S.87-63

SIMON FRASER UNIVERSITY

MEMORANDUM

To: Senate

From: J.W.G. Ivany
Chair, SCAP

Subject: Faculty of Science
Department of Mathematics and Statistics
Reference SCUS 87-34; 87-51;
Reference SCAP 87-29; 87-54

Date: November 19, 1987

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

Motion 1: that Senate approve and recommend approval to the Board of Governors as set forth in S.87-63 the introduction of Honors, Major and Minor Program options in statistics, and

New courses	STAT 103-3	Introduction to Statistics for Social Research
	STAT 280-3	Applied Probability Models
	STAT 290-3	Selected Topics in Probability and Statistics
	STAT 390-3	Selected Topics in Probability and Statistics
	STAT 402-3	Generalized Linear and Nonlinear Modelling
	STAT 440-3	Statistical Quality Control
	STAT 495-3	Directed Studies in Probability and Statistics"

Motion 2: that Senate approve and recommend approval to the Board of Governors as set forth in S.87-63

New course	MATH 447-4	Coding Theory

FOR INFORMATION

Acting under delegated authority, SCUS approved the following changes to existing courses as set out in S.87-63

- MATH 101-3 Label change to STAT ~~103-3~~ 101-3
- MATH 102-3 Label change to STAT 102-3
- MATH 272-3 Label and number change to STAT 270-3
- MATH 302-3 Change of title, description, prerequisites and label to STAT 302-3
- MATH 309-3 Change to prerequisites
- MATH 372-3 Change of title, description, prerequisites and label and number to STAT 330-3
- MATH 387-3 Label and number change to STAT 380-3
- MATH 304-3 Change prerequisites and label and number to STAT 410-3
- MATH ~~478-3~~ 473-3 Label and number change to STAT 420-3
- MATH 404-3 Change of title, description, prerequisites and label and number to STAT 430-3
- MATH 472-3 Change of title, description, prerequisites and label and number to STAT 450-3
- MATH 475-3 Label and number change to STAT 460-3
- MATH 487-3 Label and number change to STAT 480-3
- MATH 479-3 Label and number change to STAT 490-3

Proposal for Changes in Statistics Offerings

The following changes are being proposed in response to recent developments in the field of statistics, in the employment market, and in related programs of study at SFU. These developments include

(i) the emergence of the generalized linear model as a powerful new tool for handling a broad array of statistical inference problems,

(ii) the extraordinary demand for quality assurance specialists who are needed to keep North American industries competitive,

(iii) the development of a program in manufacturing systems by the School of Engineering Science, and

(iv) the maturation of our offerings in statistics into an identifiable undergraduate program.

The changes are summarized as follows:

(1) the upgrading of the three service courses, MATH 302, 304, and 404,

(2) minor alterations to MATH 272,

(3) major alterations to MATH 372 and 472,

(4) the relabelling of certain MATH courses with the abbreviation code, STAT,

(5) the creation of three new courses, STAT 280, 402, and 440,

and

(6) the delineation of formal program options in statistics.

6) Program Options in Statistics

With the maturing of the discipline of statistics, many universities are now offering formal undergraduate programs in the subject. A degree program containing substantial training in statistical methodology and reasoning, related mathematics and computing science, and detailed knowledge of a potential field of applications provides a solid foundation for a wide variety of careers as well as for graduate research. The following program proposals are designed to recognize formally the concentration of courses already being selected by many of our undergraduates.

Statistics Major and Honours Options

Students majoring or taking honors in Mathematics with the statistics option for a B.A. degree are subject to the general regulations of the Faculty of Arts. Students majoring or taking honors in Mathematics with the statistics option for a B.Sc. degree are subject to the general regulations of the Faculty of Science. In each case, students following these options will be required by the Department of Mathematics and Statistics to obtain credit for the following courses:

(1) Lower Division Mathematics: MATH 151 (or 154 or 157), 152 (or 155 or 158), 232, 242, 251, and 252.

(2) Lower Division Statistics: STAT 270 and 280.

(3) Lower Division Computing: CMPT 101 or 102 or 103, or equivalent evidence of competence in computer programming.

(4) Upper Division Mathematics/Mathematical Computing: MATH 310 and MACM 316.

(5) Upper Division Probability and Statistics: STAT 330, 430, 450, and at least three of STAT 402, 410, 420 440 and 460

(6) Upper Division - Auxiliary Concentration: At least 15 upper division credit hours in some specific field other than probability and statistics, mathematics, or computing science. These courses are to be approved by a departmental advisor.

(7) In addition, faculty requirements stipulate that at least two other upper division courses be taken in Mathematics, Statistics, or Mathematics/Computing Science. These would normally be selected from the remaining options listed in (5) or the following list.

Other recommended mathematics courses: MATH 243, 308, 309, 313, 320, 322, 343, 408, 419, 426, 438, 439, 443, and 487.

(8) In addition to requirements (1) through (6) for a Major, candidates for an Honors degree in Mathematics with the statistics option will be required to obtain credit for MATH 320, 322, 426, 438, and 487, all of the courses listed under (5) above, and three additional upper division courses labelled MATH, STAT, or MACM.

004

Statistics Minor Option

Candidates for a Minor in Mathematics with the statistics option are subject to the general regulations of the faculty in which they are registered. In addition, they must

(i) obtain credit for

MATH 151 (or 154 or 157), 152 (or 155 or 158), 232, 251, and STAT 270, and

(ii) obtain credit for at least 5 of the following courses:

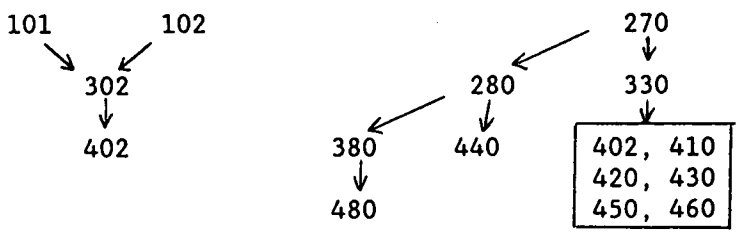
STAT 330, 380, 402, 410, 420, 430, 440, 450, and 460, and MATH 487. (This will normally include STAT 330, 430, and 450.)

