



# UNIVERSITY OF LONDON

## Probability and Statistics: To $p$ , or not to $p$ ?

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### 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!