

Numeracy Skills

ECGE4001R

Aims of the session

- ▶ To examine what kind of number work is necessary for your degree.
- ▶ To discuss the importance of number work and quantitative data.
- ▶ To examine basic fractions.
- ▶ To examine percentages.
- ▶ To calculate averages.

Aims of the session.

- ▶ To discuss the importance of graphs, charts and tables.
- ▶ To examine scales, seminar task to gather some scale data and work out the scoring system.
- ▶ To input the data into excel and make observations of the data.

What kind of number work is necessary.

Make sense of numerical information in texts, charts, graphs and tables

Recognise what is significant, relevant, valid or misleading about number-based information

Collect information for projects, reports and other assignments.

Calculate averages or percentages (use computer packages)

Identify numerical trends

Present findings from experiments, surveys, questionnaires or research projects.

Use Specialists Statistical Software (SPSS).

Attend lectures and workshops for these.

Why use numbers.

- ▶ Add value.....
- ▶ Think about the two sentences below – which one sounds better.
- ▶ “Many students from UWTSD have a part time job”.
- ▶ “75% of students from UWTSD have a part time jobs”.

Can you trust numbers?

- ▶ How useful are numbers?
- ▶ Many people have strong opinions about numbers, especially statistics.
- ▶ Do numbers “prove” anything.
- ▶ Numbers provide information, the value of which depends on what else you know about it and whether it suits your purpose.

Populations and Samples.

- ▶ The population is the **whole** set of values, or individuals, you are interested in.
- ▶ It is seldom possible to measure every individual in the population.
- ▶ E.g. The average height of 17 year olds in Wales....
- ▶ Population = Every single 17 year old in Wales will need to be measured.

Populations and Samples...

- ▶ Sample = set of observations drawn from a population. In other words, a measure of some of the individuals from a given population.
- ▶ If the sample is typical of the population, statements that are accurate for the sample are also said to be accurate for the population as a whole – known as a **representative sample**.
- ▶ From this sample you can draw **inferences** about the whole population.
 - ▶ **Inferential statistics.**

The relevance of numbers....

- ▶ When examining numerical data its relevance largely depends on what is being asked of them.
- ▶ Ask yourself.
 - ▶ Does it provide useful insights? Does it indicate oddities (outliers) that need further investigations.
 - ▶ Does it help me spot any trends?
 - ▶ Does it affect how you should think about the topic area?

Do numbers provide proof?

- ▶ Numbers may appear to be convincing, but when using any data – be objective and critical. Ask yourself.

Do these data measure what they propose to measure?

Are they likely to be accurate?

Could they contain errors or misprints?

How were they collected?

Who wanted them collected?

When were they collected?
Are they up to date?

Are they representative of a population.

Do they cover EXACTLY what you are looking for?

Questioning numbers and statistics.

Is the data
based on
estimates?

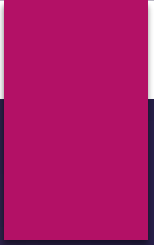
Is the data
likely to
change?

Is the data
still up to
date?

What was
actually
measured?

What kind of
sample was
used?

What kind of
“averaging”
was used?



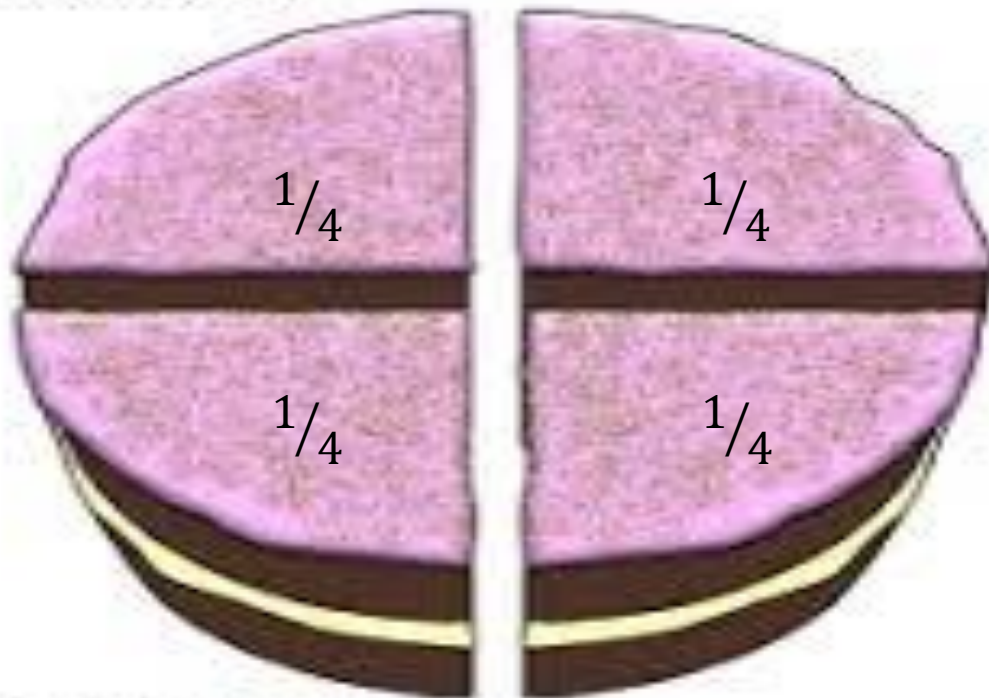
Fractions.