The proposed changes to courses are summarized in the following table:

Existing Course*	New Course Label and Title	
MATH 101-3	STAT 101-3	Introduction to Statistics A
MATH 102-3	STAT 102-3	Introduction to Statistics B
MATH 272-3	STAT 270-3	Introduction to Probability and Statistics
----------	STAT 280-3	Applied Probability Models
----------	STAT 290-3	Selected Topics in Probability & Statistics
MATH 302-3	STAT 302-3	Analysis of Experimental and Observational Data
MATH 304-3*	STAT 410-3	Statistical Analysis of Sample Surveys
MATH 372-3*	STAT 330-3	Linear Models in Applied Statistics
MATH 387-3	STAT 380-3	Introduction to Stochastic Processes
----------	STAT 390-3	Selected Topics in Probability & Statistics
----------	STAT 402-3	Generalized Linear and Nonlinear Modelling
MATH 404-3*	STAT 430-3	Statistical Design and Analysis of Experiments
MATH 472-3*	STAT 450-3	Intermediate Statistical Theory
MATH 473-3	STAT 420-3	Nonparametric Statistics
MATH 475-3	STAT 460-3	Decision Analysis and Bayesian Inference
----------	STAT 440-3	Statistical Quality Control
MATH 479-3	STAT 490-3	Selected Topics in Probability & Statistics
----------	STAT 495-3	Directed Studies in Probability & Statistics
MATH 487-3	STAT 480-3	Probability Theory

* This symbol signifies a course that is proposed to undergo major revisions.

The new prerequisite structure is summarized by the following diagram.



Detailed Proposals and Rationale

1) MATH 302, 304, and 404.

MATH 302 has been a successful service course. Nonetheless, its gradual evolution in response to student interest has rendered the title and calendar description somewhat outdated.

We are therefore proposing the following editorial changes:

From: MATH 302-3 Statistical Methods.
Nonparametric statistics, analysis of variance and related topics which are intended to help students understand the uses of statistics in experimental research.
Prerequisites: STAT 101 or 102 or 272 (or MATH 272) or ARC 376 or BUEC 232 (formerly 332).
(Mathematics major and honors students may not use this course to satisfy the required number of semester hours of upper division Mathematics courses. However, they may include the course to satisfy the total number of required hours of upper division credit.)

To: STAT 302-3 Analysis of Experimental and Observational Data.
The standard techniques of multiple regression analysis, analysis of variance, and analysis of covariance, and their role in experimental research.
Prerequisite: STAT 101 or 102 or 270 (or MATH 272) or ARC 376 or BUEC 232 (formerly 332). Students who have obtained credit for STAT 330 are not permitted to take STAT 302 for further credit.

(Mathematics major and honors students may not use this course to satisfy the required number of semester hours of upper division Mathematics courses. However, they may include the course to satisfy the total number of required hours of upper division credit.)

MATH 304 and 404 were originally designed as service courses in sample surveys and experimental design. To broaden the scope of offerings while still conserving limited teaching resources, we also made them available to mathematics majors. As service courses, they have not been very successful. MATH 304, for example, provides useful information to graduate students in the social sciences planning to run their own surveys, but for a variety of reasons (including the fact that they cannot receive graduate credit), few of these students actually take the course. Most of the students in MATH 304 and 404 have in reality had rather strong mathematical backgrounds, and have found the courses not very challenging. The problem has been compounded in the case of MATH 304 by the lack of any suitable text. By upgrading the prerequisite for MATH 304 and increasing the number to a 400-level, we are able to adopt a challenging, well-written text, often used at the graduate level.

MATH 404 will also have its prerequisite upgraded. By insisting upon STAT 330 (a modernized version of MATH 372) as a prerequisite, we can cover the material in advanced experimental design presented in the last half of the innovative text we are recommending for STAT 330.

Proposal: (a) Change the number and prerequisites for MATH 304 as follows:

From: MATH 304.
Prerequisite: One course in Statistics or Probability; e.g. MATH 101 or 102, or PSYC 201.

To: STAT 410
Prerequisite: STAT 330.

(b) Change the number, title, and calendar description for MATH 404 as follows:

From: MATH 404-3 Experimental Design
Design of experiments; factorial experiments; block designs and confounding; analysis of variance; analysis of covariance; regression and multiple regression.

Prerequisite: MATH 302 or 372. Permission will be given to students from other departments, with suitable backgrounds.

To: STAT 430-3 Statistical Design and Analysis of Experiments
An extension of the designs discussed in STAT 330 to include more than one blocking variable, incomplete block designs, fractional factorial designs, and response surface methods.

Prerequisite: STAT 330 (or MATH 372).

(c) Change the detailed descriptions to the appended versions.

2) MATH 272. In response to both the increasing numbers of engineering science students in MATH 272 and the general interest in quality assurance, we are proposing minor alterations to the detailed description (but not the calendar outline) for this course. A proposed new version is attached. The central changes are (a) inclusion of basic control charts, and (b) a change of textbook.

3) MATH 372 and 472. For MATH 372 (to be relabelled STAT 330) we propose a shift in emphasis toward experimentation and model building. The course will still introduce students to the fundamentals of statistical inference. It should provide a solid foundation for more detailed study of complex experimental designs in MATH 404 (STAT 430), and statistical theory in MATH 472 (STAT 450) and MATH 475 (STAT 460). (The recommended text for MATH 404 [STAT 430] is the same as that for MATH 372 [STAT 330]. Each course would cover a different half of the same book.) The existing version of STAT 450 (MATH 472) would conflict heavily with the proposed new versions of STAT 330 and 430. Furthermore, our existing offerings do not touch on two very important areas -- nonlinear regression and generalized linear models. For these reasons, we are proposing that the title and calendar descriptions to MATH 372 and 472 be changed as follows:

From: MATH 372-3 Introduction to Probability and Statistics II
Techniques of estimation and hypothesis testing, one-sample and two-sample tests. Introduction to analysis of variance, regression and correlation.

To: STAT 330-3 Linear Models in Applied Statistics
Standard statistical inference procedures for analyzing experimental and survey results. Statistical model building. Foundations of experimental design.

From: MATH 472-3 Linear Models in Statistics
Linear models, analysis of variance and covariance, multiple regression, introduction to the design of experiments.

To: STAT 450-3 Intermediate Statistical Theory
Methods for constructing tests and estimators, weighted least squares, nonlinear regression, and the generalized linear model.

A proposed new detailed description is attached.

