a simple scatter graph, he plots the number of gold medals against the mean percentage of overweight people and adds the line of best fit (graph printed in the book, p. 525, titled 'Number of gold medals v % overweight adults').

(a) Describe the type of correlation implied by the above graph.

(b) The student states that the graph shows that the more overweight you are the more likely you are to win a gold medal. Give two reasons why this conclusion may not be accurate.

(c) Analyse the correlation between two other sets of data and comment on whether the results are expected or not. Justify your answer.

Exercise 36.4 · Histograms with equal class intervals

36.4.1 The table (below) shows the distances travelled to school by a class of 30 students. Represent this information on a histogram.

Distance (km)	$0 \le d < 1$	$1 \le d < 2$	$2 \le d < 3$	$3 \le d < 4$	$4 \le d < 5$	$5 \le d < 6$	$6 \le d < 7$	$7 \le d < 8$
Frequency	8	5	6	3	4	2	1	1

36.4.2 The heights of students in a class were measured. The results are shown in the table (below). Draw a histogram to represent this data.

Height (cm)	145–	150–	155–	160–	165–	170–	175–	180–185
Frequency	1	2	4	7	6	3	2	1

Exercise 36.5 · Histograms with unequal class intervals

36.5.1 The table below shows the time taken, in minutes, by 40 students to travel to school.

Time (min)	0–	10–	15–	20–	25–	30–	40–60
Frequency	6	3	13	7	3	4	4
Frequency density							

(a) Copy the table and complete it by calculating the frequency density.

(b) Represent the information on a histogram.

36.5.2 On Sundays, Maria helps her father feed their chickens. Over a period of one year, she kept a record of how long it took. Her results are shown in the table below.

Time (min)	$0 \le t < 30$	$30 \le t < 45$	$45 \le t < 60$	$60 \le t < 75$	$75 \le t < 90$	$90 \le t < 120$
Frequency	8	5	8	9	10	12
Frequency density						

(a) Copy the table and complete it by calculating the frequency density. Give the answers correct to 1 d.p.

(b) Represent the information on a histogram.

36.5.3 Frances and Ali did a survey of the ages of the people living in their village. Part of their results are set out in the table below.

Age (years)	0–	1–	5–	10–	20–	40–	60–90
Frequency	35			180	260		150
Frequency density		12	28			14	

(a) Copy the table and complete it by calculating either the frequency or the frequency density.

(b) Represent the information on a histogram.

36.5.4 The table below shows the ages of 150 people, chosen randomly, taking the 0600 train into a city.

Age (years)	0–	15–	20–	25–	30–	40–	50–80
Frequency	3	25	20	30	32	30	10

The histogram below shows the results obtained when the same survey was carried out on the 1100 train (printed in the book, p. 530). The bars read from the histogram are approximately:

Age (years)	0–15	15–20	20–50	50–80
Frequency density	2	7	0.5	1

(a) Draw a histogram for the 0600 train.

(b) Compare the two sets of data and give two possible reasons for the differences.

Student assessment 1

SA1.1 The table below shows the population (in millions) of the continents. Display this information on a pie chart.

Continent	Asia	Europe	America	Africa	Oceania
Population (millions)	4140	750	920	995	35

SA1.2 A department store decides to investigate whether there is a correlation between the number of pairs of gloves it sells and the outside temperature. Over a one-year period the store records, every two weeks, how many pairs of gloves are sold and the mean daytime temperature during the same period. The results are given in the table:

Mean temperature (°C)	**3**	**6**	**8**	**10**	**10**	**11**	**12**	**14**	**16**	**16**	**17**	**18**	**18**
Number of pairs of gloves	61	52	49	54	52	48	44	40	51	39	31	43	35
Mean temperature (°C)	19	19	20	21	22	22	24	25	25	26	26	27	28
Number of pairs of gloves	26	17	36	26	46	40	30	25	11	7	3	2	0

(a) Plot a scatter diagram of mean temperature against number of pairs of gloves.