What are fractions.

- ▶ Definition – One of a number of equal parts of a complete unit.
- ▶ $\frac{1}{2}$ $\frac{3}{4}$ $\frac{1}{4}$ $\frac{2}{3}$ $\frac{1}{3}$
- ▶ Denominator = Lower number $\frac{3}{4}$
 - ▶ Represents the total number of equal parts into which the whole unit is divided.
- ▶ Numerator = Top number $\frac{3}{4}$
 - ▶ Represents the proportion of the equal parts into which the whole is divided.

Examples of Fractions – Cake.....

Cake fractions



4 quarters

Comparing Fractions....

- ▶ When fractions have the same denominator (bottom number) – it is easy to compare them.
 - ▶ Who has had the bigger portion of cake – Person A who has had $\frac{3}{12}$ or Person B who has had $\frac{5}{12}$
- ▶ However when the denominator is different, can be harder to compare.
 - ▶ Who has had the bigger portion Person A who has had $\frac{1}{4}$ or Person B who has had $\frac{4}{9}$
 - ▶ To work this out, you will need to do some maths! (next slide)

Comparing Fractions....

- ▶ Which is bigger $\frac{1}{4}$ or $\frac{2}{9}$
- ▶ You first need to work out the common denominator (multiply the two denominators)
 - ▶ $4 \times 9 = 36$.
- ▶ You next need to work out the equivalent number of $\frac{1}{36}$ for each fraction.
- ▶ For $\frac{1}{4}$ to get 36 at the bottom you multiply 4 by 9, so you multiply the top 1 by 9 also = $\frac{9}{36}$
- ▶ For $\frac{2}{9}$ to get 36 at the bottom you multiply 9 by 4, so you multiply the top 2 by 4 also = $\frac{8}{36}$
 - ▶ Consequently we can now say the bigger fraction is $\frac{1}{4}$.

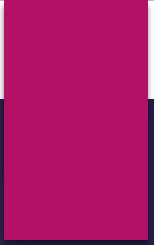
Your turn.....

- ▶ 1) Calculate $\frac{3}{4}$ of a sample of 200.
- ▶ 2) Calculate $\frac{1}{3}$ of a sample of 2000
- ▶ 3) Calculate $\frac{7}{8}$ of a sample of 1600

Top heavy fractions....

- ▶ Sometimes you see a fraction in which the numerator (top number) is higher than the denominator (bottom number).
- ▶ E.g. $\frac{7}{6}$
- ▶ What this simply means is that the fraction amounts to more than one whole item or set.
- ▶ E.g. $\frac{7}{6}$ is the same as $\frac{6}{6} + \frac{1}{6}$ or $1 \frac{1}{6}$



