

# Scales of measurement



# Learning intentions

We are learning about the scales of measurement, specifically to understand,

- what are the definitions of **interval** and **ratio** for quantitative data
- what are the definitions of **nominal** and **ordinal** for qualitative data

# Background

When trying to solve a problem in data science understanding the data you have (or need) is key.

Data can be categorised as **quantitative or qualitative**.

In this lesson we will look at **the scales of measurement** related to these data categories.



# Why this is important?

The scale of measurement lets you know the **type of information provided by a data item**.

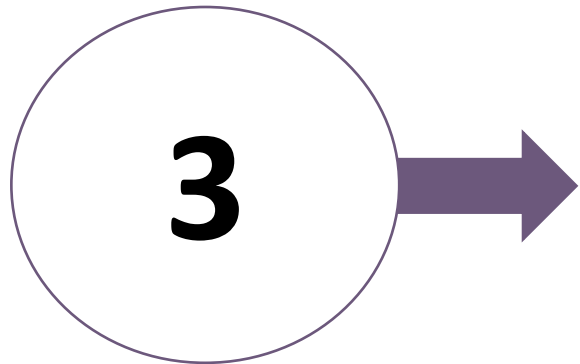
Therefore, how you capture data (and the resulting scale of measurement) determines the analysis you can perform.







# Show me...



Here is an example of **why it's important**



What is this number?	What this means for the analysis?
Height (3.0m) 	Can only have positive numbers
Temperature (+3°C) 	Can have negative or positive numbers
Position in a race (3 <sup>rd</sup> ) 	Order is important
Label for a group of people (Group 3) 	Order is not important

# Show me...



What colours can you see?

Description	red	orange	yellow	green	...
Wavelength (nm)	650	600	580	550	...
Relative description	Dark	Lighter	Lightest	Darker	...

How you collect/measure your data can impact on,

- How **detailed** it is (granularity)
- The **quality** of the data
- Whether the data can be **ordered**
- The **analysis you can perform** in it



# Data categories

Data falls into two main types:

## Data

### Quantitative



### Qualitative



# Scales of measurements

There are four scales of measurement that align to the types of data.

## Data

**Quantitative**



**Qualitative**



**Interval**

**Ratio**

**Nominal**

**Ordinal**

# Definition



## **Interval**

Can have positive or negative values so it has no true zero.

# Show me...



These are measured as an **Interval** (*has no true zero*)

-ve

0

+ve

**Company profit** (or loss) can be positive or negative



**Time** does not have a meaningful zero point to measure from

# Definition



## **Ratio**

Has a true zero, can only  
have positive values

# Show me...



These can be measured as a **Ratio** (*has a true zero*)

0

+ve

Age of a child



Height of a mountain



Length of a room

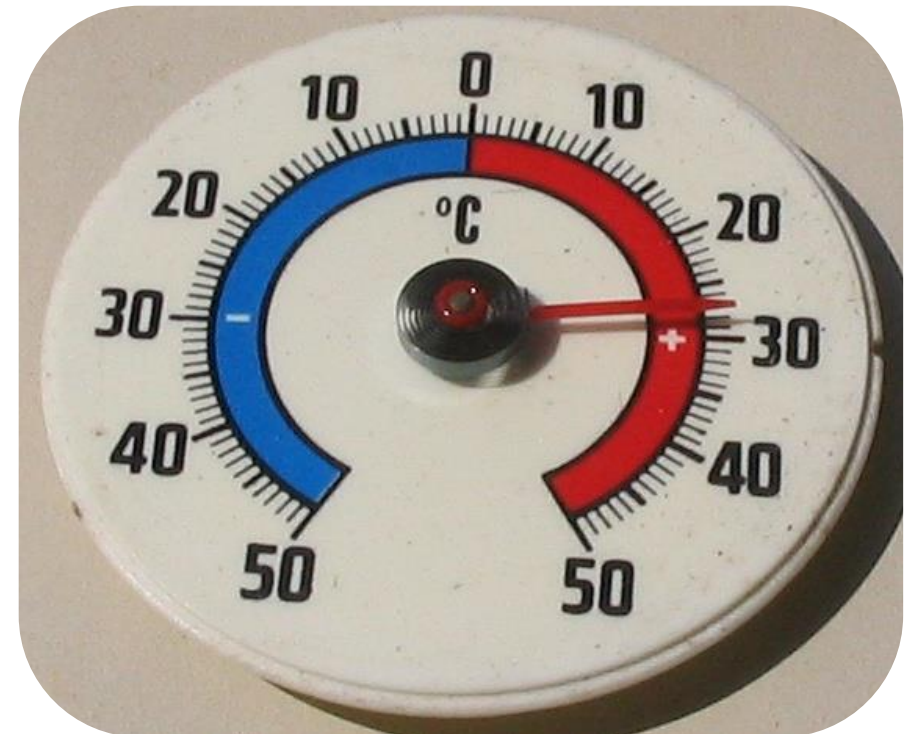


# Example

Explain why the **temperature** (in Celsius) of a room would be measured as an **'interval'**?

