

**Hong Kong Baptist University**  
**Faculty of Science**  
**Department of Mathematics**

**Title (Units): STAT 1131 STATISTICAL METHODS AND THEORY I (3,3,1)**

**Course Aims:** This course deals with the statistical methods and theory. The emphasis is on what, how, when and why certain statistical methods can and cannot be applied. Topics include exploratory data analysis, estimation, hypothesis testing, analysis of variance, simple linear regression and nonparametric methods. Students are required to solve a variety of problems by using calculators and statistical packages such as SAS, MINITAB, SPSS, S-PLUS or R.

**Prerequisite:** A-Level Pure Mathematics or A-Level/AS-Level Applied Mathematics or AS-Level Mathematics & Statistics

**Prepared by:** Dr S N Chiu

**Learning Outcomes (LOs):**

Upon successful completion of this course, students should be:

No.	Learning Outcomes (LOs)
	<b>Knowledge</b>
1	Able to understand the elementary concepts involved in descriptive statistics
2	Able to understand the basic probability distributions and the distributions of sample means and sample variances
3	Able to understand the basic ideas of estimation and hypothesis testing
4	Able to understand tests using normal, t, $\chi^2$ and F distributions, including ANOVA and goodness of fit test
5	Able to understand the basic theory of linear regression and nonparametric methods
	<b>Skills</b>
6	Able to apply solid statistical methods and theories to formulate and solve a variety of statistical problems
7	Able to manipulate some statistical software, e.g. SAS, MINITAB, SPSS, S-PLUS or R
8	Able to determine what, how, when and why certain statistical methods can and cannot be applied
	<b>Attitude</b>
9	Aware of the wide applications of Statistics

**Assessment:**

No.	Assessment Methods	Weighting	Remarks
1	Continuous Assessment	30%	Continuous Assessment is designed to measure how well the students have learned the basic statistical methods and fundamental statistical theories, as well as the use of statistical softwares.
2	Final Examination	70%	Final Examination is designed to see how far students have achieved their intended learning outcomes. The questions are set to assess the student's ability in formulating and solving a variety of probabilistic and statistical problems with pocket calculators and statistical tables. Students should have a thorough understanding of the knowledge and a good mastery of the skills in order to answer these questions satisfactorily.

**Learning Outcomes and Weighting:**

Content	LO No.	Teaching (in hours)
I. Descriptive Statistics	1, 6-9	6
II. Use of Basic Probability Distributions	2, 6-9	8
III. Estimation	3, 6-9	5
IV. Hypothesis Testing	3, 6-9	8
V. Analysis of Variance	4, 6-9	3
VI. Goodness-Of-Fit	4, 6-9	2
VII. Simple Linear Regression and Correlation	5, 6-9	3
VIII. Nonparametric Methods	5, 6-9	5

**Textbook:** J.E. Freund and B.M. Perles, Modern Elementary Statistics, 12th Ed., Prentice Hall, 2007

**References:** D. Freedman, R. Pisani and R. Purves, Statistics, 3rd Ed., Norton, 1998.  
W. Feller, Introduction to Probability Theory and Its Applications, Vol. 1, 3rd Ed., Wiley, 1968.  
J.E. Freund, Mathematical Statistics, 5th Ed., Prentice Hall, 1992.  
I. Ekeland, The Broken Dice and Other Mathematical Tales of Chance, The University of Chicago Press, 1993.  
D. Salsburg, The Lady Tasting Tea. How Statistics Revolutionized Science in the Twentieth Century, Freeman, 2001.  
S.M. Stigler, The History of Statistics, Harvard University Press, 1986.  
C.C. Heyde and E. Senete (Eds.), Statisticians of the Centuries, Springer-Verlag, 2001.  
李華剛，廖俊傑，邵慰慈，統計學入門，香港教育圖書公司。  
陳希孺，高等數理統計學，中國科學技術大學出版社，1999。  
薛留根，概率論解題方法與技巧，國防工業出版社，1996。

**Software:** SAS, MINITAB, SPSS, S-PLUS or R

**Course Content in Outline:**

	<u>Topic</u>	<u>Hours</u>
I.	Descriptive Statistics A. Population, experiment and sample B. Variables and their measurement C. Exploratory data analysis D. Graphical representations and comparisons of data sets E. Sample covariance and correlation coefficient	6
II.	Use of Basic Probability Distributions A. Concept of probability and distribution B. Applications of the Bernoulli and Binomial distributions C. Applications of the normal distribution D. Distributions of sample means and sample variances E. Applications of the central limit theorem F. Chi-Square, t- and F-distributions	8
III.	Estimation A. Point Estimation B. Confidence Intervals 1. for means and differences of means 2. for variances and ratios of variances	5
IV.	Hypothesis Testing A. Basic concepts B. Power and sample size C. Test about means, proportions and difference of means D. Test about variances E. Control charts for means and variances	8
V.	Analysis of Variance A. One-way ANOVA B. Two-way ANOVA without interaction	3
VI.	Goodness-Of-Fit A. Chi-square test B. Contingency table	2
VII.	Simple Linear Regression and Correlation A. Least Squares Estimators B. Regression Analysis C. Coefficient of correlation D. Correlation Analysis	3
VIII.	Nonparametric Methods A. Binomial test for percentiles B. Runs test for randomness C. Sign test D. Wilcoxon signed ranks test	5