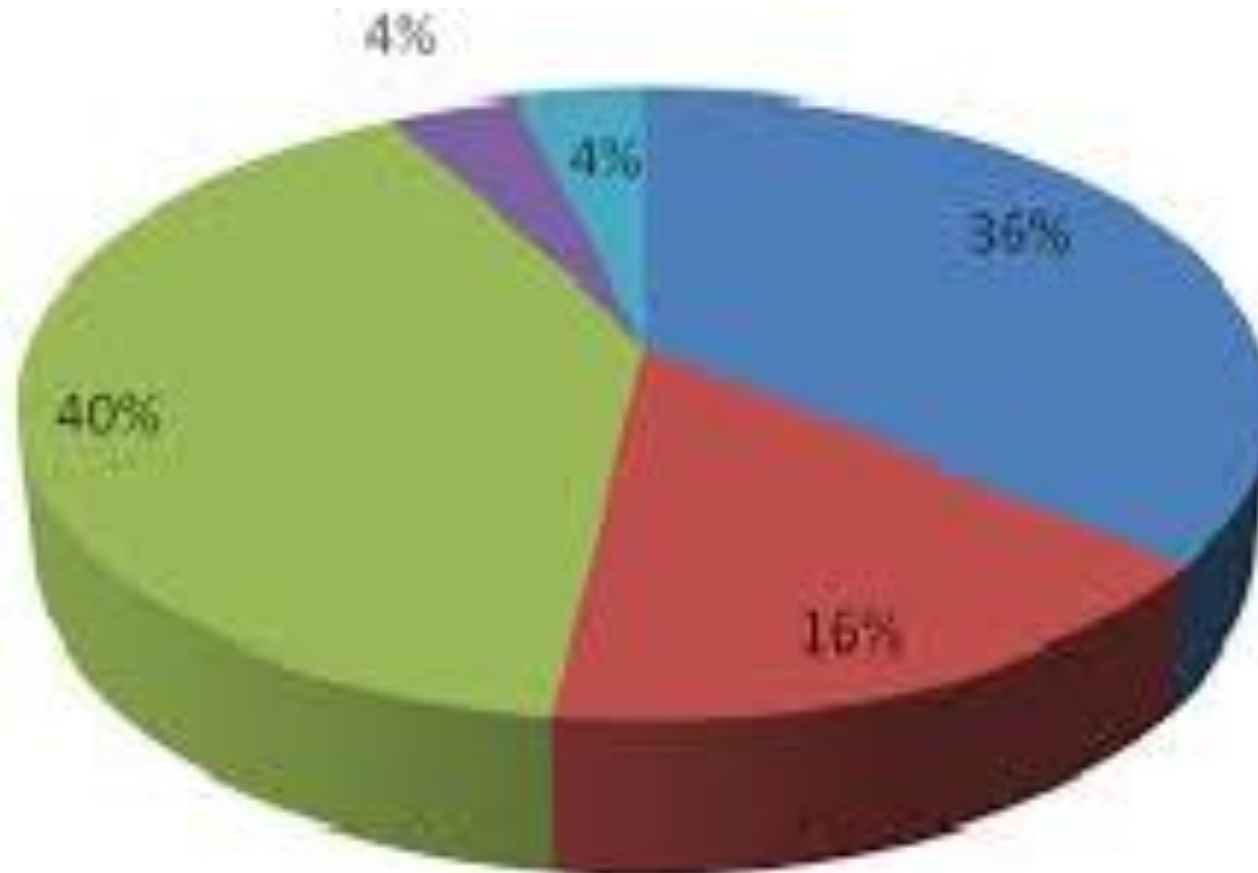


Percentages.

About percentages.

- ▶ A percentage (%) is a way of stating any fraction as a proportion of 100.
- ▶ The whole of anything – the full amount of an item or group of items is 100%
- ▶ If you divide this total into smaller parts, each part will be a proportion of the whole 100%. All the pieces together add up to 100%

Percentages...



Calculating percentages from fractions....

- ▶ To work out a percentage from fraction all you need to do is work follow the following formula.
- ▶ Numerator (top number) $\div$ Denominator (bottom number) $\times$ 100.
- ▶ For Example – To work out the percentage of $\frac{3}{4}$
- ▶ $3 \div 4 = 0.75 \times 100 = 75 = 75\%$.

Therefore....

- ▶ If you have an MCQ with 30 questions, you can work out your overall percentage...

- ▶ $\frac{10}{30} = 10 \div 30 = 0.33333$, $0.3333 \times 100 = 33.3$, $= 33\%$.

- ▶ Now it is your turn..... Work out the percentages from the following fractions.