4) To aid students in finding the courses in probability and statistics offered by this department, it is proposed that the abbreviation code MATH be changed to STAT on each of the following courses: MATH 101, 102, 272, 302, 304, 372, 404, 472, 473, and 475. Where appropriate the statement would be appended, STAT xyz may not be taken for further credit if credit has already been obtained for MATH uvw. Furthermore, new course numbers are being proposed for selected topics (STAT 290, 390, and 490) and directed studies (STAT 495) courses in probability and statistics.

5) New courses STAT 280, STAT 402 and STAT 440.
Following are detailed rationales for these course proposals. Course proposal forms and detailed descriptions appear in the appendix.

RSC 76-15a)

Appendix B_3

009

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

1. **Calendar Information**

Department: Mathematics & Statistics

Abbreviation Code: STAT **Course Number:** 103 **Credit Hours:** 3 **Vector:** 3-0-1

Title of Course: Introduction to Statistics for Social Sciences

Calendar Description of Course:

A course similar to STAT 101 (formerly MATH 101) but directed to students in the social sciences.

Nature of Course LECTURE - WORKSHOP

Prerequisites (or special instructions): See entry level requirements. Students with credit for ARC. 376, BUEC 232 (formerly 332) or STAT 270 (formerly MATH 272 and MATH 371) may not subsequently receive credit for STAT 103. Students with credit for STAT 101, STAT 102, MATH 101 or MATH 102 may not take STAT 103 for further credit.

What course (courses), if any, is being dropped from the calendar if this course is approved:

2. **Scheduling**

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered? Fall 1988.

Which of your present faculty would be available to make the proposed offering possible: D. Eaves, R. Lockhart, R. Routledge, M. Stephens, T. Swartz, K.L. Weldon

Objectives of the Course

To introduce the material of STAT 101 (formerly MATH 101) in a way that will be perceived as directly relevant to students with majors in the social sciences, and to encourage active participation in the course by these students. The Department of Mathematics and Statistics will maintain an advisory committee which will allow any department which requires or recommends this course to have a continuing opportunity to provide input on course presentation.

4. **Budgetary and Space Requirements (for information only)**

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. **Approval**

Date: Oct. 14, 1987

Department Chairman	Dean	Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

Introduction to Statistics for Social Research

Prerequisite: B.C. High School Algebra 11 (or equivalent). Students lacking this background may take the non-credit Basic Math Course offered through Continuing Studies, AQ 6050. Students with a grade of P in B.C. High School Algebra 11 should take the Math Assessment Test. Students with credit for STAT 101, STAT 102, ~~STAT 104~~, MATH 101, MATH 102, ARC. 376-5, BUEC 232-3 (formerly BUEC 332-3) or STAT 270 (formerly MATH 272 and MATH 371) may not subsequently receive credit for STAT 103-3.

Textbook: Please refer to the Departmental Textbook List, available outside of the Math & Stats. General Office TLX 10512.

******

Aimed at a non-mathematical audience, this courses discusses procedures that are most commonly used in research in the social sciences. The rationale for these procedures is explained in detail, but the use of mathematical formulas is kept to a minimum. STAT 103 is a satisfactory prerequisite for MATH 302.

1. The Design of a Statistical Study
   The two major design types, controlled experiments and observational studies, are discussed, with special emphasis on the limitations of each. The practical necessity of observational studies in social sciences research is discussed.

2. Descriptive Statistics
   The following methods of summarizing the information in large data sets are introduced: histograms and other graphs, averages, standard deviations, and the normal approximation. Applications to summary of social and political surveys.

3. Correlation and Regression
   The correlation coefficient is introduced as a measure of the strength of association between two quantities; the regression line, as a graph of averages. Deviations from this line are discussed. Use of these techniques in formulating causal hypotheses based on studies in social sciences.

4. Probability
   Methods are presented for computing the probabilities of chance occurrences. The binomial formula is stressed. Examples are introduced which explain how probability is used to model the unpredictability of human responses.

5. Chance Variability
   Fallacious interpretations of "The Law of Averages" are brought to light, and the predictable patterns that do indeed emerge in repetitions of chance experiments are discussed. The use of aggregation as a method for concentrating information from widely variable measurements, such as are encountered in social surveys.

(over)

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

011

COURSE PROPOSAL FORM

1. Calendar Information

Department: Mathematics and Statistics

Abbreviation Code: STAT Course Number: 280 Credit Hours: 3 Vector: 3-1-0

Title of Course: Applied Probability Models

Calendar Description of Course: Review of elementary probability models. Conditional probability and conditional expectation. Fitting and testing adequacy of models. Applications to production management and quality control. Introduction to simple Markov chains, Poisson processes, inventories and queues. Reliability models including lifetime analysis and circuit configuration.

Nature of Course

For students with a good mathematics background and an interest in applications.

Prerequisites (or special instructions):

STAT 270 (or MATH 272).

What course (courses), if any, is being dropped from the calendar if this course is approved: none

2. Scheduling

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered? 1988-3

Which of your present faculty would be available to make the proposed offering possible: Drs. Eaves, Lockhart, Routledge, Stephens, Swartz, Weldon

3. Objectives of the Course

(1) Preparation for STAT 380 and STAT 440.

(2) Satisfy Core-B requirements in Engineering Science.

(3) Provide an introduction to the applications of probability theory to mathematically-inclined students.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. Approval

Date: OCT 06 1987

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

STATISTICS 280-3

Applied Probability Models

1. A review of Elementary Probability Models: binomial, negative binomial, hypergeometric, Poisson, geometric, exponential, gamma, normal and F-distributions. Nonparametric probability models.

2. Conditional Probability and Conditional Expectation: modelling dependence with conditional models, simplification of dependence by conditioning, assessment of model fit (residual analysis, probability plotting, and goodness-of-fit tests).

3. Introduction to Markov Chains. Random walks. Applications to simple models for inventories and queues. Birth-death processes. Steady state assessment.

4. Introduction to lifetime analysis. Exponential and related lifetime models. Hazard functions. Poisson process and relating counting processes. Weibull distribution. Reliability.

5. Modelling serial correlation. Moving averages and autoregressive models. Predictive and explanatory models. Phenomena of serial correlation.

Each topic is illustrated with examples from many fields. The emphasis would be on the use of simple models to assist in the explanation of complex real-world phenomena. The modelling process would be discussed in detail.

