

UNIT

4

DATA HANDLING

Unit outcomes:

After completing this unit, you should be able to:

- collect data and construct simple line graphs and pie charts for a given data.
- calculate the mean, median and mode of a given data.
- find the range of a given data.

Introduction

Collection of data from a group of things help us to understand more about these things in the group. To do this the collected data should be presented systematically or pictorially so as to analyse them. In this unit you will learn how to collect simple data and present them pictorially and do some calculation on them to study their nature or property.

4.1. Collecting Data Using Tally Marks

Group Work 4.1

Discuss with your friends

Put a tick (✓) in the box for the tasks that you can perform.

1. What age are you?

Under 10

11 – 14

15 – 18

Above 18

2. Which of these fruits do you like?

Orange

Banana

Mango

Avocados

3. Do you have a mobile phone?

Yes

No



Figure 4.1 Mobile

Ways of collecting data

You can collect data:

- ✓ by using a questionnaire.
- ✓ by making observations and recording the results.
- ✓ by carrying out an experiment.
- ✓ from records or data base
- ✓ from the internet.

You must be careful how and when you collect data. If you want to find out what people think about marriage, for example, it is not sensible just to ask people at a wedding. They are interested in marriage and you might be led to the wrong conclusions!

Designing questions to collect data

When you are writing questions for a questionnaire:

- ✓ be clear what you want to find out, and what data you need.
- ✓ ask short, simple questions.
- ✓ Provide tick boxes with possible answers.

Note: Avoid questions which are too vague, too personal, or which may influence the answer.

Exercise 4A

Put a tick (✓) in the box for the tasks that you can perform.

1. Here are some questions that are not suitable for a questionnaire. For each one, say why and write a more suitable question.

- a. Do you agree that Ethiopia should have a monarchy?

Yes No Don't know

- b. What was the weather like on your holiday?

Terrible Quite good ok

- c. Most people approve of corporal punishment. Do you?

Yes No

- d. Do you still play foot ball?

Yes No



Figure 4.2 Foot ball field

e. How many hours of television do you watch?

1 2 3



Figure 4.3 Television

Challenge Problem

2. Use any source to find the following information. Give two reliable sources for each answer.
 - a. The heights of the five highest mountains in the world.
 - b. The average life expectancy of people in Ethiopia.

Some ways of presenting data

In a survey, 60 pupils were asked how many of their friends they got last Saturday. Here are the results:



3 2 4 7 7 5 8 6 7 6 7 6 8 5 4
 6 8 5 3 6 7 8 8 1 7 8 6 4 8 7
 6 5 7 6 9 7 6 5 8 3 7 9 4 5 7
 4 3 7 7 8 5 4 7 9 6 2 5 5 6 9


Table 4.1 to see this information more clearly you can draw up a tally chart;

Number of friends	Tally	Frequency (N ^o survey)
0	—	0
1		1
2		2
3		4
4		6
5		9
6		11
7		14
8		9
9		4

Note: This tally chart, or frequency table, shows the frequencies of the different numbers of friends (how often each number occurred).

Tally marks are grouped in five to make them easier to count:

 is easier to count than 

remember  represents 5 members of the group (sample).

Example 1: Consider the following data collected from the scores of 40 sample students in a mathematics examination:

Score of 40 students on a mathematics examination

56	78	62	37	54	39	62	60
28	82	38	72	62	44	54	42
42	55	57	65	68	47	42	56
56	56	55	66	42	52	48	48
47	41	50	52	47	48	53	68

To show this information more clearly you can draw a tally chart:

Table 4.2 the tally chart for the given information is as follows:

Solution:

Scores	Tally	N ^o of students (Frequency)
28		1
37		1
38		1
39		1
41		1
42		4
44		1
47		3
48		3

50		1
52		2
53		1
54		2
55		2
56		4
57		1
60		1
62		3
65		1
66		1
68		2
72		1
78		1
82		1

Example 2: A survey of 45 families was made to know about the number of children in each family. The information obtained was as follows:

2	0	3	2	2	4	4	2	2
3	3	2	3	1	2	3	3	1
2	2	4	1	2	1	1	2	1
0	3	2	3	1	5	2	2	2
1	2	3	4	2	2	2	3	2

Show this information more clearly you can draw up a tally chart.

Solution: In Table 4.3 the tally chart of the given information is as follows:

No of children in a family	Tally marks	Frequency
0		2
1	III	8
2		20
3		10
4		4
5		1
Total		45

Exercise 4B

1. The ages of students in a class were recorded as follows:

14 15 14 16 14 13 15 14 16 14 15 14
 14 15 17 15 14 16 16 13 14 15 14 14
 16 13 15 16 14 14 17 13 14 15 16 14
 15 13 15 16 14 17 15 16 14 17 13 14

Show this information more clearly by drawing a tally chart.

2. For each of the following sets of data recorded at a certain Ethiopian weather station, display the information in a tally chart.

- a. Hours of sunshine

5 6 0 1 3 1 4 7 5 6 6 2
 4 3 1 0 7 10 9 11 5 4 7 6
 9 9 11 12 12 7 9 10 11 10 9 7
 8 4 6 5 7 8 10 8 6 3 6 8
 3 3 4 1 10 9 11 7 2 6 10 7

- b. Maximum temperature in degrees Celsius

18 19 19 21 19 21 18 18 19 18 16 18
 17 18 18 17 19 18 17 16 21 22 21 21
 20 22 22 23 21 18 23 21 21 22 22 17
 19 17 19 21 19 19 17 19 19 16 19 17
 20 22 21 20 23 21 21 22 21 21 20 20

Challenge Problem

3. Collect data for the number of exercise books that the students in your class room have. Show this information by a tally chart.

