SIMON FRASER UNIVERSITY

OFFICE OF THE VICE-PRESIDENT, ACADEMIC

MEMORANDUM

To: Senate

From: D. Gagan, Chair
Senate Committee on Academic Planning

Subject: University College of the Fraser Valley/
Simon Fraser University

Date: October 17, 1996

Action undertaken by the Senate Committee on Undergraduate Studies and the Senate Committee on Academic Planning gives rise to the following motion:

Motion:

"That Senate approve and recommend to the Board of Governors, as set forth in S.96 - 60 the following new courses to be offered at the University College of the Fraser Valley:

Math 360 - 3 Operations Research I
Math 381 - 3 Mathematical Methods I
Math 420 - 3 Empirical and non-Parametric Statistics
Math 438 - 3 Advanced Linear Algebra
Math 445 - 3 Introduction to Graph Theory
Math 450 - 3 Statistical Distribution Theory
Math 451 - 3 Parametric Statistical Inference
Math 460 - 3 Operations Research II
Math 470 - 3 Methods of Multivariate Statistics"

SCAP 96-38

SIMON FRASER UNIVERSITY
MEMORANDUM

To: A. Watt
Secretary to SCAP

From: C.H.W. Jones, Dean
Faculty of Science

Subject: **UCFV Math 360, 381, 420, 438, 445, 450, 451, 460 and 470**

Date: March 29, 1996

At its meeting of March 26th, 1996, the Faculty of Science approved the attached course proposals for Math 360-3, 381-3, 420-3, 438-3, 445-3, 450-3, 451-3, 460-3 and 470-3 from the University College of the Fraser Valley as detailed in the attached document FSC 7-96.

Please include this item on the agenda of the next meeting of SCAP for consideration and approval.

C.H.W. Jones

CHWJ:rh:Encl.

W. Welsh, Dean
Science & Technology, UCFV

M. Plischke, Chair
Faculty of Science Undergraduate Curriculum Committee

APPROVED BY SCUS AT ITS MEETING OF JULY 18, 1996

FSC 7-96

SIMON FRASER UNIVERSITY
Memorandum

TO: C.H.W. Jones, Dean
Faculty of Science

FROM: M. Plischke, Chair
Faculty of Science
Undergraduate
Curriculum Committee

SUBJECT: UCFV Upper Level Courses

DATE: March 12, 1996

At its meeting of March 12th, the Faculty of Science Undergraduate Curriculum Committee approved the attached course proposals for Math 360-3, Math 381-3, 420-3, 438-3, 445-3, 450-3, 451-3, 460-3 and 470-3 from the University College of the Fraser Valley.

Would you please bring these to the next Faculty of Science meeting.

M Plischke

M. Plischke

MP:rh:Encl.

SFU SIMON FRASER UNIVERSITY

MEMORANDUM

To: M. Plischke, Chair Physics	Date: February 27, 1996 From: Katherine Heinrich, Chair Department of Mathematics & Statistics
Subject: Fraser Valley	

At the departmental meeting of February 26th, the following motion was approved.

Motion: To approve the nine courses as described in item #5 to be offered at the University College of the Fraser Valley.

Please take to the Faculty Undergraduate Studies Committee.

Thanks
Kathy

KH:jc

cc: N. Reilly, Chair, UGSC

RECEIVED
MAR - 1 1996
DEAN OF SCIENCE
OFFICE

For Departmental Meeting of February 23, 1996 - item #5

From the minutes of the Undergraduate Studies Committee Meeting of Friday, February 23, 1996.

For background material, please see Judy. It will be available at the meeting.

Approval of the following courses from the University College of the Fraser Valley:

Math 360-3	Operations Research I (deterministic)
Math 381-3	Mathematical Methods I
Math 420-3	Empirical and non-Parametric Statistics
Math 438-3	Advanced Linear Algebra
Math 445-3	Introduction to Graph Theory
math 450-3	Statistical Distribution Theory
Math 451-3	Parametric Statistical Inference
Math 460-3	Operations Research II (stochastic)
Math 470-3	Methods of Multivariate Statistics

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DISCIPLINE/DEPARTMENT: Natural Science

IMPLEMENTATION DATE: ______

Revised: ______

Mathematics 381	Mathematical Methods I	3
SUBJECT/NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDI1

CALENDAR DESCRIPTION: This course covers a wide range of mathematical techniques: calculus problem - solving devices; Fourier series, Fourier integrals; the gamma, beta, and error functions; Bessel functions, Legendre, Hermite, and Laguerre polynomials, Sturm-Lioville systems; partial differential equations; and calculus of variations.