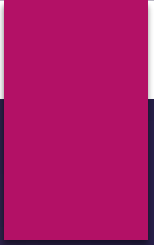
- ▶ $\frac{33}{45}$

- ▶ $\frac{4}{20}$

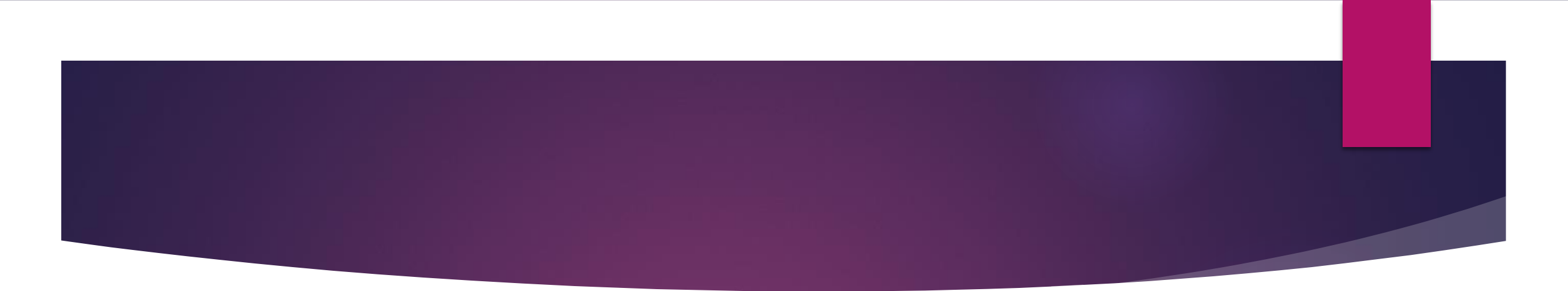
- ▶ $\frac{59}{2864}$

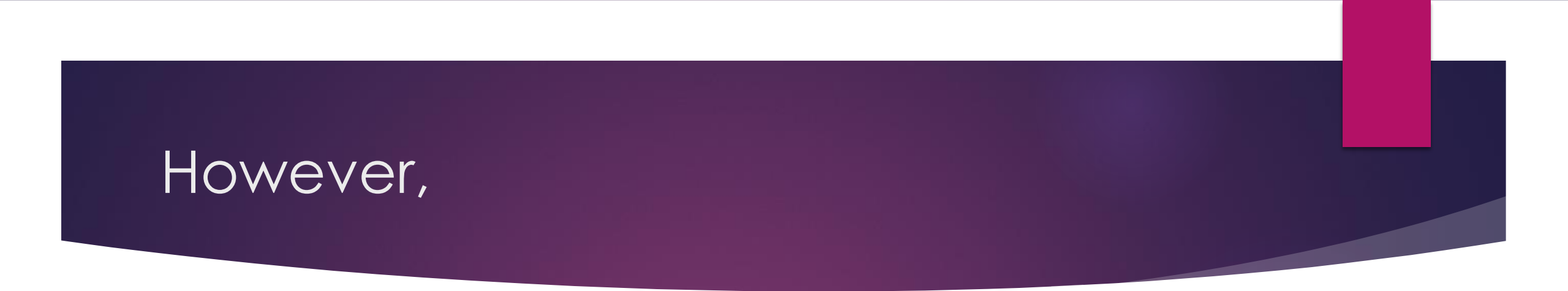
Further Understanding Percentages....

- ▶ To calculate your total marks for a module with two unequal assessment components.
- ▶ For example – if a student scored 66% for an essay worth 70% of the total mark and 76% for a presentation worth 30% of module mark.
- ▶ $66 \div 100 \times 70 = 46.2$, $76 \div 100 \times 30 = 22.8$
- ▶ $46.2 + 22.8 = 69\%$ of total module mark.



Averages.

- 
- ▶ Many kind of research involves collecting data through numbers....
 - ▶ Such as
 - ▶ How much managers earn.
 - ▶ Placing a numerical value on how an individuals wellbeing (using a scale).
 - ▶ Reaction Times.
 - ▶ Speed of Processing.



However,

- ▶ At times if you then receive an exhaustive amount of data, it can be very hard to discuss and quite easy to get lost in the numbers.
- ▶ Also difficult to draw comparisons.
- ▶ One method to deal with this is use a single number that summarises or represents the set of numbers.
- ▶ You could consider using the “average”.

Choosing the average number....

Which type of average....

The Mean

- A calculated "central" value of a set of numbers.

The Mode

- The number that occurs most often within a set of numbers.

The Median

- The middle number of a sequence of numbers.

Worked Example.

- ▶ Number List
- ▶ 1, 3, 2, 5, 41, 1, 76, 97, 3, 1
- ▶ These numbers might not mean anything to you, but these could be the individual scores of high earning individuals on a well-being scale.
- ▶ We will now go through a worked example of calculating the mean, mode and median of this data set.

Calculating the Mean.

- ▶ 1, 3, 2, 5, 41, 1, 76, 97, 3, 1
- ▶ Add all the numbers together.
 - ▶ $1, 3+2+5+41+1+76+97+3+1 = 230.$
- ▶ Divide the total number (230) by the number of responses given (10).
- ▶ $\text{Mean} = 230 \div 10 = 23.$

Calculate the Median.

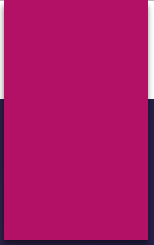
- ▶ 1, 3, 2, 5, 41, 1, 76, 97, 3, 1
- ▶ Place **all** the numbers in a sequential order from Lowest to Highest.
 - ▶ 1, 1, 1, 2, 3, 3, 5, 41, 76, 97
- ▶ Look at what number falls in the middle.
 - ▶ In the case of an odd number of items, there will be a single number that falls in the middle.
 - ▶ In the case of an even number of items there will be no true one figure.
 - ▶ 1, 1, 1, 2, 3, 3, 5, 41, 76, 97
 - ▶ To work out the median, you add these two numbers together and divide by two.
- ▶ $3 + 3 = 6$. The Median is $6 \div 2 = 3$.