4.2. Construction and Interpretation of Line Graphs and Pie charts.

4.2.1. Line graphs

Activity 4.1

Discuss with your friends in the class.

1. Measure the hand-span of each person in your class.
2. Record the data in a tally chart.
3. Draw a line graph to display your data.



Figure 4.4 Hand span

The **line graph** is most commonly used to represent two related facts. To plot a line graph, you can take two lines at right angles to each other. These lines are called **the axes of reference**. Their intersection is called **the origin**. The number of units represented by a unit length along an axis is called a **scale**. A line graph is drawn based on pairs of measurements of two quantities. Each pair of coordinates is represented by a dot, and consecutive dots are connected by a straight line or a smooth curve. So remember the following important points in making a line graph.

1. Draw the horizontal and vertical lines (axes) and label them by using appropriate scale so that it should be enough to represent the data to be used.
2. Make a table of data arranged in pairs. The first number of each pair is read from the horizontal scale (axis) and the other number is from the vertical scale (axis). Use these numbers to locate points on the graph.
3. Connect the points by a straight line or a smooth curve.

Example 3: A car uses 1 liters of petrol for every 10 km it travels.

- a. Copy and complete the Table 4.4 showing how much petrol the car uses.

Distance travelled in km	0	10	20	30	40	50	60
Petrol used in liters	0	1	2	3			

- b. Draw a graph from the information in your table.
 c. Work out how much petrol is used to travel 7km.
 d. Work out how many kilometers had been travelled by the time 10 liters of petrol had been used.

Solution:

- 10km = 1 Liters

$$40\text{km} = x$$

$$10\text{km} \times x = 40\text{km} \times 1\text{liters}$$

$$x = \frac{40\text{km} \times 1\text{Liters}}{10\text{km}}$$

$$x = 4\text{ liters}$$

- 10km = 1 liters

$$50\text{km} = x$$

$$10\text{km} \times x = 50\text{ km} \times 1\text{ Liters}$$

$$x = \frac{50\text{km} \times 1\text{ Liters}}{10\text{km}}$$

$$x = 5\text{ Liters}$$

- 10km = 1 liters

$$60\text{km} = x$$

$$10\text{km} \times x = 60\text{ km} \times 1\text{ liters}$$

$$x = \frac{60\text{km} \times 1\text{ litres}}{10\text{km}}$$

$$x = 6\text{ Liters}$$

- a.

Distance travelled in km	0	10	20	30	40	50	60
Petrol used in liters	0	1	2	3	4	5	6

- b. Plot the points (0, 0), (10, 1), (20, 2), (30, 3), (40, 4), and (50, 5) (60, 6) to draw a graph.

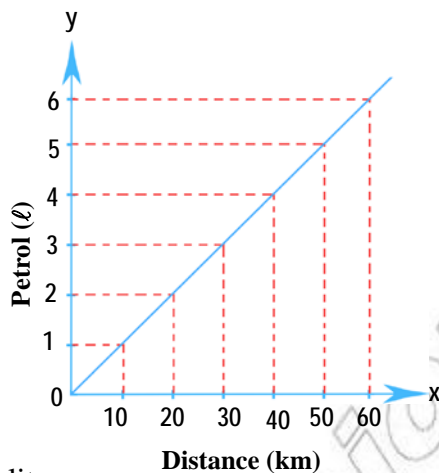


Figure 4.5

- c. 10km = 1 liters

$$7\text{km} = x$$

$$10\text{km} \times x = 7\text{km} \times 1\text{litres}$$

$$x = \frac{7\text{km} \times 1\text{litres}}{10\text{km}} = \frac{7\text{km} \times 1\text{lit}}{10\text{km}}$$

$$x = \frac{7}{10}\text{liters}$$

$$x = 0.7\text{liters}$$

- d. 10km = 1 liters

$$x = 10\text{Liters}$$

$$1\text{Liters} \times x = 10\text{km} \times 10\text{Liters}$$

$$x = \frac{10\text{km} \times 10\text{liters}}{\text{liters}}$$

$$x = 100\text{ km}$$

$$x = 100\text{ kilometers}$$

Example 4: The depth of a water in a reservoir is 144m. During a dry period the water level falls by 4m each week.

- a. Copy and complete in table 4.5 showing the expected depth of water in the reservoir.

Weeks	0	1	2	3	4	5	6	7	8
Expected depth of water in m	144	140							

- b. Draw a graph from the information in your completed table above.

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- c. How deep would you expect the level of the water to be after 10 weeks.
If the water level falls to 96m the water company will divert water from another reservoir.
- d. After how long will the water company divert water?

Solution:

a.

Weeks	0	1	2	3	4	5	6	7	8	9	10	11	12
Expected depth of water in m	144	140	136	132	128	124	120	116	112	108	104	100	96

b.

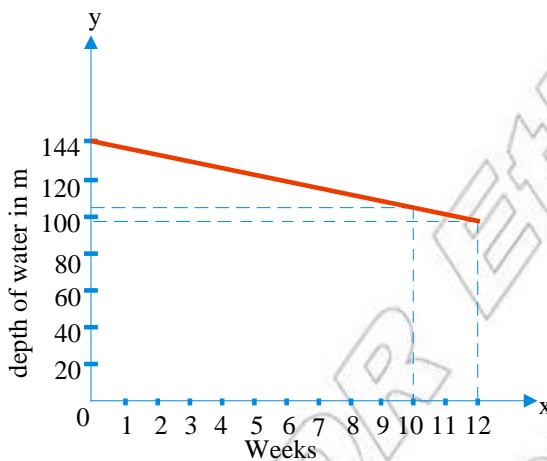


Figure 4.6

c. 104 m

d. 12 weeks

Exercise 4C

1. In Table 4.6 below gives some approximate conversion between inches and centimeters. (Hint 1 inches = 2.54 centimeters).

