General paper

SENIOR FIVE TERM 3

TOPIC 2/2: Data collection and analysis

Competence: The learners supports evidence based decision making through collecting, analyzing, interpreting and communicating using a range of media to solve societal problem.

Data collection methods

In research, **data collection methods** are the techniques used to gather information for analysis. They can be broadly divided into **primary** (directly collected by the researcher) and **secondary** (collected by others but used for your study). Here's a clear breakdown:

Types of Data Collection Methods

1. Observation

- Watching and recording behaviors, events, or conditions in natural or controlled settings.
- Example: Observing classroom interactions to study teaching methods.
- Best for: Behavioral studies, anthropology, and social sciences.

2. Interviews

- Direct questioning of individuals (structured, semi-structured, or unstructured).
- Example: Asking community members about their experiences with healthcare.
- Best for: In-depth qualitative insights.

3. Questionnaires/Surveys

- Written or digital forms with structured questions.
- Example: Online survey about consumer preferences.
- Best for: Collecting large amounts of quantitative data quickly.

4. Focus Groups

- Group discussions guided by a facilitator to explore opinions and attitudes.
- Example: Discussing youth perceptions of social media.
- Best for: Exploring collective views and generating ideas.

5. Experiments

- Controlled studies where variables are manipulated to observe effects.
- Example: Testing the impact of a new teaching method on student performance.
- Best for: Scientific and psychological research.

6. Document/Content Analysis

- Reviewing existing records, reports, books, or media.
- Example: Analyzing government policy documents on human rights.
- Best for: Historical, legal, or media studies.

7. Case Studies

- Detailed examination of a single subject, group, or event.
- Example: Studying one village's response to climate change.
- Best for: Deep, contextual understanding.

8. Secondary Data

- Using data already collected by others (e.g., census, databases, published research).
- Example: Using World Bank statistics for economic analysis.
- Best for: Large-scale, comparative studies.

Why Different Methods Matter

- **Observation & interviews** → rich qualitative insights.
- **Surveys & experiments** → reliable quantitative data.
- **Document analysis & secondary data** → cost-effective and broad coverage.
- **Focus groups & case studies** → nuanced understanding of specific contexts.

In short: Researchers often combine several methods (called **triangulation**) to strengthen validity and reliability of findings.

Data presentation styles

Common Data Presentation Styles

Style	Description	Best Use Case
Tabular	Data arranged in rows and columns	Precise numerical comparisons, structured datasets
Textual	Data explained in words or paragraphs	Summaries, qualitative insights, reports
Pie Chart	Circular chart showing proportions	Showing percentages or parts of a whole
Bar Chart	Rectangular bars comparing categories	Comparing discrete groups or categories
Histogram	Bars showing frequency distribution	Statistical data, frequency analysis
Line Graph	Points connected by lines	Trends over time, continuous data
Pictogram	Icons or images representing data	Simplified visuals for general audiences
Radar Chart	Web-like chart with multiple axes	Comparing multiple variables at once
Heat Map	Color-coded grid showing intensity	Geographic data, performance metrics
Scatter Plot	Dots showing relationship between variables	Correlation, regression analysis

Why Presentation Style Matters

- **Clarity**: The right style makes complex data easy to understand.
- **Audience engagement**: Visuals like charts and maps capture attention better than raw numbers.
- **Decision-making**: Clear presentation helps stakeholders interpret insights quickly.
- **Accuracy**: Some styles (like tables) preserve detail, while others (like pie charts) simplify for overview.

Risks & Challenges

- **Misleading visuals**: Poorly scaled charts can distort meaning.
- **Overcomplication**: Too many styles at once confuse the audience.
- **Audience mismatch**: Technical graphs may overwhelm non-specialists.

Data collection and presentation (for your practice)

Data refers to the set of values or observations collected to analyzed and interpreted in order to make decisions. It can be numbers, prices, temperature, measurements, or observations—basically anything that helps us to understand a situation or solve a problem.

Information is set of data that has been organized into useful and intelligible form that form a basis for decision making.

Data analysis

Data analysis is the process of examining, organizing, and interpreting data to uncover useful insights, answer questions, and support decision-making.