Textbook: AN INTRODUCTION TO STOCHASTIC MODELLING,
by H.M. Taylor and S. Karlin, 1984

Rationale for STAT 280

STAT 280 (Applied Probability Models) is proposed as a new course to follow STAT 270 (MATH 272) (Introduction to Probability and Statistics) and to precede STAT 380 (MATH 387) (Introduction to Stochastic Processes) and STAT 440 (Statistical Quality Control). The course would satisfy the following functions:

(1) To introduce applications of probability models.

(2) To improve the preparation for STAT 380.

(3) To provide access to the material of STAT 440.

These points are elaborated as below:

(1) Students of probability theory seldom learn of its practical utility until graduate school or later. Courses at the undergraduate level have tended to emphasize definitions and properties of models but not their discovery or identification in practical contexts. This proposed course emphasizes these latter aspects.

(2) STAT 380 (Introduction to Stochastic Processes) covers fairly advanced probability models and includes challenging problems. The sophistication it requires has made it overly difficult for all but the most able students. STAT 280 would provide a better background for STAT 380 and allow more material to be covered in STAT 380.

(3) Students in STAT 280 would spend considerable time studying several probability models of use to people working in industrial quality control, process improvement, and reliability assessment. This background would permit the development of more insight in STAT 440.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

014

1. **Calendar Information**

Department: Mathematics & Statistics

Abbreviation Code: STAT **Course Number:** 290 **Credit Hours:** 3 **Vector:** 3-1-0

Title of Course: Selected Topics in Probability and Statistics

Calendar Description of Course:

Topics in areas of probability and statistics not covered in the regular undergraduate curriculum of the department.

Nature of Course Lecture/Tutorial

Prerequisites (or special instructions):

Dependent on the topic covered.

What course (courses), if any, is being dropped from the calendar if this course is approved:

2. **Scheduling**

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. **Objectives of the Course**

The proposed relabelling of courses in probability and statistics with the code, 'STAT', would otherwise leave the department with no means of offering a selected topics course in this field.

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. **Approval**

Date: OCT 06 1987

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

015

1. **Calendar Information**

Department: Mathematics & Statistics

Abbreviation Code: STAT **Course Number:** 390 **Credit Hours:** 3 **Vector:** 3-1-0

Title of Course: Selected Topics in Probability and Statistics

Calendar Description of Course:

Topics in areas of probability and statistics not covered in the regular undergraduate curriculum of the department.

Nature of Course Lecture/Tutorial

Prerequisites (or special instructions):

Dependent on the topic covered.

What course (courses), if any, is being dropped from the calendar if this course is approved:

2. **Scheduling**

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. **Objectives of the Course**

The proposed relabelling of courses in probability and statistics with the code, 'STAT', would otherwise leave the department with no means of offering a selected topics course in this field.

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. **Approval**

Date: OCT 08 1987

Department Chairman	Dean	Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

016

1. Calendar Information

Department: Mathematics and Statistics

Abbreviation Code: STAT Course Number: 402 Credit Hours: 3 Vector: 3-1-0

Title of Course: Generalized Linear and Nonlinear Modelling

Calendar Description of Course: A skills-oriented unified approach to a broad array of non-linear regression modelling methods including classical regression, logistic regression, probit analysis, dilution assay, frequency count analysis, ordinal-type responses, and survival data.

Nature of Course Lecture/Tutorial

Prerequisites (or special instructions): STAT 302 or STAT 330.

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 404

2. Scheduling

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible: Drs. Eaves, Lockhart, Routledge, Stephens, Swartz, Weldon.

3. Objectives of the Course

To provide training to advanced undergraduates and to graduate students in other departments, in nonlinear regression modelling of a wide variety of common data types.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. Approval

Date: OCT 06 1987

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

STATISTICS 402-3

Generalized Linear and Nonlinear Modelling

Note: This course extends the concepts, methods and approach of STAT 302-3 to cover a wide variety of types of outcome data. It employs a modern unified approach to a broad array of nonlinear regression problems.

1. Brief Review of Fundamental Background.

2. Overview: Empty model, link function, simple examples of structuring a mean value vector with link function and design matrix, and of structuring variance with a variance function; iterated reweighted least squares estimation.

3. Examples from exponential-type likelihood models: Normal, including classical linear regression and other links; Poisson, including log-linear regression; Binomial, including logit, probit, and dilution assay. Examples allowing overdispersion.

4. Other Examples.

5. Inference: The variance-covariance matrix of the estimated regression vector and confidence intervals for linear predictors, fitted values, other relevant estimated quantities; comparative evaluation of models, deviance, Pearson statistic, residuals.

6. Logistic Regression.

7. Contingency tables and log-linear models.

8. Ordinal-type outcome: Proportional odds model, proportional hazards model.

9. Survival data.

(or as much of the above as time permits)

Primary Reference:

An Introduction to Statistical Modelling
by Dobson
Chapman and Hall, 1983

Other Reference: Sections 1 through 6 of:

The GLIM System, Release 3, Manual
Baker and Nelder
Numerical Algorithms Group, 1978

Rationale for STAT 402

A relatively non-mathematical two-course modern statistical methods sequence has long been offered (302-404). This concept remains sound, but a second course (402) in such a service sequence now needs to strive to rely more on intuition than on mathematics, and to exploit recent developments in nonlinear regression in such a way as to cover a much wider variety of outcome data types.

Emphasis will be on practical skills with several computing packages, and on conceptual unity. It is an essential component of skill training for data-oriented scientists in the 80's.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

019

1. Calendar Information

Department: Mathematics and Statistics

Abbreviation Code: STAT Course Number: 440 Credit Hours: 3 Vector: 3-1-0

Title of Course: Statistical Quality Control

Calendar Description of Course:
Design and implementation of control charts and alternatives, process capability analysis, acceptance sampling procedures, system reliability models, hazard analysis, and related economic considerations.

Nature of Course Lecture/Tutorial

Prerequisites (or special instructions):
STAT 280, and STAT 330 (or MATH 372).

What course (courses), if any, is being dropped from the calendar if this course is approved: none.

