Probability and Statistics: To p, or not to p?
Module Leader: Dr James Abdey

1.6 Roadmap of the course

Looking ahead, what will you learn in the rest of the course? Here we consider a 'roadmap', a direction of travel for the next five weeks.

Week 2 – Quantifying uncertainty with probability

Probability is our quantified measure of uncertainty, expressing numerically how likely some event is to occur.

In week 2 we will cover the following key areas:

2.1 Probability principles.

2.2 Simple probability distributions.

2.3 Expectation of random variables.

2.4 Bayesian updating.

2.5 Parameters.

2.6 The distribution zoo.

At the end of this week you will be able to:

- quantify uncertainty with probability applied to some simple examples
- recall a selection of common probability distributions
- discuss how new information leads to revised beliefs.

Week 3 – Describing the world the statistical way

Descriptive statistics are a simple, yet powerful, tool for data reduction and summarisation.

In week 3 we will cover the following key areas:

3.1 Classify your variables!

3.2 Data visualisation.

3.3 Descriptive statistics – measures of central tendency.

3.4 Descriptive statistics – measures of spread.

3.5 The normal distribution.

3.6 Variance of random variables.

At the end of this week you will be able to:

- explain the different levels of measurement of variables
- explain the importance of data visualisation and descriptive statistics
- compute common descriptive statistics for measurable variables.

Week 4 – On your marks, get set, infer!

Statistical inference involves inferring unknown characteristics of a population based on observed sample data. We begin with aspects of estimation.

In week 4 we will cover the following key areas:

4.1 Introduction to sampling.

4.2 Random sampling.

4.3 Further random sampling.

4.4 Sampling distributions.

4.5 Sampling distribution of the sample mean.

4.6 Confidence intervals.

At the end of this week you will be able to:

- summarise common data collection methods
- explain what a sampling distribution is
- discuss the principles of point and interval estimation.

Week 5 – To p, or not to p?

We continue statistical inference with an examination of the fundamentals of hypothesis testing – testing a claim or theory about a population parameter. Can we find evidence to support or refute a claim or theory?

In week 5 we will cover the following key areas:

5.1 Statistical juries.

5.2 Type I and Type II errors.

5.3 P-values, effect size and sample size influences.

5.4 Testing a population mean claim.

5.5 The central limit theorem.

5.6 Proportions: confidence intervals and hypothesis testing.

At the end of this week you will be able to:

- explain the underlying philosophy of hypothesis testing

- distinguish the different inferential errors in testing

- conduct simple tests of common parameters.

Week 6 – Applications

We conclude the course with a cross-section of applications of content covered in previous weeks to more advanced modelling applications of the real world.

In week 6 we will cover the following key areas:

6.1 Decision tree analysis.

6.2 Risk.

6.3 Linear regression.

6.4 Linear programming.

6.5 Monte Carlo simulation.

6.6 Overview of the course and next steps.

At the end of this week you will be able to:

- use simple decision tree analysis to model decision-making under uncertainty

- interpret the beta of a stock as a common risk measure used in finance

- describe the principles of linear programming and Monte Carlo simulation.

Ready? If so, on to week 2!