Centimeters	2.5	5	10	30	50
Inches	1	2	4	12	20

- a. Draw a conversion graph from inches to centimeters.
- b. Use your graph to find the number of centimeters in
- 6 inches
 - 10 inches
- c. Use your graph to find out the number of inches in
- 25 cm
 - 40 cm

2. The amount of petrol (in liters) in the storage tank at a garage was measured every hour between 7am and 7pm in one day. This is the shape of the line graph showing the results:

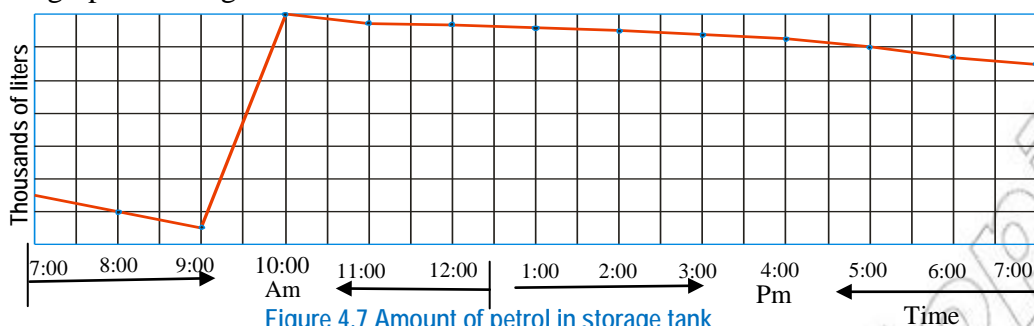


Figure 4.7 Amount of petrol in storage tank

- When was the amount of petrol in the tank at its lowest?
 - What happened to the amount of petrol between 9am and 10am?
 - What can you say about the sales like between 1 pm and 4pm?
 - Give a reason for your answer to part (c).
3. Draw line graphs to represent each of the following sets of data.
- The number of letters delivered to an office in one week (See Table 4.7)

Weeks	Sat	Sun	Mon	Tue	Wed	Thu	Fri
Letters	20	0	12	25	15	19	23

- The temperature in Addis Ababa at midday during the first week in July (See Table 4.8)

Day	Sat	Sun	Mon	Tue	Wed	Thu	Fri
Temperature(°C)	12	16	14	11	12	15	13

4.2.2 Pie Charts

Activity 4.2

Discuss with your parents (Friends)

1. Look at in Table 4.9 below:

Age	0 – 14	15 – 25	25 – 59	60 and above
Total pupil	48%	14%	30%	8%

Draw a pie chart to display your findings.

2. Draw a pie chart whose angles at the centre are: 108° , 90° , 72° , 60° and 30° .

- **Pie chart** is a very common and accurate way of representing data specially useful for showing the relations of one item with another and one item with the whole items.

The portion of a circular region enclosed between two radii and part of the circumference (an arc) is called **a sector of the circle**.

The size of the sector is determined by the size of the angle formed by the two radii. The larger the angle is, the wider the sector will be.

In a pie chart the total data is represented by the circular region as a whole and the individual data by sectors of the circle. The angle at the center of the circle is divided proportionally to determine the size of the individual data accordingly.

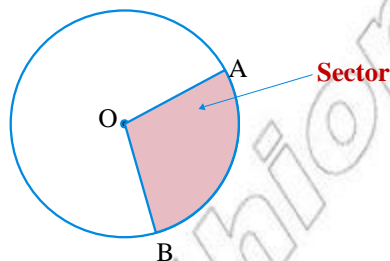


Figure 4.8 Pie chart

The following important point aid in drawing pie chart

1. Draw a circle large enough to make a clear drawing of the facts to be pictured.
2. First express the number of facts to be graphed as percentage and arrange them. Second you know that a circle has 360° . So if you divide 360° by 100 or $360 \div 100$ of the data you will get 3.6° . This gives us the idea that 1% can be represented by 3.6° .

Thus, multiply the percentage by 3.6° to get the size of the central angle of the sectors that represents the required data.

3. Mark off sectors of the circle corresponding to the required degrees using a protractor and draw the central angle which form the sectors.
4. A good graph should contain the following points:
 - a) Have a title
 - b) Be well proportioned
 - c) Have scales clearly marked and labeled
 - d) Different colors which shade each data
 - e) Show source of the facts that it represents.

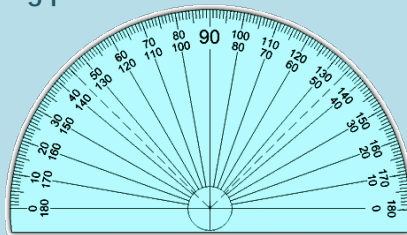


Figure 4.9 Protractor

Note: A pie charts are also called a circle graphs.

Example 5: The expenditure on different budget title of a family in amonth is given below (See Table 4.10)

Budget	Food	Education	clothing	House rent	Other	Savings	Total
Expenditures (Birr)	1200	540	900	400	360	200	3600

Show the data by a pie chart.

