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FEBRUARY 1980
UNIVERSITY OF LONDON
General Certificate of Education Examination
New syllabus in Applied Statistics (Subject N umber 875) at the Alternative Ordinary level for examination in and after June 1982. This subject may only be taken at the June examination.

Aims

This syllabus is designed to assist a student in the understanding and interpretation of the statistical data encountered in contemporary society. Students who have followed an Ordinary level course in mathematics, or equivalent, but not necessarily having obtained a Grade C or above, will have sufficient background knowledge. The syllabus should be treated in such a way as to develop the capacity to assess numerical evidence and methods in students studying subjects which may or may not include Mathematics at Advanced level.

The Examination

The examination will consist of one paper of three hours containing one compulsory question requiring comment on tabulated data, and seven other questions of which candidates will be required to answer four.

Where appropriate, questions will be set in SI units. Four-iigure mathematical tables and mathematical formulae will be provided by the University. These will include statistical formulae and tables. The use of slide rules and of electronic calculators will be permitted (see Regulation XXII.3.)

The Syllabus

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1. Sampling and Experimental Design

Surveys and censuses. Sample and population. Representative samples, Sampling units, random selection from sampling frame. Other methods of sampling. Selection (bias). Self-selection. Stratification.

The Census and The Tenpercent Sample.

Noneresponse and partial response.

Retrospective and prospective studies. Role of lcontrolsl. Comparability. Elimination of bias, reduction of residual variation.

2. Presentation

Frequency distribution. Discrete and continuous quantitative variables. Unordered and ordered qualitative scales. Grouping.

Relative frequencies expressed as fractions and percentages.

Histograms. bar-diagrams, cumulative histograms; Time-series graphs.

NOTES

Relevance of sample frame to conclusions to be drawn.

Use of records collected for other purposes.

Matched pairs. Randomization. Blind and double-blind trials. Reliability (repeatability) and validity.

To be treated from the point of view: what purpose is served by a given format?

Choice of scale and base lines. Protocol for rubrics to diagrams and graphs, and for tables.

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3. Measures

Measures of central tendency and variation. Quantiles (e.g. deciles, percentiles). Effect of scaling and shift on measures of central tendency and variation.

Variance or sum of squares about mean (S.S.M.) as measure of variation. Sensitivity to large outliers (rogue observations) and use of standard deviations for screening these.

Normal ranges (in medical use, quality control etc.). Heterogeneity and bimodality.

Standardisation of variables. Normal (Gaussian) quantile transforms (Normal equivalent deviates). Errors and rounding rules.

4. Information and Comparison

Standard error of sample means. Standard error of difference of two means.

Significance of differences which exceed two standard errors.

5. Measures ofAssociation and Relationship

Regression lines. Array variance and coefficient of variation. Array histograms.

Linear regression formulae. Plot of regression residuals.

Notion of independence (of y distribution on x).

General Information

NOTES

Measures are to be considered from the point of view of summary statistics for particular purposes, in the context of real data where real purposes are demonstrably served.

Central tendency: mean, median, mode.

Mean for grouped data.

Variation: range, maximum deviation, mean deviation, semi-interquartile range, standard deviation.

Measures of central tendency and variation discussed in relation to shape of frequency distn’butions (belleshaped or exponential J-shape). Idea of Normal (Gaussian) distribution function and use of tables as a graduation technique; 95% of frequency in : ZSD’s.

Square root rule stated and discussed (size of sample determined by precision required).

Discuss linear array-means. Mention that . r : Sxy/sty . . propomonal to slope. Dlscuss the pred1ct1ve use of regression and the following: (i) accuracy 06 (1 -r2), (ii) when r : 0 and the array variance is constant and the array distributions are Normal (Gaussian) then the y-array distribution is the same for all values ofx.

Discuss the connections between statistical and causal independence and the coefficient r2 as a measure of dependence.

A specimen paper based on this syllabus may be purchased from the Publications 0j7ice.

Notes for the Guidance of Teachers are available, upon request, to the Secretary. An addressed envelope (10" X 8") should be enclosed with the application.

Some books which may be found useful

INote: in addition to comments in footnotes, several of the other books that follow can also be introduced to students.l

(i) Background for T eachers:

Benjamin, B. & Haycocks, H. N.
Bradford Hill, A.
Cochran, W. G. and Cox, G. M.
Cox, D. R.
Finney, D. J .
Floud, R.
Gnedenko, B. V.
Oppenheim, A. N.
Stuart, A.
Tanur, J (ed)
Tippett, L. H. C.
Venn, J.
Yates, F.

(ii) TeachersT Handbook:

Moser, C. A. & Kalton, G.

(iii) Reference Works:

Kendall, M. G. & Buckland, W.
Pearson, E. S. & Kendall, M. G. (eds)
Poincare, H.
Russell, B.

(iv) Course Books:

Moore, D. S.
The Central Statistical Offlce

(v) Background for Students:

Hoinville et a1,
Huff, D.
Morris, J . N.
The analysis of mortality and other actuarial statistics; Cambn’dge
1Principles of Medical Statistics; Lancet
2Experimental Designs; Wiley
2Planning of Experiments; Wiley
2Experimental Design and its Statistical Basis; Cambridge
1Introduction to Quantitative Methods for Historians; Methuen
3Probability (Chap. 1); Chelsea
4Questionnaire Design & Attitude Measurement; Heinemann
sBasic Ideas of Scientific Sampling; Griffin
Statistics, A Guide to the Unknown; Holden-Day
Statistics; Oxford
The Logic of Chance; Chelsea
Sampling Methods for Censuses & Surveys; Griffin
4Survey Methods of Social Investigation; Heinemann
Dictionary of Statistical Terms; Oliver & Boyd
Studies in the History of Statistics & Probability; Griffin
Science & Method (part 1); Dover
Human Knowledge (part v); Allen & Unwin
Statistics, Concepts and Controversies; W. H. Freeman
6Social Trends; HMSO
Survey Research Practice; Heinemann
How to Lie with Statistics; Pelican
Uses of Epidemiology; Livingstone

1could also be read by students 4selected sections suitable for students
2alternatives 5particularly for non-mathematics teachers
3particularly for mathematics teachers 6for use with students in course work

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