Calculate the Mode.

- ▶ 1, 3, 2, 5, 41, 1, 76, 97, 3, 1
- ▶ Place **all** the numbers in a sequential order from Lowest to Highest.
 - ▶ 1, 1, 1, 2, 3, 3, 5, 41, 76, 97
- ▶ To calculate the mode you need to note the number that occurs more frequently (the most) in the data set.
- ▶ In this case the answer is 1 as this occurs three times within the data set.

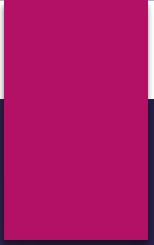
Calculating the Mode.

- ▶ A frequently asks question is what happens when there is a tie between more than one number in terms of frequency in a given data set.
- ▶ For example - 1, 1, 1, 2, 3, 3, 3, 5, 41, 76, 97
- ▶ As you can see above the number 1 occurs 3 times, the number 3 also occurs 3 times.
- ▶ Answer is you will have multiple modes – in this case the modes are 1,3.
- ▶ Do not divide the numbers – just report the multiple modes.



Now it is your turn.

- ▶ Work out the mean, mode, median for the following number sequence.
- ▶ 10, 13, 8, 6, 23, 45, 11, 19, 13, 11, 52.



Using tables, charts and
graphs.



EXAMPLE OF A LINE GRAPH



- Tables, charts and graphs provide a kind of visual shorthand – they condense complex information and present it clearly.

One Expert's Recommended Portfolio for Retired Investors

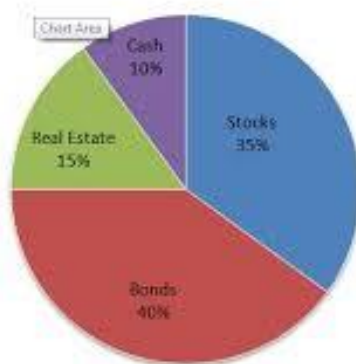
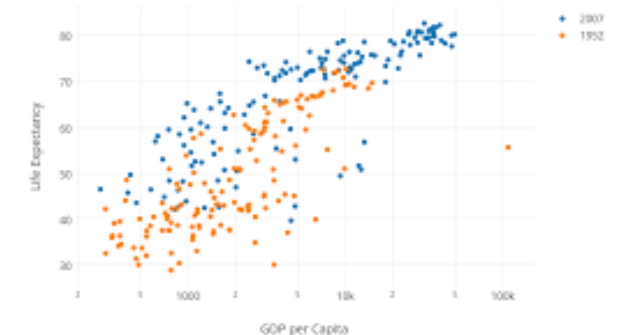


Table 2 - Distribution of the sample with regard to SWB8 and subscales

	Medicine		Law		Psychology		
	n	%	n	%	n	%	
Spiritual well-being							
=	53	31.2%	79	31.5%	53	15.4%	$\alpha = 0.05$
-	117	68.8%	172	68.5%	292	84.6%	$p < 0.001$
Existential well-being							
=	61	35.9%	79	31.5%	57	16.5%	$\alpha = 0.05$
-	109	64.1%	172	68.5%	288	83.5%	$p = 0.001$
Religious well-being							
=	61	35.9%	63	37.1%	92	26.7%	$\alpha = 0.05$
-	109	64.1%	158	62.9%	253	73.3%	$0.01 = p = 0.05$

Positive was considered for high scores and negative for moderate and low scores.



Why use tables, graphs and charts.

Good tables and charts present information in clear, orderly, systematic ways.

You can 'see' key information more quickly than when you read it as text.

You can see relationships, detect patterns and trends, and draw comparisons easily.