Solution

The measure of the angle of the sector representing the expenditure is given by the following formula:

$$\frac{\text{Expenditure on the given budget}}{\text{Total expenditure}} = \frac{\text{measure of the arc}(\theta)\text{of the sector}}{360^\circ}$$

Therefore, measure of the arc (θ) of the sector

$$= \frac{\text{Expenditure on the given budget}}{\text{total expenditure}} \times 360^\circ$$

In Table 4.11 showing the expenditure on each budget and the measure of the angle of the corresponding sector is given below:

Budget	Expenditures (Birr)	Measure of the angle(θ)
Food	1200	$\frac{1200}{3600} \times 360^\circ = 120^\circ$
Education	540	$\frac{540}{3600} \times 360^\circ = 54^\circ$
Clothing	900	$\frac{900}{3600} \times 360^\circ = 90^\circ$
House rent	400	$\frac{400}{3600} \times 360^\circ = 40^\circ$
Other	360	$\frac{360}{3600} \times 360^\circ = 36^\circ$
Savings	200	$\frac{200}{3600} \times 360^\circ = 20^\circ$
Total	3600	360°

On the basis of the given Table 4.11 the required pie chart is drawn below.

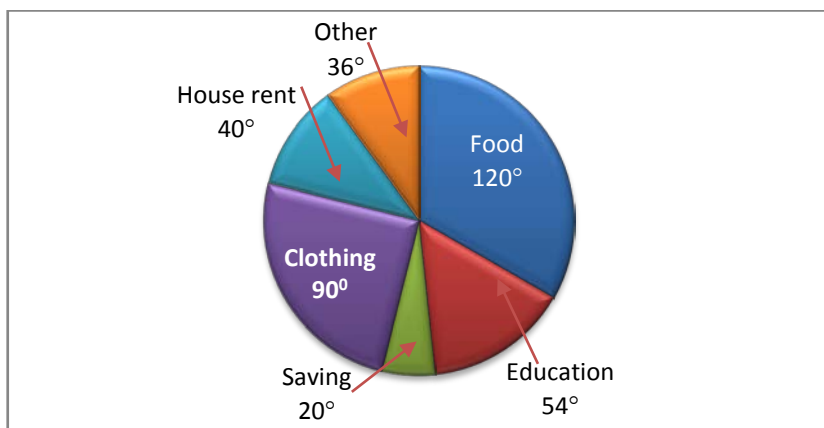


Figure 4.10 Pie chart

Example 6: The percentage of expenditure for the development programme on different budget title of a state is as show below (See Table 4.12).

budget	Agriculture	Irrigation	Electricity	Industry	Communication	Other
Percentage	25	15	15	30	10	5

Stage the data by pie chart

Solution: The measure of the angle of a sector representing expenditure on one budget title is given by the following formula:

$$\text{Measure of the angle of the sector} = \frac{\text{Percentage expenditure on each budget}}{100} \times 360^\circ$$

Using the above formula and finding the measure of the angle of the sector corresponding to each title of the percentage of expenditure, we will get the following table:

Budget	Percentage	Measure of the angle
Agriculture	25	$\frac{25}{100} \times 360^\circ = 90^\circ$
Irrigation	15	$\frac{15}{100} \times 360^\circ = 54^\circ$
Electricity	15	$\frac{15}{100} \times 360^\circ = 54^\circ$
Industry	30	$\frac{30}{100} \times 360^\circ = 108^\circ$
Communication	10	$\frac{10}{100} \times 360^\circ = 36^\circ$
Other	5	$\frac{5}{100} \times 360^\circ = 18^\circ$
Total	100	360°

On the basis of the given table the required pie chart is drawn in Figure 4.11 below:

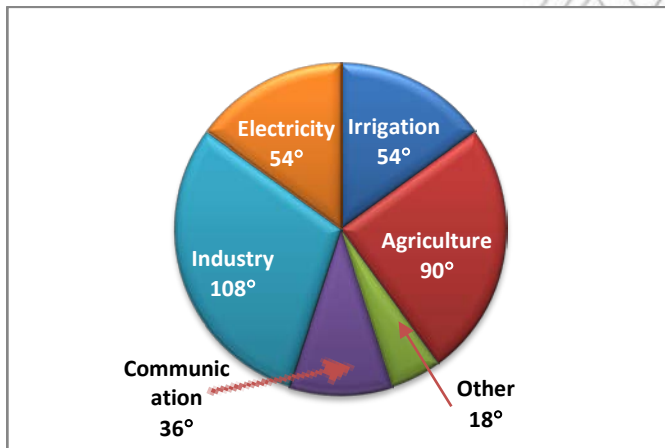


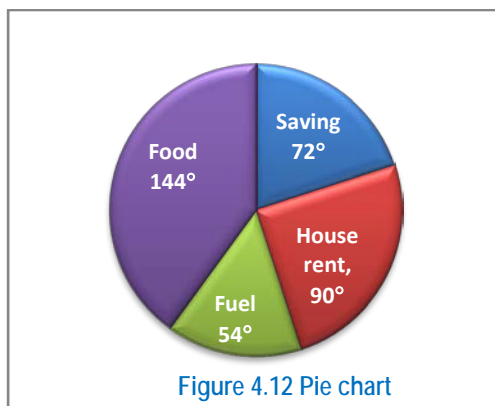
Figure 4.11 Pie chart

Example 7: The pie chart given in Figure 4.12 shows Ato Abebe's expenses and saving for the last month.

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If this monthly income was Birr 1500 then find:

- his food expenses.
- his house rent.
- his fuel expense.
- his saving.