Steps in data analysis

1. **Define the Objective**
    - What question are you trying to answer?
    - Example: "Why did sales drop last month?"
2. **Collect the Data**
    - Gather info from surveys, databases, sensors, or websites. For example, recording the heights of students in your class, recording temperature of the class at noon for one month, marks score by learners in a mathematic test, etc.
3. **Clean the Data**
    - Fix errors, remove duplicates, and fill in missing values.
4. **Explore the Data**
    - Use charts, graphs, and statistics to spot patterns or outliers.
5. **Analyze the Data**
    - Apply methods like regression, clustering, or hypothesis testing.
6. **Interpret Results**
    - What do the patterns mean? What decisions can be made?
7. **Communicate Findings**
    - Create dashboards, reports, or presentations to share insights.

Types of Data Analysis

Type	Purpose	Example
Descriptive	Summarize past data	Average monthly sales
Diagnostic	Explain why something happened	Why sales dropped in June
Predictive	Forecast future outcomes	Expected sales next quarter
Prescriptive	Recommend actions	Best time to launch a new product

Presentation of data

Data can be presented in five ways namely

- Pictogram
- Pie charts
- Tables
- Bar charts/Histograms
- Line graphs

Pictograms/Pictographs

Pictograms /pictographs are visual tools used to represent data using pictures or symbols. They're especially helpful for making information easy to understand at a glance—perfect for younger learners or quick summaries!

What Is a Pictogram?

- A **chart or graph** that uses images to show quantities.
- Each image represents a specific number of items.
- Often includes a **key** to explain what each symbol stands for.

Imagine a survey of favorite fruits among students:

Fruit	Number of Students	Pictogram (= 5 students)
Apples	15	
Bananas	10	
Oranges	5	

Here, each icon represents 5 students. So 3 = 3 x 5 =15 students.

How to Create a Pictogram

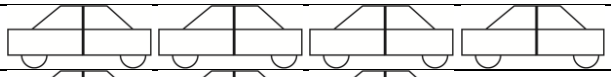
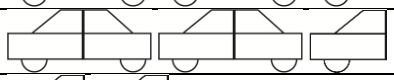
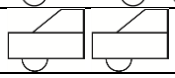
1. **Collect your data** (e.g., number of books read).
2. **Choose a symbol** that matches your topic.
3. **Decide the value** of each symbol (e.g., 1 icon = 10 units).
4. **Draw the chart** with categories and symbols.
5. **Include a key** to explain the symbol's value.

Advantages of pictographs

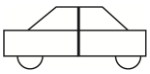
- Easy to read and interpret
- Visually engaging
- Great for comparing categories quickly

Example 1

A car company sales several types of vehicles; the pictogram below represents the number of each type of vehicles found on display on a certain day.

Vehicle type	icon
Toyota	
Isuzu	
TaTa	
Daihatsu	

Key

 represents 10 vehicle

 represents 5 vehicle

(a) How may Toyotas were on display on that day

10 x 4 = 40

(b) Which vehicle was least displayed on that day

Daihatsu

(c) How many vehicles were displayed altogether

10 4 + 3 + 2½ + 1½) = 11 x 10 = 110vehicle

Trial 1

1. The pictogram below show the number of trees cut from the forest on each day of the week for one week.

Days of the week	Number of trees cut
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	

Key:

represents 2000 trees

represents 1000 trees

Calculate

(a) Number of trees cut on each day
(b) Total number of trees cut in five days.

2. The table below show number of oranges in boxes A, B, C and D

Boxes	A	B	C	D
Number of oranges per box	45	40	35	25

Use an appropriate icon to draw a pictogram for the data above.

3. The pictogram below represents number of oranges served to each class at lunch on Monday.

Class	Number of students	Number of oranges served
S1	41	
S2	57	
S3	35	
S4	30	

Key

 = 5 oranges

(a) In which class were oranges in excess of the number of students?
(b) In which class were oranges fewer than the number of students?
(c) Find the total number of oranges served to the school

Tables

Tables are structured formats used to organize and present data clearly and efficiently. They help summarize large amounts of information so that patterns, comparisons, and insights can be easily spotted.

Tables are made of:

- A grid of **rows and columns** that displays data values.
- Each **row** typically represents a category or observation.
- Each **column** shows a variable or characteristic.
- Often includes **titles, headings, units**, and sometimes a **source**.

