Data, Frequency Tables & Diagrams

Amari Cross & Matthew Williams • Math • May 6, 2026

Statistics begins with organising information so that patterns can be seen. A table or diagram is not just a picture; it is a way to make a dataset easier to read, compare, and interpret.

In CSEC, Statistics questions may ask you to construct a diagram, read a value from a table, or explain what the data suggests. Always identify the type of data first, because that determines whether a bar chart, histogram, pie chart, line graph, or frequency polygon is appropriate. Your explanation should connect the diagram back to the data, not just describe its shape.

Understanding **what kind** of data you have is the first step in analysis.

Quantitative vs. Qualitative Data

The type of data determines what calculations and diagrams make sense. You can average numerical data, but not categories like favourite colour.

Quantitative data = numerical, can be measured

- Examples: height, age, temperature, test scores, weight

Qualitative data = descriptive, not numerical

- Examples: color, preference, opinion, gender, nationality

Discrete vs. Continuous Data

Discrete data is counted in separate values; continuous data is measured and can take values between marks on a scale.

Discrete data = counted, takes specific values only

- Examples: number of students (can't have 25.5 students), shoe size, number of cars
- Integers only

Continuous data = measured, can take any value in a range

- Examples: height (could be 175.3 cm or 175.31 cm), temperature, time
- Can be any decimal value

Ungrouped vs. Grouped Data

Ungrouped data shows individual values. Grouped data sacrifices exact detail to make large datasets easier to summarise.

Ungrouped data = individual values listed separately

- Used for: small datasets, when exact values matter
- Example: 5, 7, 8, 9, 11, 12, 15

Grouped data = values organized in classes/intervals

- Used for: large datasets, to see patterns
- Example: 5-10, 10-15, 15-20

📋 **Example**

Classify these data sets:

- 1. "Heights of 100 students: 1.50 m, 1.52 m, 1.67 m, ..."
- **Quantitative**, continuous, grouped (in height ranges)
- 2. "Colors preferred by 50 people: red, blue, red, green, ..."
- **Qualitative**, discrete
- 3. "Number of books read: 5, 7, 8, 9, 11, ..."
- **Quantitative**, discrete, ungrouped

🧠 **Remember**

- **Quantitative** = numbers; **Qualitative** = descriptions
- **Discrete** = counted (integers); **Continuous** = measured (decimals)
- **Ungrouped** = individual values; **Grouped** = in classes

---

Part 2: Frequency Tables

A **frequency table** organizes data by showing how often each value occurs.

Ungrouped Frequency Table

A frequency table counts how often each value appears. It makes repeated data easier to read and prepares it for graphs or averages.

📋 **Example**

Test scores for 20 students:

5, 7, 5, 8, 9, 5, 7, 6, 8, 7, 5, 9, 6, 8, 7, 9, 5, 6, 8, 7

Frequency table:

Score	Frequency	Cumulative Frequency
5	5	5
6	3	8
7	5	13
8	4	17
9	3	20
Total	**20**	

<JSXGraph id="stat-bar-1" title="Bar chart: frequency distribution" boundingbox={[0, 12, 6, -1.5]} axis={false} height={300} code="var labels=['A','B','C','D','E'];var vals=[3,7,5,9,4];for(var i=0;i<vals.length;i++){var x=i+0.7,w=0.6;board.create('polygon',[[x,0],[x+w,0],[x+w,vals[i]],[x,vals[i]]],{borders:{strokeColor:'#1d4ed8'},fill
/>

Grouped Frequency Table

Grouped frequency tables are used when there are many different values. Each class interval should be clear and non-overlapping.

For large datasets, group values into **class intervals**.

📋 **Example**

Heights of 40 students (in cm):

[CodeBlock:0]

Grouped frequency table:

Class Interval	Frequency	Cumulative Frequency
150-159	5	5
160-169	8	13
170-179	12	25
180-189	10	35
190-199	5	40
Total	**40**	

<JSXGraph id="stat-hist-1" title="Histogram: grouped frequency distribution" boundingbox={[0, 16.8, 6, -2.1]} axis={false} height={300} code="var labels=['0-9','10-19','20-29','30-39','40-49'];var vals=[4,8,12,7,3];for(var i=0;i<vals.length;i++){var x=i+0.7,w=0.6;board.create('polygon',[[x,0],[x+w,0],[x+w,vals[i]],[x,vals[i]]],{borders:{strokeColor:'#1d4ed8'},fill
/>

Class Features

Class boundaries and midpoints help you calculate and graph grouped data. The midpoint stands in for all the values in that interval when exact values are unavailable.

When grouping data, understand these terms:

Class interval = the range (e.g., 150-159)

- Lower class limit = 150
- Upper class limit = 159

Class boundaries = the true limits (used for graphs)

- For 150-159: boundaries are 149.5 to 159.5
- Removes the "gap" between classes

Class width = difference between boundaries

- 159.5 - 149.5 = 10

Class midpoint = center of the class

- (150 + 159) ÷ 2 = 154.5

📋 **Example**

For the class interval 170-179:

- Class limits: 170 (lower), 179 (upper)
- Class boundaries: 169.5 to 179.5
- Class width: 179.5 - 169.5 = 10
- Class midpoint: (170 + 179) ÷ 2 = 174.5

Part 3: Statistical Diagrams

Different diagrams show data in different ways.

Pie Charts

Pie charts show parts of a whole. Each sector angle is proportional to the category frequency.