2. Scheduling

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered? 1989-1

Which of your present faculty would be available to make the proposed offering possible: Drs. Eaves, Lockhart, Routledge, Stephens, Swartz, and Weldon

3. Objectives of the Course

To provide a thorough background in the theory of quality control and reliability theory. Students with this training would be in a strong position to contribute to the competitiveness of industries.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. Approval

Date: OCT 06 1987

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

STATISTICS 440-3

Statistical Quality Control

This course is designed for students with credit in STAT 280 and 330. Using this as a base, students will study in depth the design and use of (i) control charts for monitoring production processes, (ii) acceptance sampling schemes, and (iii) experiments that can be conducted in a search for improved production processes. If time permits, these ideas will be supplemented by a discussion of system reliability. By the end of the course, students should be well prepared to handle questions on these topics on the Quality-Engineer-in-Training examination set by the American Society for Quality Control.

Rationale for STAT 440

North American industries are being forced to adopt new procedures for quality control. These involve a variety of activities including, for example, the increased use of statistical charts for monitoring established production processes, experimental manipulations of production processes to reduce output variation, and the modelling of reliability for complex products. Our existing courses in statistics train students in the related, general theory. This proposed course will delve into the specific problems confronting quality assurance specialists. The demand for people with such training is forecast to continue to be very strong for the foreseeable future. We plan to use this course, and related modifications to our programs, to prepare students for careers in this expanding section of the job market. We intend to monitor the impact of these changes with a view to developing a program in quality assurance in the near future.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

021

1. **Calendar Information**

Department: Mathematics & Statistics

Abbreviation Code: STAT **Course Number:** 495 **Credit Hours:** 3 **Vector:**

Title of Course: Directed Studies in Probability and Statistics

Calendar Description of Course:

Independent reading or research in consultation with the supervising instructor.

Nature of Course Independent study and consultation.

Prerequisites (or special instructions):

Written permission of the Department Undergraduate Studies Committee.

What course (courses), if any, is being dropped from the calendar if this course is approved:

2. **Scheduling**

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. **Objectives of the Course**

The proposed relabelling of courses in probability and statistics with the code, 'STAT', would otherwise leave the department with no means of offering a directed studies course in this field.

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. **Approval**

Date: OCT 06 1987

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

022

Calendar Information

Department: Mathematics & Statistics

Abbreviation Code: MATH Course Number: 447 Credit Hours: 4 Vector: 4-0-0

Title of Course: CODING THEORY

Calendar Description of Course: An introduction to the theory and practice of error-correcting codes. Topics will include finite fields, polynomial rings, linear and non-linear codes, BCH codes, convolutional codes, majority logic decoding, weight distribution of codes, and bounds on the size of codes.

Nature of Course Lecture

Prerequisites (or special instructions):

Math 232; Math 439 is recommended.

What course (courses), if any, is being dropped from the calendar if this course is approved: None.

2. Scheduling

How frequently will the course be offered? Once a year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible: Alspach, Godsil, Heinrich, Hell, Brown

Objectives of the Course

To introduce students to the most important families of codes and the algorithms used in decoding them; to indicate the connections of coding theory to other branches of mathematics.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty
Staff
Library
Audio Visual
Space
Equipment

None.

5. Approval

Date: October 24, 1986 MAR 17 1987

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

MATH 447-4 (4-0-0) CODING THEORY

COURSE DESCRIPTION

This course is intended to be an introduction to the theory and practice of error-correcting codes. The following selection of topics is representative:

1) elementary algebra, finite fields
2) linear and non-linear codes
3) cyclic codes
4) BCH codes
5) convolutional codes
6) majority logic decoding
7) weight distributions of codes; codes and designs
8) bounds on the size of codes

PREREQUISITES: MATH 232; Math 439 is recommended.

TEXTBOOK: Richard E. Blahut: Theory and Practice of Error Control Codes, Addison Wesley (1983)

FURTHER REFERENCES:

Shu Lin and Daniel J. Costello: Error Control Coding, Prentice-Hall (1983)

F.J. MacWilliams and N.J.A. Sloane: The Theory of Error-Correcting Codes, North Holland (1977)

J.H. Van Lint: Introduction to Coding Theory, Springer (Graduate Texts in Mathematics 86) (1982)

Vera Pless: Introduction to the Theory of Error-Correcting Codes, Wiley-Interscience (1982).

Proposed new course MATH 447 CODING THEORY.

RATIONALE: Such a course will be useful to graduate engineers and mathematics majors. Universities with strength in Combinatorics and Optimization frequently have such a course. A supporting letter from Prof. Jim Cavers, Engineering Science, is enclosed. Also enclosed find the course proposal form and the extended course outline.

SIMON FRASER UNIVERSITY

MEMORANDUM

024

To: Brian Alspach, Mathematics
Chris Godsil, Mathematics

From: Jim Cavers
Engineering Science

Subject: Coding Theory Course

Date: 6 November 1985 copy

This is a very belated response to the course proposal you sent me on May 30. I didn't realize that you needed a written response or I would have replied some time ago.

We are quite enthusiastic about your offering a coding theory course. The material is essential to design of digital communication systems, but is not usually offered in any depth in a typical undergraduate engineering program. Engineers frequently discover its importance only during their first system design.

We plan to give graduate credit for engineers in our Master's program taking this course, on the grounds that engineering programs at other universites usually offer the material only at the graduate level.

I would expect it to be a fairly popular course, given the number of communications oriented companies in the Lower Mainland. I hope you would consider offering it in the late afternoon or evening, to make it more accessible to our part-time students.

cc D. George
B. Clayman

** Change of Label Only **

Appendix B

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

FOR INFORMATION

025

1. **Calendar Information**

Department: Mathematics and Statistics

Abbreviation Code: STAT Course Number: 101 Credit Hours: 3 Vector: 3-0-1

Title of Course: Introduction to Statistics, Option A

Calendar Description of Course:

Nature of Course

Prerequisites (or special instructions):
Add the statement, "Students with credit for MATH 101 may not take STAT 101 for further credit."

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 101

2. **Scheduling**

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. **Objectives of the Course**

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. **Approval**

OCT 06 1987

Date: _____ _____ _____

_____ _____ _____

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

** Change of Label Only **

Appendix B3

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

FOR INFORMATION

COURSE PROPOSAL FORM

02

1. Calendar Information

Department: Mathematics and Statistics

Abbreviation Code: STAT Course Number: 102 Credit Hours: 3 Vector: 3-0-1

Title of Course: Introduction to Statistics, Option B

Calendar Description of Course:

Nature of Course

Prerequisites (or special instructions):
Add the statement, "Students with credit for MATH 102 may not take STAT 102 for further credit."