Trial 2

The table below shows number of students in The Science foundation College

Class	S1	S2	S3	S4	S5	S6
Boys	23	35	60	53	70	42
Girls		43			45	47
Total	60		90	92		

(a) Fill the blank spaces in the table
(b) Which class has the highest number of students
(c) Which class has the least number of students
(d) What is the total number of students in the school

Pie charts

Pie charts are circular graphs used to show how a whole is divided into parts. Each slice of the pie represents a category, and the size of the slice shows how much of the total it makes up.

How to Create a Pie Chart

1. **Collect your data** Example: Number of student in school

Class	S1	S2	S3	S4
Number of students	64	48	32	16

2. **Convert numbers to angles**

   Total number of students = 64 + 48 + 32 + 16 = 160

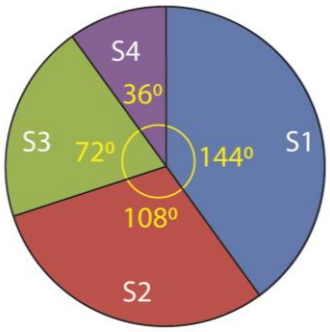
   Angle size covered by S1: $\frac{64}{160}$× 360 = 144°

   Angle size covered by S2: $\frac{48}{160}$ × 360 = 108°

   Angle size covered by S3: $\frac{32}{160}$ × 360 = 72°

   Angle size covered by S4: $\frac{16}{160}$ × 360 = 36°

3. **Draw the circle and measure angles** Use a protractor to draw each slice from the center.



Why Use Pie Charts?

Benefit	Description
Easy to understand	Great for showing proportions at a glance
Visually appealing	Makes data more engaging and memorable
Ideal for comparisons	Quickly compare parts of a whole

When Not to Use Pie Charts

- If you have **too many categories** (more than 5–6)
- If the **differences between values are small**
- If you need to show **trends over time** (use line or bar charts instead)

Trial 3

1. Draw a pie chart to represent David's monthly expenditure in the table below

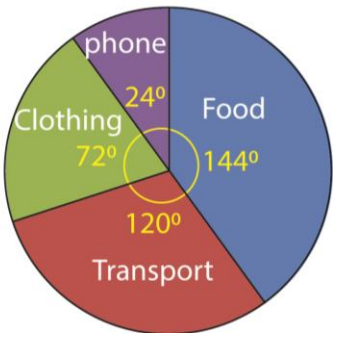
Food	450,000
Electricity	200,000
Phone call	100,000
Clothing	250,000

2. The table below shows how Dr. Bbosa Science uses his land

Land use	Coffee	Cotton	Maize	Grazing
Land size (ha)	4.5	3	2.5	2

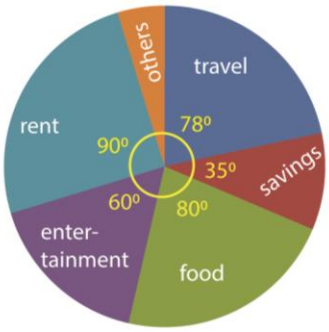
Draw a pie chart to represent the information above

3. Moses earns sh. 1,200,000 and spends it as shown on the pie chart.



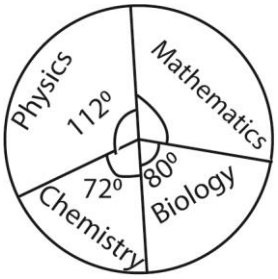
Find how much is spent on each item.

4. Yoweri spent his monthly salary as shown in the pie chart below



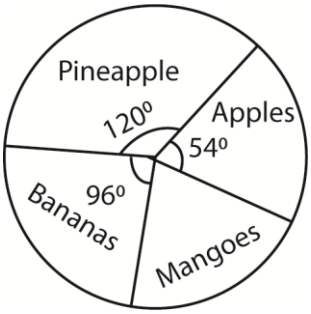
If his monthly salary is sh. 2,000,000/= find how much he spends on each item.