Solution:

$$\text{Measure of the arc}(\theta)\text{ of the sector} = \frac{\text{Food expense}}{\text{total amount monthly income}} \times 360^\circ$$

$$\begin{aligned} \text{a. Food expense} &= \frac{\text{measure of the arc}(\theta)\text{ of the sector} \times \text{total amount of monthly income}}{360^\circ} \\ &= \frac{144^\circ \times 1500}{360^\circ} \\ &= 600 \end{aligned}$$

Therefore, Abebe's food expense is Birr 600

$$\begin{aligned} \text{b. House rent} &= \frac{\text{Measure of the arc}(\theta)\text{ of the sector} \times \text{total monthly income}}{360^\circ} \\ &= \frac{90^\circ \times 1500}{360^\circ} \\ &= 375 \end{aligned}$$

Therefore, Abebe's House rent expense is Birr 375.

$$\begin{aligned} \text{c. Fuel} &= \frac{\text{Measure of the arc}(\theta)\text{ of the sector} \times \text{total monthly income}}{360^\circ} \\ &= \frac{54^\circ \times 1500}{360^\circ} \\ &= 225 \end{aligned}$$

Therefore, Abebe's Fuel expense is Birr 225.

$$\begin{aligned} \text{d. Saving} &= \frac{\text{measure of the arc}(\theta)\text{ of the sector} \times \text{total monthly income}}{360^\circ} \\ &= \frac{72^\circ \times 1500}{360^\circ} = 300 \end{aligned}$$

Therefore, Abebe's saving is Birr 300.

Exercise 4D

1. Thirty students were asked to name their favorite chewing gum. The results are shown in Figure 4.13 below.

- What does the whole circle represent?
- Which chewing gum does the largest sector represent?
- What does the smallest sector represent?
- Use the given angles to calculate the number of students who liked strawberry chewing gum

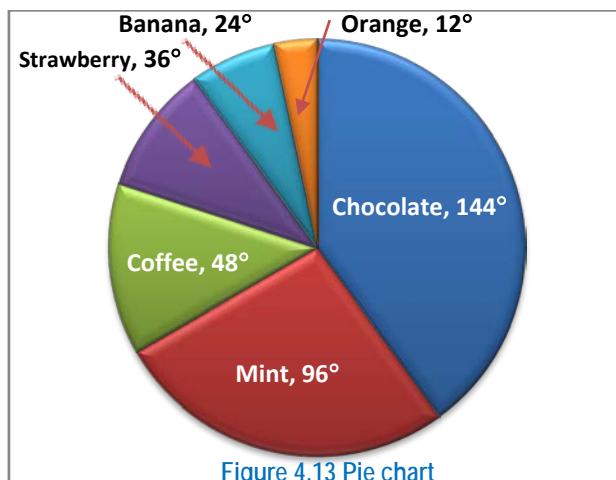


Figure 4.13 Pie chart

2. 720 students were asked how they travelled to school. The pie chart shows the results of this survey; Find

- how many of the students travelled to school by bus.
- how many students travelled on foot.

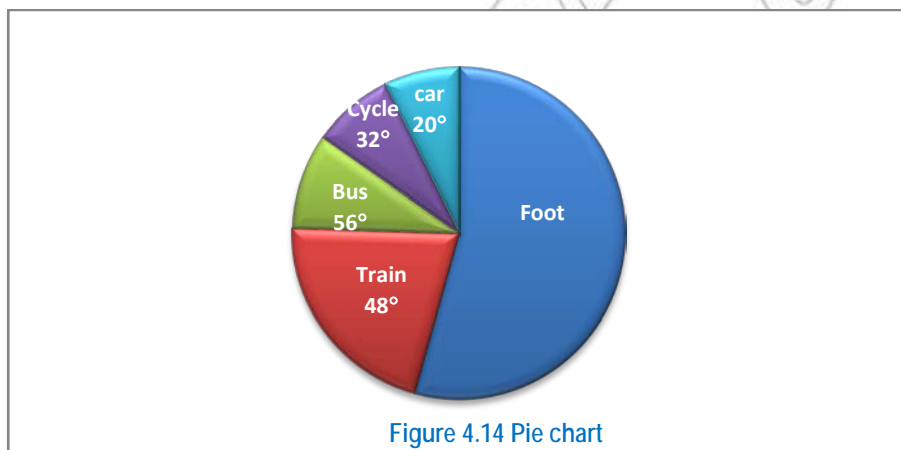


Figure 4.14 Pie chart

3. The following pie chart shows a family budget based on a net income of Birr 2400 per month.

- Determine the amount spent on rent.

- b. Determine the amount spent on car payments.
- c. Determine the amount spent on utilities.
- d. How much more money is spent than saving?

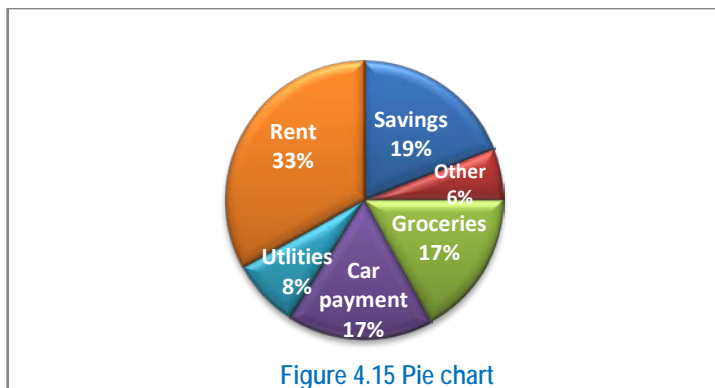


Figure 4.15 Pie chart

4. W/ro Eleni’s family had an income of Birr 12,000 a year. The following pie chart shows the family used the money. W/ro Eleni’s family expenditure:

