

This is archived information. Please visit <http://www.maths.manchester.ac.uk> for current course unit information

## MATH20802

Statistical Methods

<b>Unit code:</b>	MATH20802
<b>Credit Rating:</b>	10
<b>Unit level:</b>	Level 2
<b>Teaching period(s):</b>	Semester 2
<b>Offered by</b>	School of Mathematics
<b>Available as a free choice unit?:</b>	N

### Requisites

#### Prerequisite

- [MATH10141 - Probability 1](#) (Compulsory)
- [MATH20701 - Probability 2](#) (Compulsory)

### Additional Requirements

MATH20802 pre-requisites

### Aims

To introduce estimation and hypothesis testing methods based on likelihood and other approaches.

### Overview

Statistical methodology is concerned with taking the numerical information contained in a sample (the data) and using it to make statements (or inferences) about the population from which the sample is drawn. In that the sample provides incomplete information about the entire population,

there is inevitably some uncertainty relating to any inferences made. The methods developed in this course unit not only acknowledge this uncertainty but seek to model it in a meaningful way.

## Assessment methods

- Other - 20%
- Written exam - 80%

## Assessment Further Information

- Coursework; Weighting within unit 20%
- 2 hours end of semester examination; Weighting within unit 80%

## Learning outcomes

On successful completion of this unit students will:

- have an understanding of the underlying theory;
- be able to use these techniques on simple data sets.

## Syllabus

1. Point estimator, point estimate, sampling distribution; unbiased estimator, bias, MSE, asymptotic unbiasedness, consistency, relative efficiency and their relationships; Properties given with some proofs [2].

2. Maximum likelihood estimation: likelihood function, ML estimators for single and multi parameter cases, ML estimators for discrete and continuous models; Properties of ML estimation including invariance principle and asymptotic confidence intervals (without going into details about the Fisher information); Many examples of ML estimation given, including simple linear regression and ANOVA [9].

3. Simple hypotheses, composite hypotheses, null hypotheses, alternative hypotheses; test statistic, acceptance region, rejection region, type I error, type II error, level of significance [2].

4. Power, power function; N-P lemma; N-P lemma illustrated using one-sample and two-sample problems; Two-sample tests for differences in means; Two-sample tests for equality of variances; Uniformly most powerful tests, examples; Generalized likelihood ratio tests; Confidence intervals for one-sample, two-sample and multi-sample problems; One-way ANOVA [9].

## Recommended reading

- J.E. Freund, Mathematical Statistics with Applications, 7th edition, Pearson Prentice Hall 2004.
- W. Mendenhall, D.D. Wackerly and R.L. Scheaffer, Mathematical Statistics with Applications, PWS-Kent 1990.

- J.A. Rice, Mathematical Statistics and Data Analysis, 2nd edition, Duxbury Press 1995.

### **Study hours**

- Lectures - 22 hours
- Tutorials - 11 hours
- Independent study hours - 67 hours

### **Teaching staff**

Saralees Nadarajah - Unit coordinator