UNIVERSITY COLLEGE of the FRASER VALLEY

PAC FORM #2 (Page 1)

COURSE IMPLEMENTATION DATE:	June 1994
COURSE REVISED IMPLEMENTATION DATE:	September 2006
COURSE TO BE REVIEWED:	April 2009
(Four years after implementation date)	(MONTH YEAR)

OFFICIAL COURSE OUTLINE INFORMATION

Students are advised to keep course outlines in personal files for future use.
Shaded headings are subject to change at the discretion of the department and the material will vary - see course syllabus available from instructor

FACULTY/DEPARTMENT: **Science, Health & Human Services / Mathematics & Statistics**

MATH 451		**3**
COURSE NAME/NUMBER	FORMER COURSE NUMBER	UCFV CREDITS

Parametric Statistical Inference
COURSE DESCRIPTIVE TITLE

CALENDAR DESCRIPTION:

This course is the continuation of Math 450 in mathematical statistics. It is designed for students specializing in either mathematics or statistics. Topics include method of maximum likelihood, Fisher information, Cramer-Rao lower bound, Neyman-Pearson theorem, uniformly most powerful tests, likelihood ratio tests, sequential probability ratio test, Monte Carlo method, bootstrap procedures, Bayesian inference, and quadratic forms.

PREREQUISITES: **MATH 450, or (MATH 270, MATH 211, one of MATH 280 or MATH 460, and at least two upper-level courses).**
Effective September 2006, the prerequisites will be: MATH 450.

COREQUISITES:

SYNONYMOUS COURSE(S)
(a) Replaces: ________
(Course #)
(b) Cannot take: ________ for further credit.
(Course #)

SERVICE COURSE TO:
(Department/Program)
(Department/Program)

TOTAL HOURS PER TERM: **60**
STRUCTURE OF HOURS:

Lectures:	**60**	Hrs
Seminar:		Hrs
Laboratory:		Hrs
Field Experience:		Hrs
Student Directed Learning:		Hrs
Other (Specify):		Hrs

TRAINING DAY-BASED INSTRUCTION
LENGTH OF COURSE:
HOURS PER DAY:

MAXIMUM ENROLLMENT:	**36**	
EXPECTED FREQUENCY OF COURSE OFFERINGS:	**every second year**	
WILL TRANSFER CREDIT BE REQUESTED? (lower-level courses only)	☐ Yes	☒ No
WILL TRANSFER CREDIT BE REQUESTED? (upper-level requested by department)	☐ Yes	☒ No
TRANSFER CREDIT EXISTS IN BCCAT TRANSFER GUIDE:	☐ Yes	☐ No

AUTHORIZATION SIGNATURES:

Course Designer(s):	Math & Stats Department	Chairperson:	Gillian Mimmack *(Curriculum Committee)*
Department Head:	Gillian Mimmack	Dean:	Jacalyn Snodgrass
PAC Approval in Principle Date:		PAC Final Approval Date:	April 29, 2005

LEARNING OBJECTIVES / GOALS / OUTCOMES / LEARNING OUTCOMES:

Successful students will be able to:

1. use the likelihood function or the log-likelihood function to find the maximum likelihood estimator of a parameter,
2. find the Fisher information and establish the Cramer-Rao lower bound,
3. program an EM algorithm to determine an estimate of a parameter,
4. use uniformly most powerful tests and likelihood ratio tests for hypotheses testing,
5. construct bootstrap confidence intervals and test statistical hypotheses by computing bootstrap p-values,
6. calculate prior and posterior probability density functions in Bayesian statistics,
7. construct confidence intervals and test statistical hypotheses using Bayesian inference,
8. write a Gibbs sampler algorithm to generate random samples, and
9. derive the distributions of certain quadratic forms.

METHODS:

Classroom lectures and computer lab.

PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):

Credit can be awarded for this course through PLAR (Please check:) ☒ Yes ☐ No

METHODS OF OBTAINING PLAR:

Course challenge. Please check online at http://www.ucfv.ca/math/challenge.htm for the departmental challenge policy.

TEXTBOOKS, REFERENCES, MATERIALS:

[Textbook selection varies by instructor. An example of texts for this course might be:]

The text is chosen by a departmental curriculum committee.

Recommended texts are:

Hogg, R.V., McKean, J.W. and Craig, A.T. Introduction to Mathematical Statistics (sixth edition).

Hogg, R.V. and Tanis, E.A. Probability and Statistical Inference.

Kalbfleisch, J.G. Probability and Statistical Inference, Volume 2: Statistical Inference.

SUPPLIES / MATERIALS:

STUDENT EVALUATION:

[An example of student evaluation for this course might be:]

Assignments	20%
Midterm tests	40%
Final exam	40%

Students must achieve at least 40% on the final exam in order to receive credit for this course.

COURSE CONTENT:

[Course content varies by instructor. An example of course content might be:]

1. Maximum likelihood methods: likelihood, maximum likelihood estimation, score and information functions, Fisher information, the Cramer-Rao lower bound, efficient estimators, asymptotically efficient, limiting distributions of maximum likelihood estimators, maximum likelihood tests, estimation and hypotheses testing for the case of multi-parameter, and the EM algorithm.

2. Theory of statistical tests: simple and composite hypotheses, best critical region, Neyman-Pearson theorem, uniformly most

powerful tests, likelihood ratio tests, Pearson's chi-square approximation, tests of significance, power, sequential probability ratio test, sample size estimation, minimax and classification procedures.

3. Numerical methods for statistical inference: the Monte Carlo method, simulations, accept-reject generation algorithm, bootstrap procedures, resampling, percentile bootstrap confidence intervals and bootstrap tests of hypotheses (one-sample and two-sample location problems), consistency and regularity conditions.

4. Bayesian inference: subjective probability, prior and posterior distributions, posterior intervals, Bayesian significance testing, the Bayes' factor, predictive distributions and intervals, setting the prior distribution - simple priors, invariance priors, conjugate priors, quantification of prior knowledge, priors for multi-parameter situations and exchangeability, the Gibbs sampler, empirical Bayes, sequential experimentation, sample size estimation with prior information and costs.

5. Inferences about normal models: quadratic forms, noncentral chi-squared and F distributions, the distributions and independence of certain quadratic forms.