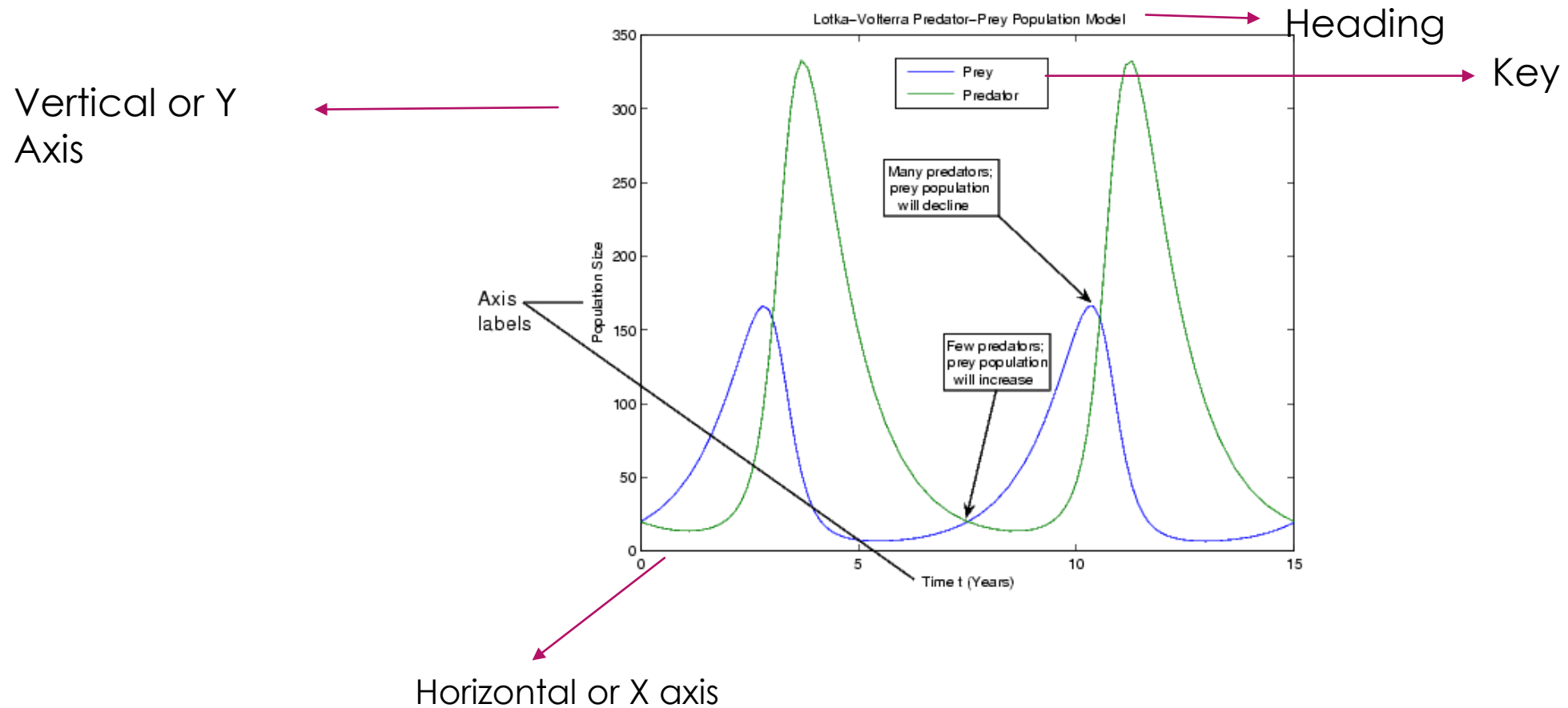
You may find visual information easier to interpret

You may see aspects to tables and charts that the authors did not see – that is, you may bring an additional interpretation.

Take your time, looking at charts, graphs and tables.

- ▶ Familiarise yourself with the style, symbols and measurements.
- ▶ Note dates and the source of information.
- ▶ Work your way systematically along each row, column (table), axis (graph), line, etc.
- ▶ Keep checking back to the key and the measurement.
- ▶ Work out amounts. Look at any totals that are presented – what do these tell you.

Graphs.



Interpreting Tables – Example.

Data Set: 24 students' test scores, by subject and group (Aremia University, 2008).							
Test scores for Group A				Test scores for Group B			
Student	Course	Test Score	M/F	Student	Course	Test Score	M/F
Belinda	Geology	67	F	Assunta	Politics	60	F
Darren	Oriental Studies	41	M	Chiara	Social Work	57	F
Dilishad	History	54	F	Diane	Maths	55	F
Elizabeth	Maths	64	F	Horace	Psychology	68	M
Femi	English	61	M	Joachim	Film	23	M
Francis	Oriental Studies	60	M	Joseph	Nursing	69	M
Geraint	Psychology	65	M	Kiran	Arabic	53	M
Omar	Geology	67	M	Natasha	Film	49	F
Patrick	Geology	72	M	Niall	French	44	M
Rosa	Geology	71	F	Otto	Physics	62	M
Sunjit	Geology	54	M	Soraya	Film	57	F
Thandi	Geology	58	F	Zoe	Film Art	31	F

Interpreting Tables – Key Questions on the Example.