(b) What type of correlation is there between the two variables?

(c) How might this information be useful for the department store in the future?

(d) The mean daytime temperature during the next two-week period is predicted to be 20°C. Draw a line of best fit on your graph and use it to estimate the number of pairs of gloves the department store can expect to sell.

SA1.3 A test in mathematics is marked out of 40. The scores of a class of 32 students are shown below.

24, 27, 30, 33, 26, 27, 28, 39, 21, 18, 16, 33, 22, 38, 33, 11, 16, 11, 14, 23, 37, 36, 38, 22, 28, 11, 9, 17, 28, 11, 36, 34

(a) Display the data on a stem-and-leaf diagram.

(b) The teacher says that any student getting less than the average score will have to sit a re-test. How many students will sit the re-test? Justify your answer fully.

SA1.4 The grouped frequency table below shows the number of points scored by a school basketball player.

Points	0–	5–	10–	15–	25–	35–50
Number of games	2	3	8	9	12	3
Frequency density						

(a) Copy and complete the table by calculating the frequency densities. Give your answers to 1 d.p.

(b) Draw a histogram to illustrate the data.

Check yourself

1 A pie chart shows 90 people. The sector for 'bus' is 80°. How many take the bus? [2]

2 Explain why the bars of a histogram with unequal class widths use frequency density, not frequency. [2]

3 A class $20 \le t < 30$ has frequency 15 and a class $30 \le t < 50$ has frequency 15. Find both frequency densities and say which bar is taller. [3]

4 Points on a scatter diagram fall from top left to bottom right and lie close to a straight line. Describe the correlation. [2]

5 Give one reason why a line of best fit should not be extended far beyond the data. [1]

Chapter quiz

Q1 In a survey of 40 students, 14 chose music. What angle is the music sector on a pie chart?

A	B	C	D
90°	126°	140°	14°

Q2 A pie chart shows 240 votes. A sector has an angle of 90°. How many votes is that?

A	B	C	D
30	60	90	120

Q3 A stem and leaf diagram has key 6 | 3 = 63. What does the row 5 | 0 0 8 show?

A	B	C	D
5, 0, 0 and 8	50, 50 and 58	500 and 508	50, 0 and 8

Q4 A stem and leaf diagram has 20 values in order. Which values give the median?

A	B	C	D
The 10th value	The 11th value	The 10th and 11th, averaged	The 20th value

Q5 On a scatter diagram, y falls as x rises and the points lie close to a line. What is this?

A	B	C	D
Strong positive correlation	Weak negative correlation	Strong negative correlation	No correlation

---

Q6 Which pair of data would most likely show NO correlation?

A	B	C	D
Age of a car and its resale price	Height and shoe size	Hair colour and distance to school	Temperature and cold drinks sold

---

Q7 Why should a line of best fit not be extended far beyond the data collected?

A	B	C	D
The line would stop being straight	The trend may not continue there	It makes the points move	It is against the rules

---

Q8 Which feature belongs to a histogram but not to an ordinary bar chart?

A	B	C	D
Bars can have different widths	Bars have gaps between them	It has a title	The bars are coloured

---

Q9 A class $20 \le t < 24$ has frequency 12. What is its frequency density?

A	B	C	D
2	3	4	48

Q10 A histogram bar has class width 2.5 and frequency density 6. What is the frequency?

A	B	C	D
2.4	8.5	15	3.5

Q11 On a histogram with unequal class widths, what shows the frequency?

A	B	C	D
The height of the bar	The area of the bar	The width of the bar	The colour of the bar

---

Q12 In a stem and leaf diagram, what is the main advantage over a bar chart?

A	B	C	D
It is quicker to draw	The original data can be read back	It needs no key	It works for any data

---

End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/o-level-mathematics/chapter-36-collecting-displaying-and-interpreting-data/