RATIONALE: This is a cross listing of Phys 381

COURSE PREREQUISITES: Math 211, 212, 213 or 310. Phys 111/112 recommended

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT						
	Lecture	60	hrs	Student Directed Learning		hrs
	Laboratory		hrs	Other - specify:		
	Seminar		hrs	______		hrs
	Field Experience		hrs	TOTAL	60	HRS

MAXIMUM ENROLMENT: 35

Is transfer credit requested? ☒ Yes ☐ No

[This course already has credit as Phys 381]

AUTHORIZATION SIGNATURES:

Course Designer(s): Tim Cooper

Chairperson: Art Last
Curriculum Committee

Department Head: Susan Milner

Dean: Wayne Welsh

PAC: Approval in Principle ______
(Date)

PAC: Final Approval: ______
(Date)

OUTLN95/01/dd

Mathematics 381 - Mathematical Methods I
NAME & NUMBER OF COURSE

SYNONYMOUS COURSES:

(a) replaces ________________
(course #)

(b) cannot take Phys 381 for further credit
(course #)

SUPPLIES/MATERIALS:

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

Advanced Mathematics for Engineers and Scientists, Murray R. Spigel

Integral Equations, L.G. Chambers, International Textbook

Mathematical Physics, E. Butkov, Addison - Wesley

Mathematical Methods of Physics, J. Mathews and R.L. Walker, W.A. Benjamin Inc

OBJECTIVES:

To give students the necessary mathematical skills to tackle the most common problems they will encounter in physics.

METHODS:

Lecture, demonstration, computer simulations.

STUDENT EVALUATION PROCEDURE:

Assignments	25%
Midterm Exam	30%
Final Exam	45%

Mathematics 381 - Mathematical Methods I
NAME & NUMBER OF COURSE

COURSE CONTENT

1. A large orientation assignment will be given covering the first six chapters of the text which covers material students should know from the prerequisites for the course. Followed by review lectures if needed.

Course continues with:

2. Fourier Series

3. Fourier Integrals

4. Special Functions I (Gamma, Beta, Ei, Si, Erf)

5. Special Functions II (Bessel Functions, cylindrical & spherical; Polynomials, Legendre, Hermite & Laguerre)

6. Partial differential equations, separation of variables, Laplace Transform techniques, Sturm-Lioville systems, eigenvalues, eigenfunctions

Complex variables, contour integrals & Cauchy's theorem, application to evaluation of integrals

Calculus of Variations (with and without constraint)
Discussion of minimum action principles in physics

Integral Equations, Green Functions and Dirac delta-function techniques

Numerical methods for quadratures and solving integral and differential equations. Richardsonian techniques will be discussed.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics
DATE: 01/06/94

MATH 360	Operations research I (deterministic)	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

The application of mathematical methods to business problems. Operations research was developed during and just after the last world war, and has had amazing success in enabling organisations to be more effective and efficient. The topics covered include: an overview of linear programming, duality theory and sensitivity analysis; transportation and assignment problems, network algorithms; dynamic and integer programming, scheduling; nonlinear programming, optimization with and without constraints; network models and applications; PERT and CPM.

COURSE PREREQUISITES:
Math 211, 221.

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT			
LECTURE	60	HRS	STUDENT DIRECTED LEARNING - HRS
LABORATORY		HRS	
SEMINAR		HRS	OTHER - specify: - HRS
FIELD EXPERIENCE		HRS	TOTAL 60 HRS

UCFV CREDIT TRANSFER	UCFV CREDIT NON-TRANSFER	NON-CREDIT
3		

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC TBA

SFU TBA

UVIC TBA

Math Curr. Com.
COURSE DESIGNER

J.D. Tunstall
DEAN

Math 360 Operations research I (deterministic)
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: MATH 460	RELATED COURSES: MATH 460

TEXTBOOKS, REFERENCES, MATERIALS

TEXT: Hillier & Lieberman, Introduction to mathematical programming. (1990) McGraw Hill (includes 2 3.5" disks)

COURSE OBJECTIVES:

