5 Minute

Guides

Getting to grips with statistics

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The study of statistics falls into two main categories:

- Descriptive statistics.
- Inferential statistics.

What is descriptive statistics?

Descriptive statistics is the process of describing and summarising a collection of data. Many students should be familiar with the basics of descriptive statistics, because a wide range of academic subjects require them to collect or understand data of some kind.

Activity

Activity: Write down an example of data that might be collected in:

(a) Biology

(b) Economics

(c) History

(d) Your own subject (if different)

Different kinds of data

In simple terms, data will either be numerical or non-numerical.

Numerical data (also known as **scale** data) could be age, height, weight, number of children, annual salary, time taken, or anything else that can be measured and recorded as a number.

Non-numerical data (also known as **nominal** data) is where you are recording nominal categories, e.g. gender (“male”, “female”), favourite colour (“red”, “blue”, “green”, etc.), social class, injury type, etc.

Advice

Advice: It is important to be clear what type of data you have, because different types of data require different statistical methods.

Techniques of descriptive statistics

(i) **Tables**. Present your results clearly in rows and columns. Make sure everything adds up. Label rows and columns clearly and unambiguously. This is easier said than done! Ask a friend if they can understand your table of data.

(ii) **Summary calculations**. For nominal data, this involves finding the totals and sub-totals of the various categories, and perhaps converting to percentages. (For example, if 28 out of 50 people were dissatisfied with their treatment then that equates to 56%.)

For numerical data, summary calculations could include working out the average (mean or median), the dispersion (standard deviation or range) or the skewness.

(iii) **Graphs**. A picture speaks a thousand words, and a well-produced graph can illustrate the key features of a data set. Nominal data are best presented using bar charts or pie charts. Numerical data can be presented using histograms, line graphs, box plots or scatter graphs.

Advice

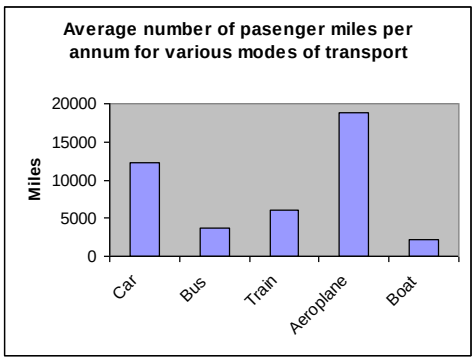
Advice: Computer software packages (such as Excel, SPSS and Minitab) have lots of pre-defined graphs, but do not just accept what they automatically produce for you. Decide yourself in advance how you want your graph to look, and use the software as a tool to produce a clear copy of what you want. Don’t get carried away with all the fancy options – simple clarity is best.

Common bad practice in descriptive statistics

(a) Working with data that are incomplete or biased in some way.

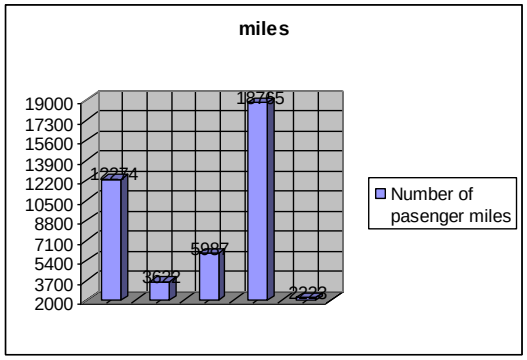
(b) Presenting irrelevant summary calculations. Computer software will work out everything for you, but it is for you to be selective.

(c) Producing meaningless or misleading graphs. Choose sensible and consistent scales, and ensure everything is clearly labelled.



← Nice graph

Not so nice →



What is inferential statistics?

Inferential statistics deals with analysing **samples** and drawing **conclusions** from them. This is routinely done by researchers. Obviously, a sample can never be totally representative of the whole population, so procedures are devised to take **sampling error** into account.

Activity

Activity: Think of some examples of research questions (sometimes called hypotheses) from your own subject that could be addressed using inferential statistics.

Techniques of inferential statistics

The vast majority of research questions are to do with establishing a difference or identifying a relationship.

A **difference** could be an increase/improvement or a decrease/reduction. For example: is the yield of a certain crop higher when planted in sandy soil rather than clay soil?

A **relationship** looks at links between two or more variables. For example: does personal esteem increase as earned income increases?

Depending on the research question, the type of data you are working with, and other factors, there exists a whole armoury of statistical tests that can be used to provide an answer. The good news is that computer software packages are available to carry out these tests for you. The bad news is that unless you choose the right test, your results will be meaningless!

Common pitfalls in inferential statistics

"I have collected my data, but I don't know what to do with it."

This comment will have your tutors/supervisors tearing their hair out! **Never** allow yourself to get to this stage. Without planning your strategy in advance, there is a real danger that you have wasted time collecting data that is inappropriate for further analysis.

Advice

Advice: Here is a suggested approach to using inferential statistics:

(1) Attend the theory classes and learn about some standard statistical tests (e.g. t-test, chi-squared test, ANOVA, etc.). This will be your "toolbox" for future reference.

(2) Only set yourself a research question if you know you have the tools (i.e. an appropriate statistical test) to answer it.

(3) Only pursue a research question if you know you can access data of the type and quantity required by your statistical test.

(4) Never use the word *significant* in your write-up unless you have actually carried out a statistical test to formally show that your results actually are significant. (The word *significant* has a precise meaning in statistics.)

Reference

Suggested reading

Coolican, H. (2004). *Research Methods and Statistics in Psychology*. 4th edition London: Hodder Arnold. (This is a good reference for everyone, not just psychologists!)

The Open University (2008). *Exploring data: graphs and numerical summaries*, available online at http://openlearn.open.ac.uk/course/view.php?id=1710

Academic Skills Centre Library and Learning Resources
Galton Learning Centre G312: City North Campus: 0121 331 6296
Edge Learning Centre: City North Campus: 0121 331 5201
Millennium Point Learning Centre: 0121 202 2500
Guide written by Peter Samuels, 2010
Further online guides: http://library.bcu.ac.uk/learner/Guide%20Index.htm