It is **quantitative** data.

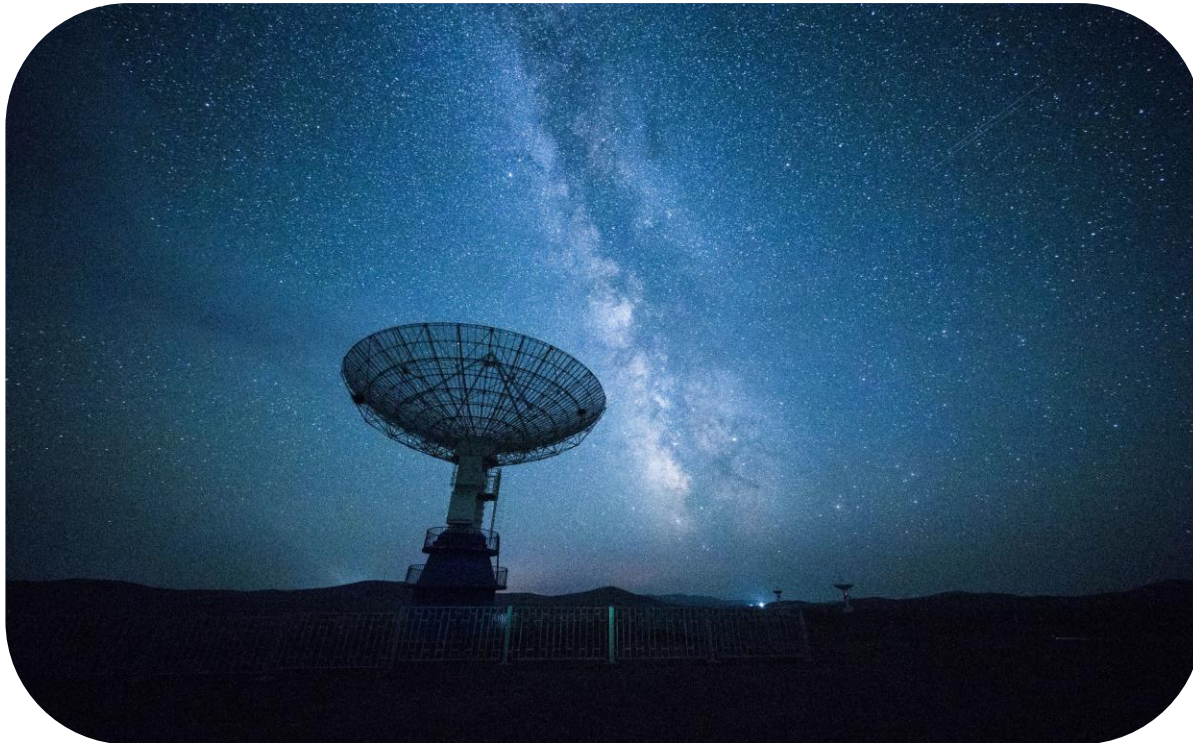
It has **no true zero** (you can have a positive and negative values)



# Your turn...



Scientists are **measuring the distance** from the Earth to nearby stars. Would you measure this as a 'Interval' or 'Ratio'?



## Interval

Can have positive or negative values so it has no true zero.

## Ratio

It has a true zero



## Your turn...



Scientists are **measuring the distance** from the Earth to nearby stars. Would you measure this as a 'Interval' or 'Ratio'?

It would be **ratio** because it has a true zero.

You can not have a meaningful negative distance between the Earth and nearby stars; therefore, you have a true zero.



# Definition



## **Nominal**

Data that cannot be  
ordered or measured

# Definition



## **Ordinal**

Data that ***can be*** ordered  
but not measured

# Show me...



These are Nominal (unordered)

Eye colour



Subjects studied at school



Pizza toppings



Crops grown on a farm



These are Ordinal (ordered)

Months of the year



Clothes sizes



Top 5 selling songs



Feedback in a survey



# Example

**Nominal** Data that cannot be ordered or measured  
**Ordinal** Data that *can be* ordered but not measured

A restaurant holds the following qualitative data. Decide whether the data is **nominal** or **ordinal**?