A **pie chart** shows data as slices of a circle. Each slice is proportional to the frequency.

$$\text{Angle for slice} = \frac{\text{Frequency}}{\text{Total}} \times 360°$$

📋 **Example**

Favorite fruit for 60 students:

Fruit	Frequency	Angle
Apple	20	(20÷60)×360° = 120°
Banana	15	(15÷60)×360° = 90°
Orange	15	(15÷60)×360° = 90°
Mango	10	(10÷60)×360° = 60°
Total	**60**	**360°**

<JSXGraph id="stat-pie" title="Pie chart with 4 slices" boundingbox={[-5, 5, 5, -5]} axis={false} height={320} code="var O=board.create('point',[0,0],{visible:false});var angles=[0,90,200,290,360];var colors=['#fca5a5','#86efac','#93c5fd','#fcd34d'];for(var i=0;i<4;i++){var a1=angles[i]Math.PI/180,a2=angles[i+1]Math.PI/180;var p1=board.create('point',[4Math.cos(a1),4Math.sin(a1)],{visible:false});var p2=board.create('point',[4Math.cos(a2),4Math.sin(a2)],{visible:false});board.create('sector',[O,p1,p2],{fillColor:c
/>

Bar Charts

Bar charts compare separate categories or discrete values. The gaps between bars show that the categories are separate.

A **bar chart** uses rectangular bars to show frequencies. Good for categorical or discrete data.

<JSXGraph id="stat-bar-generic" title="Bar chart" boundingbox={[0, 12, 6, -1.5]} axis={false} height={300} code="var labels=['Mon','Tue','Wed','Thu','Fri'];var vals=[5,8,6,9,7];for(var i=0;i<vals.length;i++){var x=i+0.7,w=0.6;board.create('polygon',[[x,0],[x+w,0],[x+w,vals[i]],[x,vals[i]]],{borders:{strokeColor:'#1d4ed8'},
/>

📋 **Example**

Number of cars sold per day (Monday-Friday):

Day	Cars Sold
Monday	15
Tuesday	12
Wednesday	18
Thursday	20
Friday	14

<JSXGraph id="stat-bar-cars" title="Daily car sales" boundingbox={[0, 16.8, 7, -2.1]} axis={false} height={300} code="var labels=['Mon','Tue','Wed','Thu','Fri','Sat'];var vals=[3,5,2,7,8,12];for(var i=0;i<vals.length;i++){var x=i+0.7,w=0.6;board.create('polygon',[[x,0],[x+w,0],[x+w,vals[i]],[x,vals[i]]],{borders:{strokeColor:'#1d4ed8'},fill
/>

Histograms

Histograms show grouped continuous data. Bars touch because the intervals run continuously into each other.

A **histogram** is like a bar chart, but for continuous grouped data. **No gaps between bars**.

<JSXGraph id="stat-hist-grouped" title="Histogram of grouped data" boundingbox={[0, 14.399999999999999, 6, -1.7999999999999998]} axis={false} height={300} code="var labels=['0-10','10-20','20-30','30-40','40-50'];var vals=[2,6,11,8,3];for(var i=0;i<vals.length;i++){var x=i+0.7,w=0.6;board.create('polygon',[[x,0],[x+w,0],[x+w,vals[i]],[x,vals[i]]],{borders:{strokeColor:'#1d4ed8'},
/>

📋 **Example**

Heights grouped into classes:

<JSXGraph id="stat-hist-heights" title="Histogram of heights (cm)" boundingbox={[0, 19.2, 6, -2.4]} axis={false} height={300} code="var labels=['140-150','150-160','160-170','170-180','180-190'];var vals=[2,7,15,9,3];for(var i=0;i<vals.length;i++){var x=i+0.7,w=0.6;board.create('polygon',[[x,0],[x+w,0],[x+w,vals[i]],[x,vals[i]]],{borders:{strokeColor:'#1d4ed8'},fill
/>

Frequency Polygon

A frequency polygon joins class midpoints to show the shape of a distribution. It is useful for comparing two grouped datasets on the same axes.

A **frequency polygon** connects the midpoints of each class with straight lines. Shows the shape of the distribution.

📋 **Example**

Using the same height data:

Plot a point at each class midpoint at its frequency height, then connect with straight lines.

<JSXGraph id="stat-freq-poly" title="Frequency polygon (line through midpoints)" boundingbox={[0, 18, 7, -3]} axis={false} height={300} code="var pts=[[1,2],[2,7],[3,15],[4,9],[5,3]];for(var i=0;i<pts.length-1;i++){board.create('segment',[pts[i],pts[i+1]],{strokeColor:'#dc2626',strokeWidth:2});}for(var i=0;i<pts.length;i++){board.create('point',pts[i],{name:'',size:3,fillColor:c.red});}board.create('axis',[[0,0],[7,0]],{t
/>

Line Graph

Line graphs show change over time or ordered values. The pattern of rise, fall, and flat sections is the main information.

A **line graph** shows how a variable changes over time.

<JSXGraph id="stat-line" title="Line graph over time" boundingbox={[-1, 12, 8, -2]} height={300} code="var pts=[[1,3],[2,5],[3,4],[4,7],[5,8],[6,6],[7,10]];for(var i=0;i<pts.length-1;i++){board.create('segment',[pts[i],pts[i+1]],{strokeColor:'#2563eb',strokeWidth:2});}for(va i=0;i<pts.length;i++){board.create('point',pts[i],{name:'',size:3,fillColor:c.blue});}" />

🧠 **Remember**

When to use which diagram:

- **Pie chart**: Showing parts of a whole; percentages
- **Bar chart**: Categorical data; comparing groups
- **Histogram**: Continuous grouped data; seeing distribution shape
- **Frequency polygon**: Showing distribution shape; comparing distributions
- **Line graph**: Data over time; showing trends