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 102

2. Scheduling

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. Objectives of the Course

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. Approval

Date: OCT 06 1987

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM **FOR INFORMATION**

027

1. **Calendar Information**

Department: Mathematics and Statistics

Abbreviation Code: STAT Course Number: 270 Credit Hours: 3 Vector: 3-1-0

Title of Course: Introduction to Probability and Statistics

Calendar Description of Course:

Nature of Course

Prerequisites (or special instructions):
Add the statements, "Students with credit for MATH 272 may not take STAT 270 for further credit."

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 272

2. **Scheduling**

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. **Objectives of the Course**

The course label is being changed as part of a major relabelling of probability and statistics courses. The course title is to be altered editorially. (The Roman Numeral 'I' is being dropped because the title of the sequel, MATH 372 is to be changed.)

4. **Budgetary and Space Requirements (for information only)**

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. **Approval**

Date: OCT 06 1987

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

STATISTICS 270-3

Introduction to Probability and Statistics

This course introduces students to probability theory and its applications to statistics, management science, reliability, quality control, insurance, computing science, etc. Students who do reasonably well in mathematics are encouraged to take the stream beginning with STAT 270 instead of STAT 101 or 102. This is particularly important for students considering taking a concentration of courses in mathematics and statistics. The foundations of statistical inference procedures are established in each of these courses; however, only STAT 270 has sufficient mathematical content to prepare students for the entire sequence of probability and statistics courses offered by the Department of Mathematics and Statistics.

DETAILED CONTENTS (not necessarily covered in this order)

1. Chance Phenomena and Randomization

   Examples of naturally arising chance phenomena and the role of randomization in experimental design will be discussed.

2. Laws of Probability

   Methods will be developed for computing probabilities of chance occurrences. These will include laws for probabilities of combinations of simple events, and combinatorial arguments for use when all outcomes are equally likely.

3. Paradoxes in Probability

   Common misconceptions and myths about chance events in everyday life will be scrutinized. This will involve special attention to the notion of conditional probability. The paradoxes will specifically include inspection and waiting-time paradoxes.

4. Probability Distributions and Random Variables

   Histograms and density curves, means, variances, and standard deviations will be introduced. The following special distributions will be developed: uniform, binomial, negative binomial, geometric, hypergeometric, Poisson, gamma, exponential, normal. Other distributions may be discussed, time permitting. These will be applied to such fields as engineering, risk theory, quality control, reliability, and the interpretation of scientific experiments.

5. Laws of Expectation and Standard Error

   Rules for finding the expectation and standard error for sums of independent random variables will be developed.

6. Transformations of Random Variables

Methods for finding the distribution of a transformation of a single random variable will be discussed.

7. The Sampling Behaviour of an Average

The average of a randomly drawn sample is subject to chance fluctuations. Predictable patterns that exist in these chance fluctuations will be derived. Moment generating functions will be used to aid in the derivation. The often misunderstood "law of averages" will be examined in light of the formal law of large numbers and central limit theorem.

8. Making Decisions Under Uncertainty

Standard procedures for assessing the accuracy of a sample estimate of an average and a proportion along with methods for making decisions under uncertainty will be introduced in an informal way. The discussion will specifically include applications to basic control charts and acceptance sampling schemes, and confidence intervals and hypothesis tests for a single mean or proportion.

Textbook: AN INTRODUCTION TO MATHEMATICAL STATISTICS AND ITS APPLICATIONS
by R. Larsen and M. Marx
Prentice-Hall Publishers, 1981.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

FOR INFORMATION

1. Calendar Information

Department: Mathematics and Statistics 03

Abbreviation Code: STAT Course Number: 302 Credit Hours: ___ Vector: (3-0-1)

Title of Course: Analysis of Experimental and Observational Data

Calendar Description of Course:
The standard techniques of multiple regression analysis, analysis of variance, and analysis of covariance, and their role in scientific research.

Nature of Course

Prerequisites (or special instructions):

Prerequisites: STAT 101 (or MATH 101) or STAT 102 (or MATH 102) or STAT 270 (or MATH 272) or ARC 376 or BUEC 232 (formerly 332). Students with credit for MATH 302 may not take STAT 302 for further credit.
[Mathematics major and honors students may not use this course to satisfy the required number of semester hours of upper division Mathematics courses. However, they may include the course to satisfy the total number of required hours of upper division credit.)

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 302.

2. Scheduling

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. Objectives of the Course

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. Approval

Date: OCT 30 1987

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

STATISTICS 302-3 **FOR INFORMATION**

ANALYSIS OF EXPERIMENTAL AND OBSERVATIONAL DATA 031

NOTE: This course is designed for the non-mathematician. It is intended to follow STAT 101-3 or STAT 102-3. Some mathematical notation is introduced but mathematical results are not proved. Instead the results are explained heuristically so that the student can understand the rationale of the techniques commonly used in applied statistics. The exposition will use many examples from both the social and natural sciences.

TOPICS

1. The course begins with a review of STAT 101, STAT 102; the review will cover and extend the mathematical notation introduced in STAT 102, and used less extensively in STAT 101.

2. Introduction to Regression Analysis
Simple regression, regression and causality, assumptions of linear regression, measuring adequacy of assumptions, estimation of error variance, inferences concerning slope and intercept, inferences concerning the simple regression line, interpretation of estimated regression lines, prediction with regression lines.

3. Correlation and its Relationship to Regression
Definition of the correlation coefficient, r, measures of association, and the bivariate normal distribution, what r does not measure, estimation and testing with r.

4. Analysis of Variance
One- and two-way analysis of variance, the analysis of variance table and related tests, fixed and random effects, multiple comparison procedures and contrasts.

5. Multiple Regression Analysis
Using more than one independent variable, graphical considerations for this problem, assumptions, collinearity, estimation of the best regression equation, analysis of variance table, overall and partial F tests.

6. The General Linear Model
Multiple Regression and analysis of variance as special cases of the general linear model. The general procedure for constructing F-tests by fitting restricted models. Applications to analysis of covariance and comparison of two regression model.

7. Correlations: Multiple, Partial and Multiple-Partial
Correlation matrix, multiple correlation coefficient, the multivariate normal distribution, partial correlation coefficient, F-tests for multiple and partial correlations.

8. Analysis of Residuals
Checking on the assumptions of regression and analysis of variance models, effects of departures from the assumptions, transformations.