1. To introduce the students to the fundamental deterministic models in applied operations research.

2. To develop the students' skills in formulating and building mathematical models.

3. To familiarize the students with using computers to solve operational research problems in business and industry.

STUDENT EVALUATION PROCEDURE:

Assignments	20%
Midterm exams	30%
Quizzes and short tests	10%
Final exam	40%

MATH 360 Operations research I (deterministic)
NAME & NUMBER OF COURSE

COURSE CONTENT:

1. Linear programming: simplex method, post-optimality analysis.

2. Duality theory, sensitivity analysis.

3. Special algorithms: transportation/transhipment problems, assignment problems, network algorithms.

4. Dynamic programming: formulation and solution; Bellman's principle of optimality.

5. Applications of dynamic programming: scheduling, inventory control with deterministic demand.

6. Integer programming: branch-and-bound technique, binary integer programming, mixed integer programming.

7. Applications of integer programming: facility layout, assignment problems.

8. Nonlinear programming: optimization without constraints, the one-dimensional search procedure, the gradient search procedure.

9. Optimization with constraints, the Karush-Kuhn-Tucker conditions, quadratic programming.

10. Separable programming; convex programming, Frank-Wolfe algorithm, non-convex programming, SUMT.

11. Applications of nonlinear programming: financial planning and operations management.

12. Network models: the shortest path problem, the minimum spanning tree problem, the maximum flow problem.

13. The minimum cost flow problem, PERT and CRM.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics
DATE: 01/06/94

Math 420	Empirical & non-parametric statistics	3 credits
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

Empirical and non-parametric statistics are used when either little can be assumed about the underlying distribution or it is very complex. These are methods based on order statistics, rankings, or resampling; and are very useful when a relatively quick answer is required.

COURSE PREREQUISITES:
Math 211, 270.

Recommended: Math 221 and additional upper level statistics courses.

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT				
	LECTURE	60	HRS	STUDENT DIRECTED LEARNING - HRS
	LABORATORY		HRS	
	SEMINAR		HRS	OTHER - specify: - HRS
	FIELD EXPERIENCE		HRS	TOTAL 60 HRS

UCFV CREDIT TRANSFER	3	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC TBA

SFU TBA

UVIC TBA

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Math 420 Empirical & non-parametric statistics
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: None	RELATED COURSES:

TEXTBOOKS, REFERENCES, MATERIALS

TEXTS:

Jean D. Gibbons & S. Chakraborti. Nonparametric statistical inference (3rd edition). Marcel Dekker (1992)

V. Choulakian, R.A.Lockhart, M.A.Stephens. Cramer-von Mises statistics for discrete distributions. *The Canadian Journal of Statistics*, 1994, 125-137.

COURSE OBJECTIVES:

The course is designed to introduce the student to a range of techniques that do not conveniently fall into one of the standard schools of inference. It will enable the student to:

1. develop a theoretical framework for use of order statistics and the empirical distribution function;

2. become familiar with the inference methods using these tools;

3. meet the inference methods based on randomization and rank-randomization;

4. become acquainted with the bootstrap and jacknife methods of resampling to obtain variance estimates;

5. meet simple standard measures of bivariate association.

STUDENT EVALUATION PROCEDURE:

Assignments	20%
Midterm exams	40%
Final exam	40%

MATH 420 Empirical & non-parametric statistics
NAME & NUMBER OF COURSE

COURSE CONTENT:

1. Review of joint probability distribution theory and transformations.

2. The distribution of the empirical distribution function, order statistics.

3. Quantile point and interval estimation, tolerance limits.

4. Kolmogorov-Smirnov statistics, and Cramer-von Mises, Watson and Anderson-Darling tests of fit. Durbin's method for allowing for adjustable parameters or, equivalently, components of the statistics.

5. Fisher-Pitman randomization and rank-randomization methods, especially the Wilcoxon and Kruskall-Wallis tests.

6. Bivariate association, rank correlation, Kendall's tau, concordance.

7. Efron's bootstrap techniques.

8. The Quenouille-Tukey jacknife methods for obtaining standard errors.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics
DATE: 30/11/94

Mathematics 438	Advanced Linear Algebra	3 credits
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

Advanced techniques and applications of linear algebra. Topics include general inner product spaces, projection matrices, least squares approximation, the spectral theorem, Jordan canonical form, orthogonal transformations, singular value decomposition, applications to optimization and differential equations.