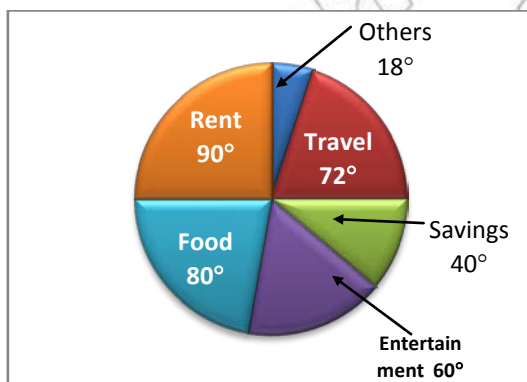


Figure 4.16 Pie chart

How much money did the family spend on:

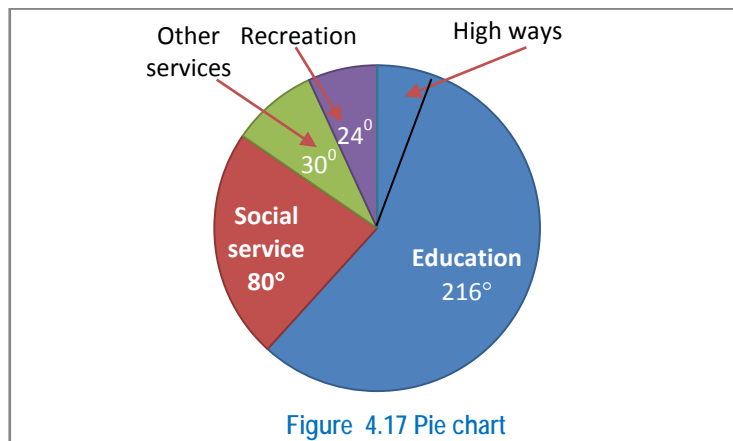
- a. food ?
 - b. savings ?
 - c. travel?
 - d. rent?
 - e. entertainment ?
5. The budge for social development programme of a district is given as follows (See Table 4.13)

Item	Amount(Birr)
Education	75,000
Public health	20,000
Community development	5,000

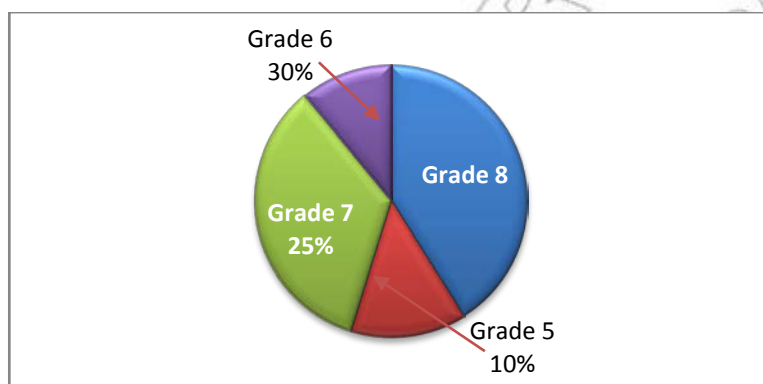
Construct a circle graph or pie chart representing this information.

Challenge Problems

6. The total expenditure of a region council is Birr 36,000,000. The pie chart below shows how the money was spent. How much money was spent on high ways? (See Figure 4.17 below).



7. The pie chart shown below is the number of students in a certain school. There are 1200 students in the school. What is the number of students in grade 8?



4.3. The Mean, Mode, Median and Range of Data

In this sub-topic you will learn about the three basic **measures of central tendency**: the **mean**, **median** and **mode**; while the **range** is called **measure of dispersion**.

4.3.1 The mean

Group Work 4.2

Discuss with your friends.

1. Find the mean of these numbers.

a. 132	148	141	136	134	129
b. 146	132	137	118	150	141

2. The mean of 15, 17, x , 28 and 19 is 16. What is the value of x ?

Definition 4.1: The mean of a set of data is the sum of all values divided by the number of values:

$$\text{mean} = \frac{\text{sum of all values}}{\text{number of values}}$$

Example 8. Find the mean of 6, 14, 10, 14, 14, 12, 8, 2.

Solution: The sum of the values is: $6 + 14 + 10 + 14 + 14 + 12 + 8 + 2 = 80$.
There are 8 values, so divide 80 by 8.

$$\begin{aligned}\text{Thus, mean} &= \frac{\text{sum of all values}}{\text{number of values}} \\ &= \frac{80}{8} = 10\end{aligned}$$

The mean is 10

Example 9. The mean of three numbers is 10, and the mean of four other numbers is 16. What is the mean of all seven numbers?

Solution: For the first set of data

We get, sum of values = mean \times number of values

$$\text{Sum of values} = 10 \times 3$$

$$\text{Sum of values} = 30$$

For the second set of data

Similarly sum of values = mean \times number of values

$$= 16 \times 4$$

$$= 64$$

Thus total sum = $30 + 64 = 94$

And total number of data = $3 + 4 = 7$.

$$\begin{aligned}\text{Therefore, mean of all seven numbers} &= \frac{\text{Total sum}}{7} \\ &= \frac{94}{7} \\ &= 13.4\end{aligned}$$

Therefore, the mean of all seven number is 13.4.

Example 10. The mean of four numbers is 9. Three of the numbers are 8, 16 and 6. Find the value of the other number.