Textbook: APPLIED REGRESSION ANALYSIS
by D.G. Kleinbaum and L.L. Kupper
PUB: Duxbury, 1978

** CHANGE IN PREREQUISITE ONLY **

Appendix B_3

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM **FOR INFORMATION**

032

1. **Calendar Information**

Department: Mathematics & Statistics

Abbreviation Code: MATH Course Number: 309 Credit Hours: 3 Vector: 3-1-0

Title of Course: CONTINUOUS OPTIMIZATION

Calendar Description of Course:

(no change)

Nature of Course

Prerequisites (or special instructions):

MATH 232 and 251; MATH 308 is recommended.

What course (courses), if any, is being dropped from the calendar if this course is approved:

2. **Scheduling**

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

Objectives of the Course

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. **Approval**

Date: March 16, 1987 MAR 17 1987

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

FOR INFORMATION

033

1. Calendar Information

Department: Mathematics and Statistics

Abbreviation Code: STAT Course Number: 330 Credit Hours: 3 Vector: 3-1-0

Title of Course: Linear Models in Applied Statistics

Calendar Description of Course:
Standard statistical inference procedures for analyzing experimental and survey results. Statistical model building. Foundations of experimental design.

Nature of Course Lecture/Tutorial

Prerequisites (or special instructions):
Math 232, and STAT 270 (or MATH 272). Students with credit for MATH 372 may not take STAT 330 for further credit.

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 372-3.

2. Scheduling

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. Objectives of the Course

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. Approval

Date: OCT 06 [illegible]

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

STATISTICS 330

FOR INFORMATION

034

Linear Models in Applied Statistics

1. Scientific method and its implications for statistical method.

2. Methods for comparing two treatment means with emphasis on the reference distributions appropriate in various situations. Independence and serial correlation.

3. Randomization and blocking: two treatment examples. Methods of analysis and interpretation of results. Implications for experimental design.

4. Significance tests and confidence intervals for means variances, proportions, and frequencies. Introduction to likelihood ratio tests and maximum likelihood estimation.

5. Analysis of variance. Comparison of several treatment means. Model diagnostics.

6. Elementary design of experiments. Randomized blocks and two-way factorial designs.

7. Regression Analysis. Multiple regression. Use of regression for analysis of variance. Analysis of covariance. Model diagnostics.

8. Use of statistical computer packages for regression and analysis of variance models. Monte Carlo demonstrations in the linear models context.

Textbook: Statistics for Experimenters
Box, Hunter and Hunter
Wiley, 1978.

The material in this course is primarily contained in chapters 1 through 7, and chapter 14 of the text.

Prerequisites: Math 232, and STAT 270 (or MATH 272).

** CHANGE OF LABEL AND PREREQUISITE ONLY **

Appendix B3

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

FOR INFORMATION

COURSE PROPOSAL FORM

035

1. Calendar Information

Department: Mathematics and Statistics

Abbreviation Code: STAT Course Number: 380 Credit Hours: 3 Vector: 3-1-0

Title of Course: Introduction to Stochastic Processes

Calendar Description of Course:

Nature of Course

Prerequisites (or special instructions):
STAT 280. Students with credit for MATH 387 may not take STAT 380 for further credit.

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 387.

2. Scheduling

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. Objectives of the Course

The change is part of a major relabelling of probability and statistics courses.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. Approval

OCT 06 1987

Date: _____ _____ _____

_____ _____ _____

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

FOR INFORMATION

1. Calendar Information

Department: Mathematics and Statistics

Abbreviation Code: STAT Course Number: 410 Credit Hours: 3 Vector: 3-1-0

Title of Course: Statistical Analysis and Sample Surveys

Calendar Description of Course:
An introduction to the major sample survey designs and their mathematical justification. Associated statistical analyses.

Nature of Course Lecture/Tutorial

Prerequisites (or special instructions):
From: One course in statistics or probability
To: STAT 330 (or MATH 372) or permission of the instructor.
Students with credit for MATH 304 may not take STAT 410 for further credit.

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 304.

2. Scheduling

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible: Drs. Eaves, Lockhart, Routledge, Stephens, Swartz, and Weldon.

3. Objectives of the Course

To provide training to advanced undergraduates in the design and analysis of complex sample surveys. Training in this field is a major advantage to graduates seeking employment with survey agencies such as Statistics Canada.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty
Staff
Library
Audio Visual
Space
Equipment

Because this course would be offered less frequently than the course to be deleted, MATH 304, adoption of this proposal would result in a net saving to the university.

5. Approval

Date: OCT 06 1987

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

STATISTICS 410-3

Statistical Analysis of Sample Surveys

This course develops the statistical theory required for constructing and analyzing complex sample surveys. Applications to be discussed may include e.g., the Gallup Poll, market surveys, the Canadian Labour Force Survey, and forest surveys.

Detailed Description

1. The Role of Randomization in Sample Surveys: Bias, standard error, and root mean squared error, survey terminology.

2. Simple Random Sampling: Using random number generators and tables to take a simple random sample, the sampling frame, estimating means, totals, and proportions, the finite population correction factor, confidence limits, problems with the use of the normal approximation, choosing the sample size.

3. Stratified Random Sampling: Advantages of stratification, estimating gains in precision, confidence limits, optimal sample sizes, effects of errors in calculated stratum sizes and in optimal allocation, stratification after selection.

4. Ratio and Regression Estimates: Purpose and examples, bias, standard error, confidence limits, optimal conditions, optimal allocation, weak dependence on usual regression assumptions.

5. Systematic Sampling: A brief survey of the models required to estimate the variance, and of potential advantages and disadvantages.

6. Cluster and Multi-Stage Sampling: Purpose and examples, comparison estimators, equal- vs. unequal-probability sampling, optimal choice of sampling fractions and probabilities.

7. Double Sampling: An overview of the role of double sampling in constructing stratified, ratio, and regression estimates; sampling on two or more occasions.

Text: Sampling Techniques, 3rd ed., by W.G. Cochran

** CHANGE OF LABEL ONLY **

Appendix B3

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

FOR INFORMATION

038

1. Calendar Information

Department: Mathematics and Statistics

Abbreviation Code: STAT Course Number: 420 Credit Hours: 3 Vector: 3-1-0

Title of Course: Non-Parametric Statistics

Calendar Description of Course:

Nature of Course Lecture/Tutorial

Prerequisites (or special instructions):
Change to read, "STAT 330 (or MATH 372) or permission of the department. Students with credit for MATH 473 may not take STAT 420 for further credit."