COURSE PREREQUISITES:
Math 221, and at least two upper level math courses.

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT				
LECTURE	52	HRS	STUDENT DIRECTED LEARNING	- HRS
LABORATORY		HRS		
SEMINAR		HRS	OTHER - specify:	- HRS
FIELD EXPERIENCE		HRS	TOTAL 52	HRS

UCFV CREDIT TRANSFER	3	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC TBA

SFU Math 438

UVIC TBA

Math 438 Advanced Linear Algebra
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: None	RELATED COURSES: Math 439.

TEXTBOOKS, REFERENCES, MATERIALS

TEXT: Material selected from:

Linear Algebra - Hoffman & Kunze, Prentice-Hall.
Matrix Computations - Golub & Van Loan, North Oxford.

COURSE OBJECTIVES: Students will be introduced to central ideas and methods of linear algebra as they are applied in modern computation. A symbolic manipulation package (e.g. Maple) will be employed throughout.

Upon completion of the course, students should:

(a) have a basic but broad knowledge of the fundamental ideas and techniques of modern linear algebra,

(b) be able to recognize the many guises of projection in situations of approximation, and carry out the necessary computations,

(c) be able to understand and apply the spectral theorem,

(d) be able to employ canonical form decompositions,

(e) and employ efficient techniques of analyzing and solving linear systems.

STUDENT EVALUATION PROCEDURE:

Students will be given 2 to 3 midterm exams during the semester, as well as a final exam. They will also be expected to turn in assignments weekly. The weighting will be as follows:

Midterm exams	40%
Final exam	40%
Assignments	20%

25

MATH 438, Advanced Linear Algebra
NAME & NUMBER OF COURSE

COURSE CONTENT: Topics covered will include:

1. Review of Matrix Algebra (matrix arithmetic over the complex numbers.)

2. Review of Vector spaces (basis, dimension, coordinates, subspaces.)

3. Linear transformations and linear functionals.
   (a) Kernel, range, isomorphisms.
   (b) Matrix representation
   (c) Dual spaces and dual bases.

4. Brief review of determinants.

5. Inner Product Spaces
   (a) General inner products and norms.
   (b) Generalized Gram-Schmidt process.
   (c) Orthogonal complements and projection matrices.
   (d) Least squares approximation (multiple regression, orthogonal polynomials, finite Fourier series.)
   (e) If time permits: positive, unitary and normal operators.

6. Canonical forms
   (a) Eigenvalues and diagonalizability.
   (b) The spectral theorem. (Applications to optimization.)
   (c) Direct sum decompositions.
   (d) Jordan canonical form. (Applications of systems of differential equations.)
   (d) If time permits: The Cayley-Hamilton theorem.

7. Computational linear algebra
   (a) Orthogonal transformations (Householder, Givens.)
   (b) QR factorization.
   (c) Singular value decomposition.
   (d) Generalized inverses.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics
DATE: 05/11/94

Mathematics 445	Introduction to graph theory	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION: An introduction to graph theory and its applications.

COURSE PREREQUISITES:
Math 243 or Cmpt 205

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT				
	LECTURE	52	HRS	STUDENT DIRECTED LEARNING - HRS
	LABORATORY		HRS	
	SEMINAR		HRS	OTHER - specify: - HRS
	FIELD EXPERIENCE		HRS	TOTAL 52 HRS

UCFV CREDIT TRANSFER	3	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC TBA

SFU Math 445

UVIC TBA

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Math 445 Introduction to graph theory
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: None	RELATED COURSES: upper level math and computing courses

TEXTBOOKS, REFERENCES, MATERIALS

TEXT: Graph Theory with Applications
by A. Bondy and U. Murty
Elsevier Press

COURSE OBJECTIVES: This course is intended as an introduction to graph theory and its applications. The aim is to present the basic material, together with a wide variety of applications, both to other branches of mathematics and to real-world problems.