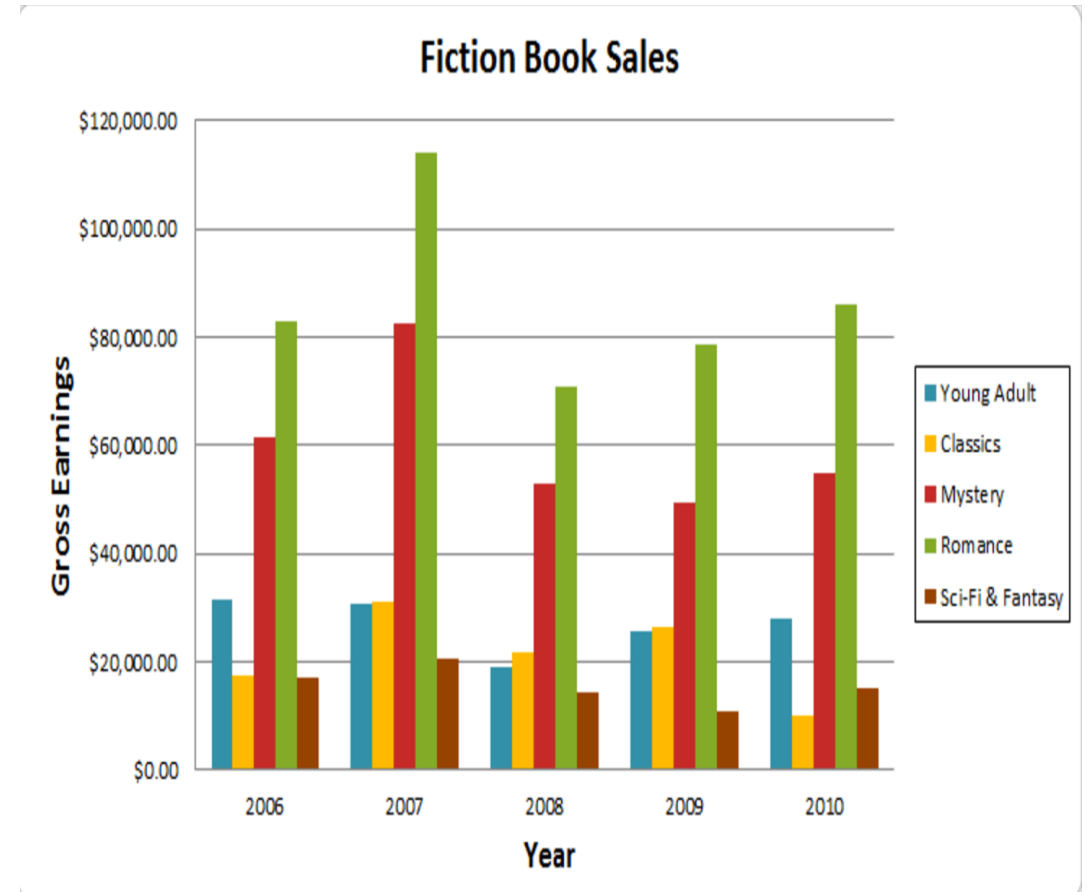
- ▶ Is 24 students representative of the University Popular?
- ▶ What about the subject choice of the two groups, how much variation?
- ▶ What is the mean test score for Group A, What is the mean test score for group B?
- ▶ What factors could influence the differences in marks between the tests scores in the two groups?
- ▶ What key information is missing, which makes it difficult to interpret the table?

Interpreting Tables – Example.

Data Set: 24 students' test scores, by subject and group (Aremia University, 2008).							
Test scores for Group A				Test scores for Group B			
Student	Course	Test Score	M/F	Student	Course	Test Score	M/F
Belinda	Geology	67	F	Assunta	Politics	60	F
Darren	Oriental Studies	41	M	Chiara	Social Work	57	F
Dilishad	History	54	F	Diane	Maths	55	F
Elizabeth	Maths	64	F	Horace	Psychology	68	M
Femi	English	61	M	Joachim	Film	23	M
Francis	Oriental Studies	60	M	Joseph	Nursing	69	M
Geraint	Psychology	65	M	Kiran	Arabic	53	M
Omar	Geology	67	M	Natasha	Film	49	F
Patrick	Geology	72	M	Niall	French	44	M
Rosa	Geology	71	F	Otto	Physics	62	M
Sunjit	Geology	54	M	Soraya	Film	57	F
Thandi	Geology	58	F	Zoe	Film Art	31	F

Charts.

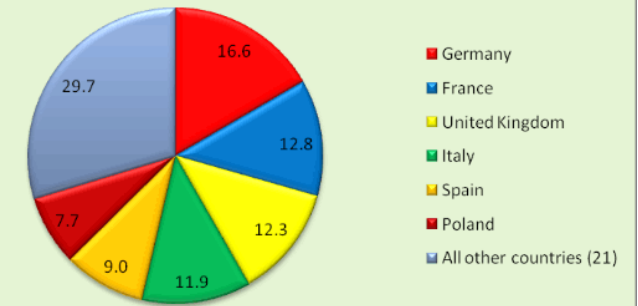
- ▶ Bar Charts.
- ▶ Bar charts contain less detail than table, but summarise data in a way that makes it easier to read.



