# Contents

## **1** This is Statistics

Unit 1: Fundamental ideas Input and output, A statistical system, Data and statistics, Statistical enquiries.

Unit 2: Asking the question Asking the question, Clarifying the question, Moral.

### Unit 3: Collecting the data Collecting the data, Constructing a questionnaire, Gathering the data together.

## Unit 4: Deriving the statistics

Deriving the statistics, Re-arranging the data, Frequency table, Average, The answer, Comments on the answer.

### Unit 5: Communicating the results Communicating the results, Symbols.

## **2 Asking Questions**

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## Unit 1: Questions and statistics

Questions, The past, The present, The future, Foundations, Need for statistics, Types of statistics, Descriptive statistics, Inferential statistics, The need to know.

## Unit 2: Who asks the questions

Daily life, Government, Education, Health care, Crime, Science and technology, Business management, Production, Stock control, Manpower, Finance, Sales and advertising, Corporate organisation. 39

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#### Unit 3: How to ask questions

Clearly stated problems, Simple and concise questions, Precise answers, Yes or no answers, Precoded answers, Rating scale answers, Open ended answers.

### Unit 4: How not to ask questions

Multiple questions in one, The use of unfamiliar words, Questions containing multiple instructions, Questions requiring calculation, Questions relying on memory, Questions that are inappropriate, Questions that are unnecessary, Tactless or offensive questions, Ambiguous questions, Biased questions, Asking leading questions, Use of emotional words.

#### Unit 5: Questionnaire design

The purpose of a questionnaire, Constructing questionnaires, Object and Authority, Instructions, How to complete, When to complete, How to return the questionnaire, Details of the respondent, Body of the enquiry, Points previously noted, Length of questions, Sequence of questions, Units to be used in answers, Distribution and collection.

#### Unit 6: When to ask questions Availability of the respondent, Temporarily absent, Absent for a period, Unsuitability of respondent, Un-cooperative respondents, Current events.





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## **3** Collection of Data

### **Unit 1: Primary data**

Primary data, Monthly Digest of Statistics, Financial Statistics, Employment Gazette, Gathering primary data, Interviews, Direct interview, Indirect interview, Questionnaire, The Population Census, Diary, Advantages of a diary, Disadvantages of a diary, Surveys, Pilot survey, Panel survey, Longitudinal survey, Market research survey, Public Opinion Polls, Non-response.

#### Unit 2: Probability and sampling

The need to sample, Elements of probability, Certainty and Impossibility, Presetting probabilities, Statistical regularity, Sampling from a population, Selecting samples, Errors, Bias, Sampling error, The law of large numbers, Random samples, Further bias errors, Types of sample, Quota samples, Multistage samples, Cluster samples, Systematic samples, Stratified samples, Public **Opinion** Polls.

#### Unit 3: Organizing the data Editing the data, Checking for completeness, Checking for accuracy, Entering

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calculated numbers, Coding answers, Sorting the questionnaires, Ranking the data, Counting the data.

#### Unit 4: Tabulation of data

Data attributes, Measurable attributes, Discrete attributes, Continuous attributes, Descriptive attributes, Tables, Reference tables, Demonstration tables, Table construction, Columnar layout, Spacing and partitions, Column and row labels, Multiple rows and columns, Arrangement of data, Space for calculated data, Headers and footers, Description, Explanation, Keys, Sources, Types of reference table, Simple tables, Complex tables, Summary tables, Cross tabulation tables, Contingency tables, Time series tables, Frequency tables, Cumulative frequency tables. stobablillerer Prolese

#### Unit 5: Secondary data

Secondary data, Handling secondary data, Selection of secondary data, Extraction, Preliminary reference table, Historical records, Adjusting tables, Generating summary figures, Totals, Ratios, Percentages, Simplifying tables, Rounding, Significant figures, Re-ordering, Limitations of secondary data, Benefits of secondary data.