STUDENT EVALUATION PROCEDURE:

Students will be given 2 midterm exams during the semester, as well as a final exam. They will also be expected to turn in assignments approximately biweekly. The weighting will be as follows:

Midterm exams	40%
Final exam	45%
Assignments	15%

MATH 445 Introduction to graph theory
NAME & NUMBER OF COURSE

COURSE CONTENT: Topics covered will include:

1. Graphs amd sibgraphs: Isomorphism, subgraphs, adjacency matrix, paths, cycles and vertex degrees.

2. Trees: Cut-vertices, cut-edges and Cayley's formula.

3. Connectivity: Blocks and applications of connectivity.

4. Eulerian graphs: Euler tours, Hamiltonian cycles and applications.

5. Matchings: Matchings, coverings and the assignment problem.

6. Edge and vertex colorings: Chromatic number, Vizing's Theorem, Brooks' Theorem and chromatic polynomials.

7. Independence: Independent sets, cliques, Ramsey's Theorem and applications.

8. Planar graphs: Plane and planar graphs, dual graphs, Euler's formula and Kuratowski's Theorem.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics
DATE: 01/06/94

Mathematics 450	Statistical distribution theory	3 credits
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

This course provides the mathematical theory underlying statistical inference. Illustration is given in terms of the classical Gauss-Markov least squares theory. In addition, there is extended discussion of the basic limiting distribution laws. Contents include: Probability and distribution theory, Gauss-Markov least squares inference, sampling distributions in large samples.

This course is directed towards students specialising in either mathematics or statistics.

COURSE PREREQUISITES:
Math 211, 221, 270, and at least two upper-level courses in mathematics or statistics.

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT			
LECTURE	60 HRS	STUDENT DIRECTED LEARNING	- HRS
LABORATORY	HRS		
SEMINAR	HRS	OTHER - specify:	- HRS
FIELD EXPERIENCE	HRS	TOTAL	60 HRS

UCFV CREDIT TRANSFER	3	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC TBA

SFU TBA

UVIC TBA

Math 450 Statistical distribution theory
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: None	RELATED COURSES:

TEXTBOOKS, REFERENCES, MATERIALS

TEXTS: Probability and Statistical Inference, Volumes 1 & 2: Statistical inference. Kalbfleisch, J.G. (Springer-Verlag, 1985)

Introduction to the Theory of Statistics. Mood, Graybill & Boes. (McGraw-Hill)

Introduction to Probability and Statistics, from a Bayesian viewpoint. Parts 1 & 2: Inference. D.V. Lindley (Cambridge University Press)

COURSE OBJECTIVES:

This course is designed to give the basic mathematical background underlying standard statistical theory. The formal approach given here is motivated by applications in the the second and third year statistical courses to which the students have hopefully been exposed.

1. The students should be sufficiently confident in probability and distribution theory to set up their own probabilistic models in real situations.

2. The student should be knowlegable with the classical least squares theory used extensively in science and be able to justify and derive the classical inference distributions.

3. The student should be able to understand the notion of the asymptotic distributions of the sample mean and proportion, and of the maximum likelihood estimators, and the relevance to finite sample size estimation procedures.

STUDENT EVALUATION PROCEDURE:

Assignments	10%
Midterm exams	30%
Final exam	60%

MATH 450 Statistical distribution theory
NAME & NUMBER OF COURSE

COURSE CONTENT:

1. The axioms of probability, conditional probability, independence, Bayes' theorem. Random variables and distribution functions. Joint, marginal and conditional distributions.

2. Mathematical expectation, moments, conditional expectation, means and variances of linear combinations, moment generating functions.

3. Special univariate distributions. The multinomial, bivariate normal and multivariate normal distributions. Transformations of random variables. The sum of squares of normal variables, joint distribution of sample mean and variance, the chi-square, Student 't', and 'F' distributions. Conditional mean or regression with the multinomial and multivariate normal.

4. The Gauss-Markov model, least squares estimators and the normal equations, estimation of the residual variance, variance and covariance of l.s. estimators, the analysis of variance table. Adjustments for weights and correlation. Least squares theory with constraints.

5. Asymptotic distributions. The convergence of a sequence of random variables, the laws of large numbers, the Central Limit theorem.

6. The notion of the asymptotic distribution of an estimator.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics
DATE: 01/06/94

Mathematics 451	Parametric statistical inference	3 credits
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

A course on the ideas, nomenclature and techniques of the main schools of parametric statistical inference, namely, likelihood, Neyman-Pearson, Bayesian. The general similarities of the inferences made by each school will be emphasised, but inference situations which are controversial will also be discussed. This course is directed towards students specialising in either mathematics or statistics.