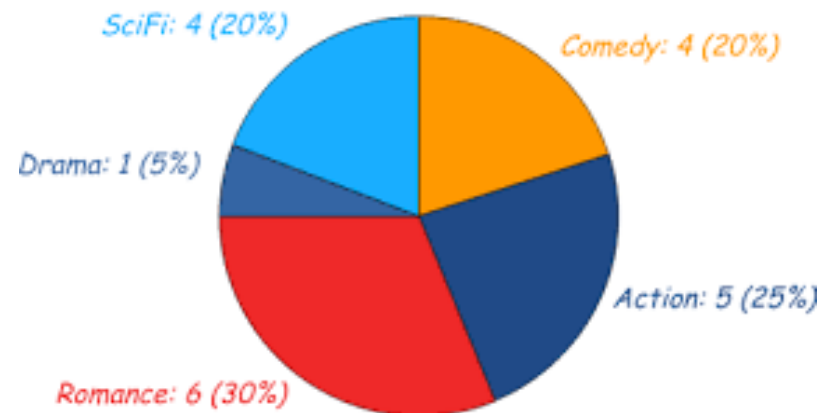
Charts.

- ▶ Pie Charts.
- ▶ Pie Charts are useful in indicating the relative proportions of the various components that make up a whole.
- ▶ Cannot provide statistical precision.

Population of Countries of the European Union in 2007 by percentage



Favorite Type of Movie



Seminar – Scales and Surveys.

Questionnaires and Scales.

- ▶ Questionnaires and Scales provide a relatively cheap, quick and efficient way of obtaining large amounts of information from a large sample of people.
- ▶ Data can be collected relatively quickly because the researcher would not need to be present when the questionnaires were completed.
- ▶ This is useful for large populations when interviews would be impractical.

Questionnaires and Scales....

- ▶ Various kinds of rating scales have been developed to measure attitudes directly (i.e. the person knows their attitude is being studied). The most widely used is the Likert Scale.
- ▶ Likert (1932) developed the principle of measuring attitudes by asking people to respond to a series of statements about a topic, in terms of the extent to which they agree with them, and so tapping into the cognitive and affective components of attitudes.
- ▶ A Likert-type scale assumes that the strength/intensity of experience is linear, i.e. on a continuum from strongly agree to strongly disagree, and makes the assumption that attitudes can be measured. Respondents may be offered a choice of five to seven or even nine pre-coded responses with the neutral point being neither agree nor disagree.
- ▶ In its final form, the Likert Scale is a five (or seven) point scale which is used to allow the individual to express how much they agree or disagree with a particular statement.

Seminar Task.

- ▶ Go out and find two participants to complete the two scales provided.
- ▶ Using the scoring system, calculate the scores.
- ▶ We will then input these scores into Microsoft Excel and start making some observations on the scores.

Technical Terms (linked to today's lecture)....

▶ Average

- ▶ A number that is in some way 'typical' of a group of numbers, and that can be used to represent them. Three kinds of average commonly used: **Mean**, **Mode** and **Median**.

▶ Data

- ▶ 'Data' is plural of the Latin word datum (meaning 'something given'). Data are facts, observations and measurements; collectively data provides information. Numerical data are collected by sorting, measuring and counting.

▶ Data Set

- ▶ A complete collection of information on a particular topic.

Technical Terms (linked to today's lecture)....

- ▶ Denominator
 - ▶ The bottom number in a fraction
- ▶ Elements
 - ▶ The basic categories of data used for counting and analysis.
- ▶ Extreme Values
 - ▶ Numbers that are much lower or much higher than the rest of the set.
- ▶ Numerator
 - ▶ The top number in a fraction.

Technical Terms (linked to today's lecture)....

- ▶ Percentage
 - ▶ The number of occurrences in each 100 instances.
- ▶ Prime Numbers
 - ▶ Numbers that, without resulting in a fraction, can be divided **only** by themselves or by the numbers 1. For example, the number 7 can be divided only by 1 or by 7.
- ▶ Qualitative Data
 - ▶ Information that comprises subjective descriptions, rather than objective measurements.
- ▶ Quantitative Data.
 - ▶ Information that comprises objective measurements, rather than subjective descriptions.

Technical Terms (linked to today's lecture)....

- ▶ Raw data.
 - ▶ The basic information as collected, with no interpretation.
- ▶ Rounding up or Rounding Down.
 - ▶ Replacing a number with a simpler number that is no longer as accurate but is easier to work with.
- ▶ Statistics
 - ▶ Sets of data, and techniques for working with them.
- ▶ Variables
 - ▶ The aspects of the elements that may differ from one item or group to another.