Solution: let x be the missing number.

$$\text{Thus mean} = \frac{\text{Sum of all values}}{\text{number of values}}$$

$$9 = \frac{8+16+6+x}{4}$$

$$30 + x = 36$$

$$x = 6$$

The missing number is 6.

Exercise 4E

- Calculate the mean for each set of data.
 - 12 18 9 14 8 7
 - 23 15 37 26 16 21 33 23
 - 15 25 22 34 19 20
 - 25 12 31 26 31 19 30
 - 60, 75, 95, 80, 200
- The heights of a group of students, in centimeters, are 158, 162, 172, 157, 161.
 - Calculate the mean height.
 - Another student joins the group. His height is 169 cm. calculate the new mean height.
- The mean of four numbers is 94, and the mean of another nine different numbers is 17. What is the mean of all thirteen numbers?
- Find the value of x so that the mean of the given data: 14, 6, 2x, 8, 10, 4 is 8.
- What number should be included in the data 2, 8, 7, 4 and 9 so that the mean is 6?

Challenge Problems

- If the mean of A and B is 20, the mean of B and C is 24 and the mean of A, B and C is 18. What is the mean of A and C?
- If $2x^4 + 2y^4 + 2z^4 = 144$, what is the mean of x^4 , y^4 and z^4 ?
- A student has an average score of 90 on four tests. If the student scored 88, 96 and 92 on the first three tests. What was the student's score on the fourth test?
- The mean of 5 numbers is 11. The numbers are in the ratio 1:2:3:4:5. Find the smallest number.
- The mean length of 6 rods is 44.2cm. The mean length of 5 of them is 46 cm. How long is the sixth rod?

4.3.2. The Mode

Activity 4.3

Discuss with your teacher orally in the class

- Find the mode of these sets of data.

a.	4	8	10	12	16	30	10	9		
b.	24	23	22	25	24	0	24	25	26	25
c.	26	29	60	70	80	60	70	80	100	
d.	200	600	700	800	900	1000				

Definition 4.2: The **mode** of a set of data is the value which occurs most frequently.

Note:

- A data that has a unique mode is called **unimodal**.
- A set of data which has two modes is called **bimodal**.
- A set of data has three modes is called **Trimodal**.
- Each value occurs only once, so there is **no mode** at all.
- The mode can usually be determined by observation.

Example 11 Find the mode of these sets of data.

- a. 8 16 18 20 24 32 60 20
 b. 48 64 44 50 48 0 48 50 52 50
 c. 300 400 150 900 250 350

Solution:

- a. The mode is 20, since it occurs more frequently than any other values of the data. Note that 20 occurs two times, which is more than any of the other numbers of the given data.
 b. The number 48 occurs three times and the number 50 occurs three times. Hence, there are two modes 48 and 50.
 c. Each value occurs only once, so there is no mode for the given data.

Exercise 4F

1. Calculate the mode of the following sets of numbers.

- a. 200 406 406 609 708
 b. 326 580 580 799 799 900 900
 c. 1100 966 688 499 366 1278 1000 699 566
 d. 1106 1207 1138 1166 1188 1196 1278 1179
 1186 1186 1138

4.3.3. The Median

Group work 4.3

Discuss with your group member.

1. Find the median of these numbers.

- a. 2 3 4 8 12 13 14 18 19
 b. 3 8 8 9 10 12 14 18 21 23 25 30

Definition 4.3. The **median** is the middle value when the data is arranged in order of size.

Note: The **median** for a set of data with a total of n values is found by arranging the data in order from the smallest to the largest or from the largest to the smallest.

Example 12 Find the median of the population function whose values are:

- a. 6 12 2 0 4 10 4 6
 b. 18 4 2 18 14 8 4 6 12

Solution:

- a. Arranged in increasing order: 0 2 4 4 6 6 10 12

8 data items \Rightarrow even items.

The two middle values are the 4th and 5th elements of the list which are 4 and 6. The median is half the sum of 4 and 6.

$$\begin{aligned}\text{So the median of the even items} &= \frac{4+6}{2} \\ &= 5\end{aligned}$$

Therefore, the median is 5

- b. Arranged in increasing order: 2 4 4 6 8 12 14 18 18

9 data items \Rightarrow odd items

And the middle value is the 5th element of the list which is 8.

So the median of the odd items is 8

Hence the median is 8.

Example 13. Given a population function values: 10, -6, 4, -2, 7. What number must be included in the data so that the median will be 5.2?

Solution

population function values: 10, -6, 4, -2, 7

Median = 5.2

Numerical order: -6, -2, 4, x , 7, 10 since $4 < 5.2 < 7$

$$\text{Median} = \frac{4+x}{2} = 5.2$$

$$\Rightarrow 4 + x = 10.4$$

$$\Rightarrow x = 6.4$$

Therefore, the included number is 6.4 .

Exercise 4G

- Use the information given to find the value of x in each of the following sets of numbers.
 - 2, x , 5, 7, 1, 3: the median is $\frac{7}{2}$.
 - 4, 7, 2, x , 2, 9, 6: the median is 5
- Find the median of these numbers.
 - 38, 35, 35, 35, 30, 29, 28, 28, 11, 5
 - 1, 3, 17, 18, 19, 20, 21, 21, 24

4.3.4. The Range

Activity 4.4

Discuss with your Friends.

- Find the range of these sets of data.

a. 4	8	9	10	11	15	16	25	28	0
b. 10800	15000	15500	18300	21300					
c. -900	-200	-700	0	-1000					

- The range of a set of data is 32. If the biggest data value is 52, find the smallest value.

