On-line course materials

MATH48082 - Design and Analysis of Experiments

Year: 4 - **Semester:** 2 - **Credit Rating:** 15

Requisites

Prerequisites
MATH20701 Probability 2
MATH20802 Statistical Methods
Knowledge of MATH38011, Linear Statistical Models, is helpful but not essential.

Aims

To introduce the student to the principles and methods of statistical analysis of designed experiments.

Brief Description

Experiments are carried out by researchers in many fields including biology, medicine, chemistry, physics, engineering and agriculture. In such experiments the results are affected both by the choice of factors to study and experimental error (such as measurement error or inherent randomness between experimental units). Choosing a good experimental design ensures that the aim of the study where it is used is achieved. Moreover, the statistical analysis of data collected from such designed experiments is simple, easier to interpret and the experimental resources are spent most efficiently. The main principles for designing and analyzing experiments will be introduced. Various standard experimental designs and the analysis of data obtained using them are covered. Criteria for optimality of experimental designs will be introduced. Methods for constructing nonstandard designs when the model is linear or nonlinear in the parameters will be presented.

Learning Outcomes

On successful completion of this course unit students will

given the description of how a set of data were collected, be able to:

recognise what design was followed,

comment on the shortfalls of the design used,

decide what assumptions are appropriate in modelling the data,

perform the appropriate analysis;

be familiar with the principles of:

randomisation and replication,

nested designs,

block designs,

factorial designs and fractional layouts

response surface designs.

Future topics requiring this course unit

None.

Syllabus

1.Basic concepts; Definitions. Treatment, factors, plots, blocks, precision, efficiency, replication, randomisation and design. [2]

2.Completely randomised design. Fixed and random effects, contrasts, ANOVA table. [4]

3.Factorial designs. General factorial experiment; fixed and random effects; interactions. [3]

4.Nested designs. [2]

5.Blocking. Orthogonal designs: Randomised complete block designs; Latin square designs; extensions of the Latin square design. Non-orthogonal designs: Balanced incomplete block designs. [6]

6.2m Factorial experiments; Confounding; fractional replication; aliasing. [4]

7.Response surface designs [1]

8.Criteria for design optimality [3]

9.The General Equivalence Theorem and its applications; construction of D-optimal experimental designs. [5]

10.Designs for nonlinear models. [3]

Teaching & Learning Process (Hours Allocated To)

Lectures	Tutorials/ Example Classes	Practical Work/ Laboratory	Private Study	Total
33	11	0	106	150

Assessment and Feedback

- Coursework: weighting 7%
- End of semester examination: Three hours, weighting 93%

Further Reading

- A. C. Atkinson, A. N. Donev, R. D. Tobias (2007). Optimum Experimental Designs, With SAS. OUP.
- G. Cassela (2008). Statistical Design. Springer.
- G.M. Clarke and R. E. Kempson (1997). Introduction to the Design and Analysis of Experiments. Arnold.
- D. C. Montgomery (1997). Design and Analysis in the Design of Experiments, (4th edition).

Staff Involved

Dr Alexander Donev - Lecturer

Data source is EPS system

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