5. The pie chart below represent the subjects taught by 45 science teachers



Determine the number of teachers who teach mathematics [12]

6. The pie chart below shows the fruits popularly solid in a daily supermarket in Kampala



If 420 apples were sold on a given day, determine

(a) The total number of fruits that were sold that day [2800]
(b) How many mangoes were sold that day. [700]

Bar charts

Bar charts are one of the most popular and easy-to-read ways to display data visually. They use rectangular bars to represent values, making it simple to compare categories side by side.

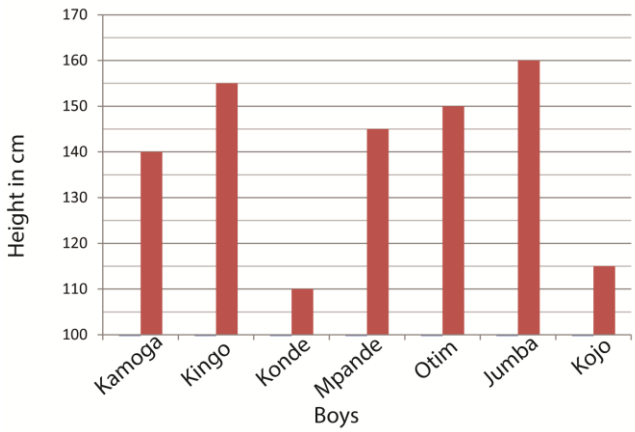
Bars can be **vertical** or **horizontal**. The **length or height** of each bar represents the value of the data.

Uses Bar Charts

- Comparing **quantities across categories**
- Showing **survey results**
- Visualizing **frequency distributions**
- Tracking **changes over time** (if categories are time-based)

Example 2

1. The bar graph below shows heights in cm of 7 boys from Kelima secondary School. Use it to answer the questions that follow;



(a) Complete the table below

Kamoga	Kingo	Konde	Mpambe	Otim	Jumba	Kojo
145cm	155cm	110cm	**145cm**	**150cm**	**160cm**	**115cm**

(b) What is the height of the shortest boy?

The height of the shortest boy = 110cm

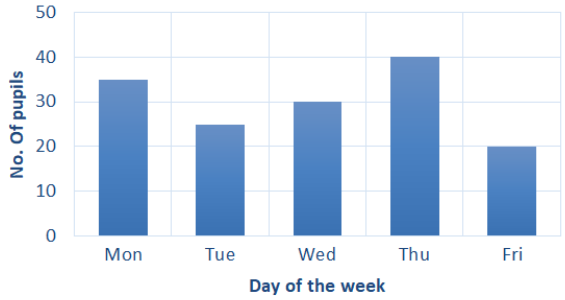
(c) What does one square on the vertical axis represent? :

1square vertical axis = 5cm

(d) What is the average height of the boys

Average height of the boys = $\frac{145+150+110+145+150+160+115}{7}$ =125cm

2. The graph below shows the number of student present in a class of 40 pupils in a certain week. Study it and answer the questions that follows



Find the average number of student who were absent in the week.

Days	Number of students present out of 40	Number of students absent
Mon	35	40-35=5
Tue	25	40-25=15
Wed	30	40-30=10
Thur	40	40-40=0
Fri	20	40-20=20

Average number of pupils absent in the five days = $\frac{(5+15+10+0+20)}{5}$

= 10 students/day

Trial 4

1. The data below shows the number of students that attended school on the different days of the week.

Monday	300
Tuesday	250
Wednesday	350
Thursday	400
Friday	200

Draw a bar chart to represent the above data.

2. The table below shows number of oranges, lemons, tomatoes, tomatoes sold on a market day by a trader.

Name of the fruit	Oranges	Lemon	Tomatoes	
Number sold	5	12	8	4

Represent the data on

(c) Vertical bar chart

(d) horizontal bar chart

3. The table below contains number of candidates that sat final examination five school A, B, C, D and E.

Schools	Number of candidates
A	40
B	56
C	80
D	32
E	60

Represent the information on a bar chart.

4. The number of visitors accommodated per night by a certain hotel was recorded over a period of a month.

No. of visitors	0<10	10<20	20<30	30<40	40<50
No. of nights	2	8	12	5	3

Using a scale of 1cm to represent 2 nights and 1cm to represent 10 visitors, display the given data on a bar-graph. Use your bar-graph to estimate the modal number of visitors accommodated by the hotel [24]

Histogram

Histogram resembles a bar graph or bar chart with the bars touching one another for continuous data.