Definition 4.4. The **range** of a set of data is the difference between the highest value and the lowest value:
the range = highest value – lowest value.

Example 14. Find the range of these sets of data.

- 100, 600, 900, 500, 700
- 600, 0, -2000, -1000, -8000

Solution:

- Range = highest value – lowest value
 $= 900 - (-100)$
 $= 900 + 100$
 $= 1,000$
- Range = highest value – lowest value
 $= 0 - (-8000)$
 $= 0 + 8000$
 $= 8000$

Example 15. The range for an English test was 70. What was the highest point, if the lowest had been 20.

Solution:

$$\text{Range} = \text{highest value} - \text{lowest value}$$

$$70 = \text{highest value} - 20$$

$$\text{Highest value} = 90$$

Exercise 4H

- Find the range of the following mathematics examination scores.
80 65 84 73 90 96
- In a class of 30 students the highest score in physics test was 98 and the lowest was 35. What was the range?
- Find the range of these sets of data: -2, -9, -1, -2000, -6000.
- The range for the eight numbers shown is 40.

Find the two possible values of the missing number.

13	5	27
?	19	?
42	11	33

Summary For Unit 4

1. A **database** is an organized collection of information. It can be stored on paper or computer.
2. **Line graph** is most commonly used to picture how two sets of data are related to each other.
3. **A pie charts** are also called a circle graphs.
4. **Pie chart** is a very common and accurate way of representing data specially useful for showing the relations of one item with another and one item to the whole item.
5. A good graph should contain the following points:
 - a) Have a title.
 - b) Be well proportioned.
 - c) Have scales clearly marked and labeled.
 - d) Show source of the facts that it represents.
6. **The mean** of a set of data is the sum of all the values divided by the number of values:

$$\text{Mean} = \frac{\text{sum of values}}{\text{number of values}}$$

7. The **mode** of a set of data is the value which occurs most frequently.
8. The **median** is the middle value when the data is arranged in order of size.
9. The **range** of a set of data is the difference between the highest value and the lowest value:
Range = highest value – lowest value.

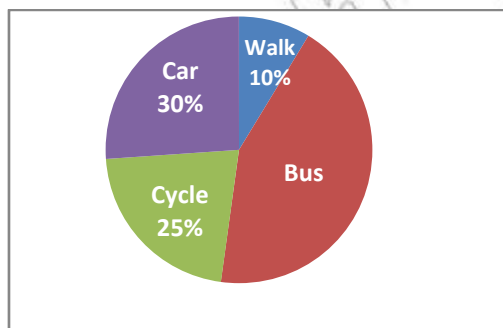
Miscellaneous Exercise 4

I. Fill each of the following blank space with the appropriate Terminology.

- The difference between the maximum and minimum value is called _____.
- An arrangement of data in an ascending or descending order is called _____.
- _____, _____ and _____ are called measure of location while _____ is measure of variation.
- A set of data which has two modes is called _____.
- _____ graphs can be used to show continuous data.

II. Work out questions

6. A survey was conducted by asking 120 students in a town how they traveled to school. The following pie chart shows the result of the survey.



What are the number of students that travel to school by bus?

Figure 4.19 Pie chart

7. 3000 students appeared for an examination from five different centres C_1 , C_2 , C_3 , C_4 and C_5 of a city. From the given pie chart, find the number of students appearing for the examination from each centre.

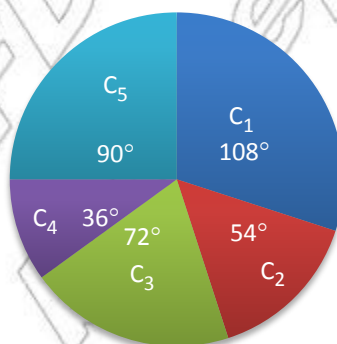


Figure 4.20 Pie chart

8. The following table shows the distribution of 90 apprentice workers in a factory according to trade (See Table 4.14).

Trade	Fitting	Turning	Welding	Molding	Spray painting
Number	25	30	8	15	12

Show the above data by a pie chart

9. A teacher listed 28, 30, 32 and 36 as ages of students in his class with frequencies 8, 10, 5 and 7 respectively.
- How many students were in the class?
 - What was the average age of the class?
 - What was the range for the students?
 - What was the modal age?
10. Given the data 4, y , 9, 5, 2, 7. Find y if
- the mean is 5
 - the median is 6
 - the mode is 4
11. The mean of six numbers is 12. Five of the numbers are 11, 7, 21, 14 and 9. Calculate the sixth number.
12. Use the information given to find the value of n in each of the following sets of numbers.
- 5, 7, 4, 1, n , 5: the mean is 6
 - 3, 1, 4, 5, 4, n : the mode is 4
 - 1, 7, 2, 1, n , 4, 3: the modes are 1 and 2
 - 2.6, 3.5, n , 6.2: the mean is 4
13. Find five numbers so that the mean, median, mode and range are all 4.
14. The mean of 3, 7, 8, 10 and x is 6. Find x .
15. Write down five numbers so that: the mean is 6, the median is 5 and the mode is 4.
16. Find the mean, median and mode of these sets of data:
- 14, 12, 24, 36, 23
 - 114, 112, 124, 136, 123
 - 2, 3, 4, 5, 30
 - x , $2x$, $3x$, $4x$, $5x$
17. a) The mean of 5 numbers is 8. Four of the numbers are 7, 9, 11 and 5. Find the fifth number.
- b) The mean of 4, 8, 9, x and $2x$ is 6. Calculate the value of x .