Which days they receive deliveries



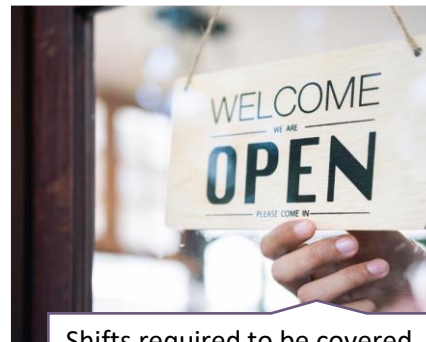
Customer comments (with no ratings attached)



Alphabetically list of the names of employees



Randomly shuffled music to play in the restaurant



Shifts required to be covered by staff (morning, afternoon, evening)



Descriptions of the food on the menu

# Example

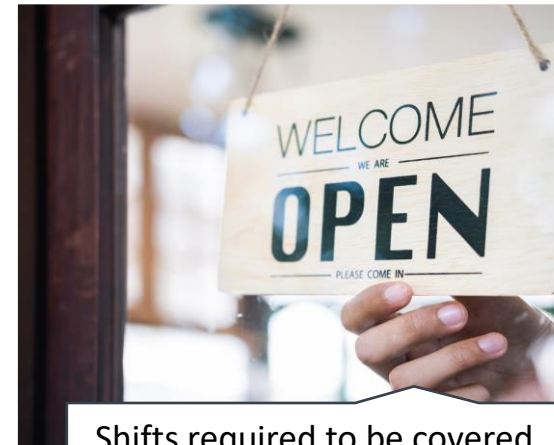
These are **ordinal**.



Which days they receive deliveries



Alphabetically list of the names of employees



Shifts required to be covered by staff (morning, afternoon, evening)

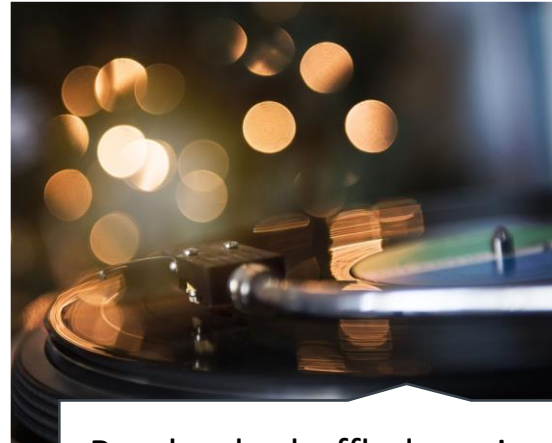
All these data types have words that **can be** ordered.

# Example

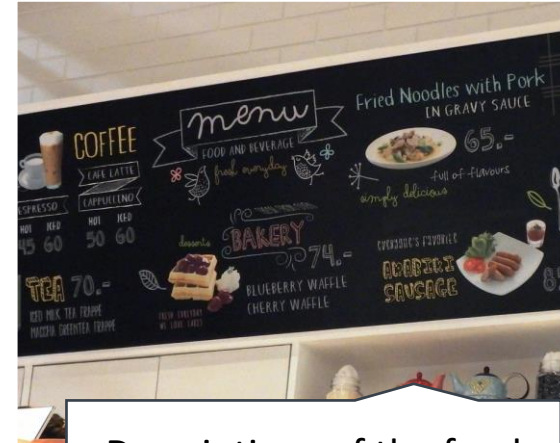
These are **nominal**.



Customer comments (with  
no ratings attached)



Randomly shuffled music  
to play in the restaurant



Descriptions of the food  
on the menu

All these data types have words that **cannot be ordered**.

# Your turn...



Which of these are **ordinal** data types?

Marital status



Agree/ Neutral/ Disagree  
in a survey



Recipe ingredients



Transport types



## Nominal

Data that cannot be ordered or measured

## Ordinal

Data that *can be* ordered but not measured



# Your turn...



Which of these are **ordinal** data types?

Marital status



Agree/ Neutral/ Disagree in  
a survey



Recipe ingredients



Transport types



Only 'Agree/Neutral/Disagree in a survey' is ordinal as it can be meaningfully **ordered**.

## Next steps

Complete the **all questions** in the  
'Scales of measurement' workbook.

# Learning checklist

I can *describe* interval and ratio scales of measurement for quantitative data.

I can *describe* nominal and ordinal scales of measurement for qualitative data.

# How you can use this lesson



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