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 473.

2. Scheduling

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. Objectives of the Course

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. Approval

Date: OCT 26 1987

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

** MODIFICATION OF EXISTING COURSE **

Appendix B_3

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM **FOR INFORMATION**

039

1. **Calendar Information**

Department: Mathematics & Statistics

Abbreviation Code: STAT Course Number: 430 Credit Hours: _____ Vector: _____

Title of Course: Statistical Design and Analysis of Experiments

Calendar Description of Course:

An extension of the designs discussed in STAT 330 to include more than one blocking variable, incomplete block designs, fractional factorial designs, and response surface methods.

Nature of Course

Prerequisites (or special instructions): From: MATH 302 or 372 or permission.
To: STAT 330 (or MATH 372).

Students with credit for MATH 404 may not take STAT 430 for further credit.

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 404.

2. **Scheduling**

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. **Objectives of the Course**

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. **Approval**

Date: OCT 06 [illegible]

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

FOR INFORMATION

040

STATISTICS 430-3

Statistical Design and Analysis of Experiments

1. Review of blocking and factorial designs. Two-way blocking and Latin Squares. Fractional factorials. Sequential use of these designs in practical settings.

2. More elaborate designs based on Latin squares and incomplete blocks.

3. Response surface methods. Optimization under uncertainty. Parametrization of complex phenomena.

4. Model building: Mechanistic and Empirical models. Introduction to nonlinear normal error distributions, heterocedastic data, transformations, and weighted least squares. Use of standard statistical computer packages for non-standard analyses.

5. Industrial Process control. Study of variation.

6. Modelling dependence in time series.

Textbook: STATISTICS FOR EXPERIMENTERS
by Box, Hunter and Hunter
PUB: John Wiley and Sons

** MODIFICATION OF EXISTING COURSE **

Appendix B3

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

FOR INFORMATION

041

1. Calendar Information

Department: Mathematics and Statistics

Abbreviation Code: STAT Course Number: 450 Credit Hours: 3 Vector: 3-1-0

Title of Course: Statistical Theory

Calendar Description of Course:
Methods for constructing tests and estimators, weighted least squares, nonlinear regression and the generalized linear model.

Nature of Course

Prerequisites (or special instructions):
From: MATH 232 and 372 (or 371).
To: MATH 232, and STAT 330 (or MATH 372).
Students with credit for MATH 472 may not take STAT 450 for further credit.

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 472.

2. Scheduling

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. Objectives of the Course

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. Approval

Date: OCT 06 1987

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

STATISTICS 450-3

FOR INFORMATION

Statistical Theory

042

Methods for constructing tests and estimators, weighted least squares, nonlinear regression, and the generalized linear model.

Detailed Description

This course explores strategies for constructing new estimation and hypothesis testing procedures. Emphasis will be placed on using the likelihood function, and on related least-squares theory for normally distributed errors. These strategies will be used to derive methods for extending regression techniques to models involving unequal variances, nonlinearity, and non-normal error distributions.

1. Distribution Theory
   Joint, marginal, and conditional densities. Multivariate changes of variables.

2. Maximum Likelihood Estimation.
   Motivation, alternatives, properties, computations.

3. Likelihood Ratio Tests.
   Neyman-Pearson theory and applications to simple hypotheses, extensions and large-sample approximations, relation between hypothesis tests and confidence intervals.

4. The Geometry of Ordinary Least Squares.
   Least squares and orthogonal projections; the multivariate normal density and its relationship to t- F- and chi-squared-distributions; applications to analysis-of-variance.

5. Unequal Variances.
   Weighted least squares and the Gauss-Markov theorem, relation to maximum likelihood estimates, iterative schemes.

6. Nonlinear Regression.
   Mechanistic model building, transformations, nonlinear least squares, computations, hypothesis tests and confidence intervals.

7. Generalized Linear Models for Frequency Data.
   Models involving Poisson and related error distributions, likelihood ratio tests for frequency data, log-linear models, introduction to GLIM.

** CHANGE OF LABEL ONLY **

Appendix B_3

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

FOR INFORMATION

043

1. **Calendar Information**

Department: Mathematics & Statistics

Abbreviation Code: STAT Course Number: 460 Credit Hours: 3 Vector: 3-1-0

Title of Course: Decision Analysis and Bayesian Inference

Calendar Description of Course:

Nature of Course

Prerequisites (or special instructions):
Add the statement, "Students with credit for MATH 475 may not take STAT 460 for further credit."

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 475.

2. **Scheduling**

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. **Objectives of the Course**

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. **Approval**

OCT 06 1987

Date: _____

Department Chairman | Dean | Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

** Change of Label and Title Only **

Appendix B3

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

FOR INFORMATION

044

1. **Calendar Information**

Department: Mathematics and Statistics

Abbreviation Code: STAT Course Number: 480 Credit Hours: 3 Vector: 3-0-0

Title of Course: Probability Theory

Calendar Description of Course:

Nature of Course

Prerequisites (or special instructions): STAT 380 (or MATH 387).
Students with credit for MATH 487 may not take STAT 480 for further credit.

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 487

2. **Scheduling**

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. **Objectives of the Course**

The change is part of a major relabelling of probability and statistics courses.

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. **Approval**

Date: OCT 06 1987

Department Chairman Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

FOR INFORMATION

045

1. **Calendar Information**

Department: Mathematics & Statistics

Abbreviation Code: STAT **Course Number:** 490 **Credit Hours:** 3 **Vector:** 3-1-0

Title of Course: Selected Topics in Probability and Statistics

Calendar Description of Course:

Topics in areas of probability and statistics not covered in the regular undergraduate curriculum of the department.

Nature of Course Lecture/Tutorial

Prerequisites (or special instructions):

Dependent on the topic covered.

What course (courses), if any, is being dropped from the calendar if this course is approved: MATH 479-3.

2. **Scheduling**

How frequently will the course be offered?

Semester in which the course will first be offered?

Which of your present faculty would be available to make the proposed offering possible:

3. **Objectives of the Course**

The proposed relabelling of courses in probability and statistics with the code, 'STAT', would otherwise leave the department with no means of offering a selected topics course in this field.

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library

Audio Visual

Space

Equipment

5. **Approval**

Date: OCT 06 1987

Department Chairman	Dean	Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).