A frequency polygon is the line graph that joins the midpoints of the bars of a histogram.

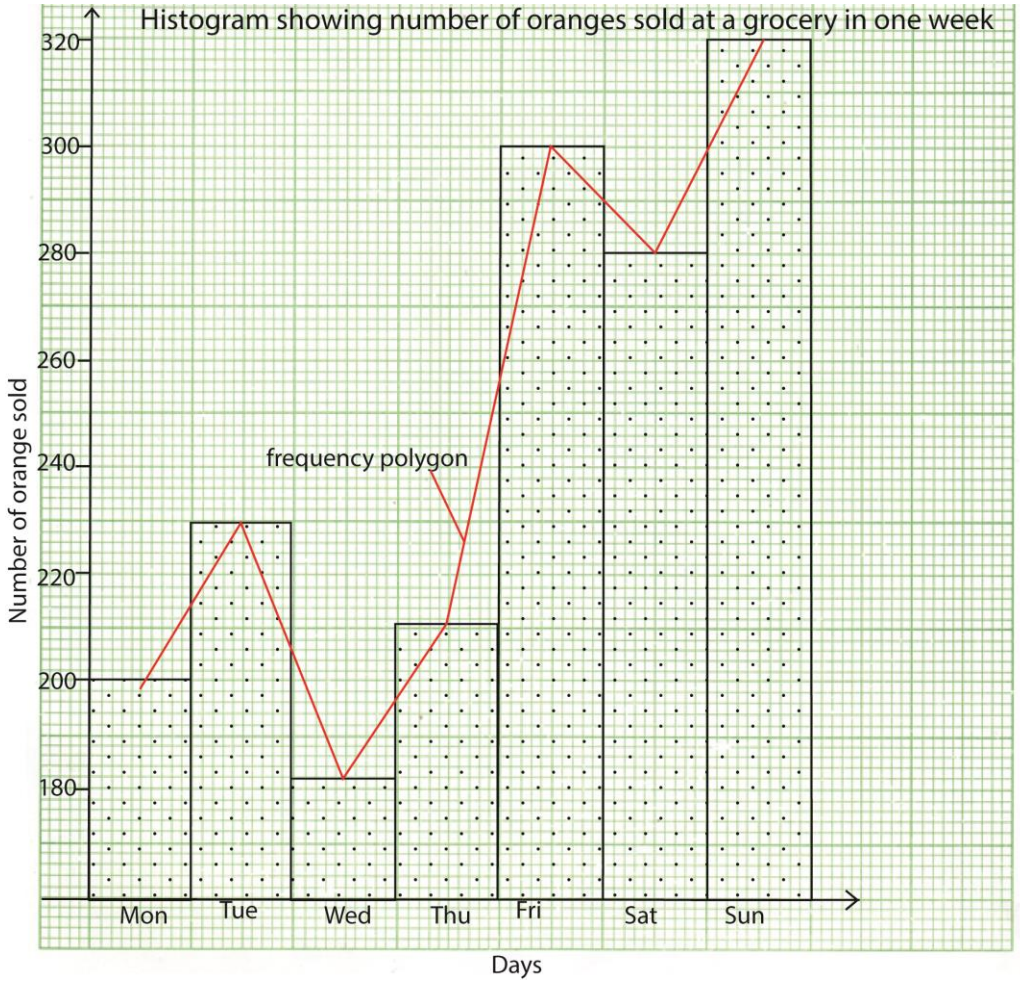
Example 3

The table below shows number of oranges sold at a grocery in one week

Day of the week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Number of orange sold	200	230	180	210	300	280	320

(a) Draw a histogram to represent the data.

(b) Use the histogram to construct a frequency polygon



Trial 5

1. The table below shows age of120 students entering senior one.

Age (years)	12.5 – 12.9	13.0 – 13.4	13.5 – 18.9	14.0 - 14.4	14.5-14.9
No. of students	8	35	52	17	8

(a) State the

(i) class width [0.4]

(ii) modal class [13.5-13.9]

(b) Determine the mean and median age of the students [13.625, 13.61]

Thank You

Dr. Bbosa Science