COURSE PREREQUISITES:
Math 450

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT				
LECTURE	60	HRS	STUDENT DIRECTED LEARNING	- HRS
LABORATORY		HRS		
SEMINAR		HRS	OTHER - specify:	- HRS
FIELD EXPERIENCE		HRS	TOTAL 60	HRS

UCFV CREDIT TRANSFER	3	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC TBA

SFU TBA

UVIC TBA

Math 451 Parametric statistical inference
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: None	RELATED COURSES:

TEXTBOOKS, REFERENCES, MATERIALS

TEXTS: Probability and Statistical Inference, Volume 2: Statistical inference. Kalbfleisch, J.G. (Springer-Verlag, 1985)

Introduction to the Theory of Statistics. Mood, Graybill & Boes. (McGraw-Hill)

Introduction to Probability and Statistics, from a Bayesian viewpoint. Part 2: Inference. D.V. Lindley (Cambridge University Press)

COURSE OBJECTIVES:

This course is designed to enable students to be familiar, in a straightforward manner, with the standard tools of parametric statistical inference. These will include:

1. The method of likelihood.

2. The frequency or Newman-Pearson approach. Where possible, the sampling distribution approach will be illustrated by simulation.

3. Bayesian inference.

In addition, there will be discussion about special problems and techniques, such as: conditional and marginal likelihoods, conditional tests, exact tests, the problem of the relevant reference set.

In particular, the general similarities of the inferences made by each school of thought will be emphasised, but inference situations which are controversial will also be discussed.

STUDENT EVALUATION PROCEDURE:

Assignments	10%
Midterm exams	30%
Final exam	60%

MATH 451 Parametric statistical inference
NAME & NUMBER OF COURSE

COURSE CONTENT:

1. Likelihood methods: likelihood, method of maximum likelihood, score and information functions, relative likelihood and contour maps, likelihood regions and intervals, continuous models, censoring, invariance, transformations, normal approximations, numerical methods.

2. Frequency or Neyman-Pearson methods: sampling distributions (use of computer where possible), expected (or Fisher) information, the likelihood ratio statistic, Pearson's chisquare approximation, confidence intervals, tests of significance, power, unbiasedness, uniformly most powerful tests. The sequential probability ratio test. Sample size estimation.

3. Special cases: nuisance parameters, the problem of the number of parameters increasing with the sample size, conditional and marginal likelihoods, residual maximum likelihood estimation, sufficient and ancillary statistics, the exponential family, conditional tests, exact tests, the reference set. [Fiducial inference, if time allows.]

4. Bayesian inference: 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, exchangeability; the Gibbs sampler; empirical Bayes. Sequential experimentation. Sample size estimation with prior information and costs.

5. Discussion of competing inferences in common situations.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics
DATE: 01/06/94

MATH 460	Operations research II (stochastic)	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

The application of mathematical methods problems in industry and business, allowing for random occurrence. Topics covered include: decisions under uncertainty; renewal theory, stochastic inventory control; Markov chains; queueing models, networks of queues; Markov decision processes, waiting lines; simulations; reliability.

COURSE PREREQUISITES:
Math 270, Math 360

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT				
	LECTURE	60 HRS	STUDENT DIRECTED LEARNING	- HRS
	LABORATORY	HRS		
	SEMINAR	HRS	OTHER - specify:	- HRS
	FIELD EXPERIENCE	HRS	TOTAL 60	HRS

UCFV CREDIT TRANSFER	3	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC TBA

SFU TBA

UVIC TBA

Math Curr. Com.
COURSE DESIGNER

J.D. Tunstall
DEAN

Math 460 Operations research II (stochastic)
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: NONE	RELATED COURSES: MATH 360

TEXTBOOKS, REFERENCES, MATERIALS

TEXT: Hillier & Lieberman, Introduction to stocahstic models in operations research. (1990) McGraw Hill (includes 2 3.5" disks)

Reference: S.Ross, introduction to probability models, 4th edition, (1991), Academic Press.

COURSE OBJECTIVES:

1. To introduce the students to the fundamental probabilistic models in applied operations research.

2. To develop the students' skills in formulating stochastic models in a business and industrial context.

3. To familiarize the students with using computers to solve operational research problems in business and industry.

STUDENT EVALUATION PROCEDURE:

Assignments	20%
Midterm exams	30%
Quizzes and short tests	10%
Final exam	40%

MATH 460 Operations research II (stochastic)
NAME & NUMBER OF COURSE

COURSE CONTENT:

1. Review of probability theory.

2. Decisions under uncertainty, decision trees, utility theory, Bayesian analysis.

3. Random variables, discrete and continuous variables, moment generating functions, limit theorems, stochastic processes.

