

Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): STAT 1210 PROBABILITY AND STATISTICS (3,3,0)

Course Aims: This course aims to provide an understanding of the basic concepts in probability theory and statistical analysis. Students will learn the fundamental theory of distribution of random variables, the basic theory and techniques of parameter estimation and tests of hypotheses. After taking this course, students will be able to use calculators and tables to perform simple statistical analyses for small samples and use popular statistics packages, such as SAS, SPSS, S-Plus, R or Matlab, to perform simple and sophisticated analyses for large samples.

Prerequisite: (i) MATH 1000 Supplementary Mathematics (Calculus and Linear Algebra), or (ii) Grade D or above in AL Pure Math

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Learning Outcomes (LOs):

Upon successful completion of this course, students should be:

No.	Learning Outcomes (LOs)
	Knowledge
1	Able to understand the basic knowledge on fundamental probability concepts, including random variable, probability of an event, additive rules and conditional probability
2	Able to understand the concept of Bayes' theorem
3	Able to understand the basic statistical concepts and measures
4	Able to develop the concept of the central limit theorem
5	Able to understand several well-known distributions, including Binomial, Geometrical, Negative Binomial, Pascal, Normal and Exponential Distribution
6	Able to understand the concepts of various parameter estimation methods, like method of moments, maximum likelihood estimation and confidence intervals
7	Able to perform hypotheses testing
	Skills
8	Able to apply the central limit theorem to sampling distribution
9	Able to use estimation technique to determine point estimates confidence interval and sample size.
10	Able to apply the appropriate Chi-Squared test for independence and goodness of fit
11	Able to perform and analyze hypotheses tests of means, proportions and variances using both one-and two-sample data sets.
12	Able to implement the analyses in SAS, S-PLUS, R or MATLAB
	Attitudes
13	Able to solve problems independently
14	Able to appreciate the diversity of the applications of central limit theorem
15	Able to appreciate the diversity of the applications of hypothesis testing

Assessment:

No.	Assessment Methods	Weighting	Remarks
1	Continuous Assessment (assignments and test)	30%	Assignments and mid-term test are designed to measure how well the students have learned various basic concepts in probability and statistics. The students will learn to use the software MATLAB to perform various statistical analysis on real life problems.
2	Final Examination	70%	Final Examination is designed to see how far students have achieved their intended learning outcomes in both Knowledge and Skills domains. Students should have a thorough understanding on basic probability concepts and to apply statistical methods to real data and draw inference. They are also expected to understand the underlying properties implicit in each family of distributions, identify steps in the parameter estimation and hypothesis testing, and recognize which assumptions are applicable.

Learning Outcomes and Weighting:

Content	LO No.	Teaching (in hours)
I. Introduction to Probability	1	3
II. Conditional Probability and Independence	1,2,12	3
III. Random Variables	3,4,5,8,12,13,14	15
IV. Parameter Estimation	6,9	6
V. Hypotheses Testing	7,11,13,15	6
VI. Contemporary Statistical Packages such as SAS	12,13	7

Textbook: R.E. Walpole, R.H. Myers, S.L. Myers and K. Ye, Probability and Statistics for Engineers and Scientists, 8th Ed., Pearson International Edition, 2007.

References: M. Spiegel, J. Schiller and R. Srinivasan, Schaum's Outline of Probability and Statistics, McGraw Hill, 2000.
W. Mendenhall and R. Beaver, Introduction to Probability and Statistics, Wadsworth Publishing, 1994.
S. Ross, Introduction to Probability and Statistics for Engineers and Scientists, John Wiley, 1988.
M. Berger, An Introduction to Probability and Stochastic Processes, Springer-Verlag, 1992.

Course Content in Outline:

<u>Topic</u>	<u>Hours</u>
I. Introduction to Probability	3
A. Mathematical models, sets	
B. Nondeterministic experiments, sample space	
C. Events	
D. Relative frequency	
E. Basic notions of probability	
II. Conditional Probability and Independence	3
A. Conditional probability	
B. Bayes' theorem	
C. Independent events	
III. Random Variables	15
A. Continuous and discrete random variables	
B. Cumulative distribution function	
C. Expected value, mean and variance	
D. Conditional expectation	
E. Two- and higher- dimensional random variables	
F. Marginal and conditional probability distributions	
G. Binomial, Poisson, Geometrical, Pascal, Normal, and Exponential distributions	
H. Central limit theorem	
IV. Parameter Estimation	6
A. Method of moments	
B. Maximum likelihood estimation	
C. Point estimation	
D. Confidence intervals	
V. Hypotheses Testing	6
A. The use of p-values in hypothesis testing	
B. One-sample, two-sample and paired-sample t-test	
C. Sample size determination	
D. Goodness of fit tests	
VI. Contemporary Statistical Packages such as SAS	7