#### Unit 6: Graphical representation of data

Elements of graph construction, Relationships, Graphs, Constructing a graph, Plotting the data, Using the graph, Warning, Discrete graphs, Scattergraphs, Frequency graphs for ungrouped data, Continuous graphs, Jagged line graphs, Histogram, Types of graph, Single line graph, Multiple graphs, Band charts, Multiple line charts, Cumulative graphs, The Lorenz Curve, The mechanics of graph construction, Equipment, Axes, Zero-ed scales, Breaks and pleats, Titles, Sources and footnotes, Finished appearance. 107

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## **4** Deriving the statistics

## Unit 1: Single statistics

Single statistics, Central tendency, The means, The weighted arithmetic mean, The progressive mean or moving average, The geometric mean, The harmonic mean, The median, The median of grouped data, Graphical location of the median, The mode, The modal class for grouped data, Single mode for grouped data, Graphically, By formula, Bi-modal data.

### Unit 2: Dispersion

Dispersion, Measures of dispersion, Range, Mean absolute deviation, The variance, The standard deviation, Comparing statistics, Coefficient of variation, Grouped data..

### **Unit 3: Multiple statistics**

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Multiple statistics, Fractiles, Quartiles, Quartile deviation, Deciles, Percentiles, Graphical determination of fractiles.

#### **Unit 4: Index numbers**

Index numbers, Price relative, Weighted aggregative index, Laspeyre index, Paasche index, Laspeyre and Paasche contrasted, Chain base index, Change of base year, The creation of an index, The purpose for which it will be used, Choice of base year, The Retail Prices Index, Food and Catering, Alcohol and Tobacco, Housing and Household Expenditure, Personal Expenditure, Travel and Leisure.

### **Unit 5: Regression**

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Scattergraphs and relationships, The straight line, Fitting a straight line to data, Fitting by eye, Regression by formulae, Limitations of the regression line.

#### Unit 6: Correlation

Correlation, The amount of correlation, Measuring correlation, The product moment correlation coefficient, Spearman's rank correlation coefficient, The limitations of correlation.

#### **Unit 7: Time Series**

Time series, Uses of time series, The short term variation, Seasonal fluctuations, Cyclical fluctuations, Residual fluctuations, The long term tendency, Moving averages and the trend, Drawing a trend line of best fit by eye, Drawing a trend line using regression, Drawing a trend line using the method of moving averages, Seasonal factors, Predictions, Caution, Continuance of the trend pattern, No residual or cyclical fluctuations expected. 211

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## 5 Communicating the results

Unit 1: The general principles of presentation The purposes of presenting results, Demonstrating facts, Supporting an argument, Influencing decisions, Demonstration tables, Summary data, Conclusive data, Pictures, Words.

#### **Unit 2: Demonstration tables**

The purpose of a demonstration table, The contents of the table, The layout of the tables, Columnar display, Visual simplicity, Clear title and footnotes.

## **Unit 3: Pictorial representation**

The purpose of a picture, General features of data, Relative sizes of data, Bar charts, Multiple bars, Back-to-back bars, Component bars, Gantt charts, Proportions of a whole, Pie charts, Exploded pies, Three dimensional pies, Comparative pies, Change of data over time, Line graphs, Z charts, Pictograms.

### Unit 4 The use of words



The purpose of words, Summarizing a table or picture, Summarizing the conclusions as a whole, The conclusions, The sources

## **6 Inferential Statistics**

Unit 1: Random experiments Random experiments, Sets, Subsets, Outcomes and events, Combining outcomes into events, Combining events, Venn diagrams.

### Unit 2: Events and probabilities

Probabilities of simple events, Probabilities of combined events, The connective 'OR', Mutually exclusive events, Not mutually exclusive events, The connective 'AND', Dependent events, Independent events, Probability trees.



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## Unit 3: Probability distributions

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Probability distributions, Random variable, Bernoulli trials, The binomial distribution, Rare events and the Poisson distribution, The normal distribution, The standard normal distribution, Areas beneath the standard normal distribution, Using tables.

## Unit 4: Sampling distributions 295 Random sampling and the central limit theorem, Sampling distribution of means, Statistical inference.

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## **Unit 5: Hypothesis testing**

Hypothesis testing, The null and alternative hypothesis, One and two sided hypotheses.



## Standard normal distribution tables

#### **Answers to Exercises**

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