4. Renewal theory: renewal and renewal-reward processes, regenerative processes.

5. Applications of renewal processes: stochastic inventory control, machine maintenance problems.

6. Markov chains: Chapman-Kolmogorov equations, limiting probabilities.

7. Queuing models: M/M/1, M/G/1 systems. Variations on single server systems.

8. Multiserver queues: M/M/k, M/G/k systems. Network of queues.

9. Applications of queuing models: assembly line problems, telecommunications problems, traffic control problems.

10. Markov decision processes, policy improvement algorithm, value iteration algorithm.

11. Applications of Markov decision processes: inventory control and scheduling problems, optimization problems in waiting lines.

12. Simulations: techniques for simulating random variables, reducing variance and determining the number of runs.

13. Reliability theory: systems with independent components, systems with repair.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics
DATE: 01/06/94

MATH 470	Methods of multivariate statistics	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

This course consists of the extension of the linear model methods developed in Math 302 to the multivariate situation. The emphasis of the course is on a range of widely used multivariate statistical techniques, their relationship with familiar univariate methods and the solution to practical problems. Topics will include: Hotelling's T^2, the analysis of dispersion, repeated measures, discriminant analysis, canonical correlations, principal components, factor analysis.

COURSE PREREQUISITES:
Math 211, 221, 270, 302 and at least two upper level courses.

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT				
LECTURE	60	HRS	STUDENT DIRECTED LEARNING	- HRS
LABORATORY		HRS		
SEMINAR		HRS	OTHER - specify:	- HRS
FIELD EXPERIENCE		HRS	TOTAL 60	HRS

UCFV CREDIT TRANSFER	3	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC TBA

SFU TBA

UVIC TBA

Math Curr. Com.
COURSE DESIGNER

J.D. Tunstall
DEAN

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Math 470 Methods of multivariate statistics
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: None	RELATED COURSES:

TEXTBOOKS, REFERENCES, MATERIALS

TEXT: TBA

Basic references:
Rao, C.R. (1973) Linear statistical models (chapter 8). John Wiley & Sons.

Timm, Neil H : 'Multivariate analysis of variance of repeated measures'. In P.R.Krishnaiah (ed), Handbook of Statistics: Analysis of variance; Volume 1, pages 41-87, Amsterdam, North-Holland (1980)

Berhard Flury and Hans Riedwyl (1985), 'T^2 tests, the linear group discrimination function and their computation by linear regression', The American Statistician, 39, 20-25.

COURSE OBJECTIVES:

1. Understand how a sound grasp of the univariate linear model can be simply developed into an intuitive understanding of the commonly used multi-normal statistical techniques.

2. Be conversant with the commonly used multivatite statistical methods and how to apply them to data sets using statistical software.

3. Become acquainted with the major multivariate criteria for the comparison of competitive hypotheses, and inter-relationships of these criteria.

STUDENT EVALUATION PROCEDURE:

Assignments	20%
Midterm exams	40%
Final exam	40%

MATH 470 Methods of multivariate statistics
NAME & NUMBER OF COURSE

COURSE CONTENT:

1. Expectation, dispersion and covariance of vector random variables.

2. The general multivariate normal distribution, its marginal and conditional distributions and properties.

3. Estimation of μ and Σ; the sums of squares and cross-products matrices. Sampling and the use of the basic results on the Wishart distribution, the distribution of special cases of Wilks' lambda criterion and of Hotelling's T^2.

4. Tests for assigned mean values, for a given structure of mean values, for differences between (vector) mean values of two populations. Fisher's linear discriminant. Relationship between linear discriminant analysis and linear regression. Mahalanobis' D^2.

5. The analysis of dispersion, test of linear hypotheses, test for additional information. Test for differences in mean values between several populations.

6. Multivariate regression. Repeated measures, growth curves.

7. Discussion of criteria and their interrelationships: Wilks' lambda, Hotelling-Lawley trace, Roy-Pillai largest root.

8. Discriminant analysis, the equivalent discrimination score.

9. Canonical correlations. Canonical discriminant functions.

10. Principal components.

11. The ideas underlying factor analysis; the principal factor method. Modern methods illustrated by use of software.