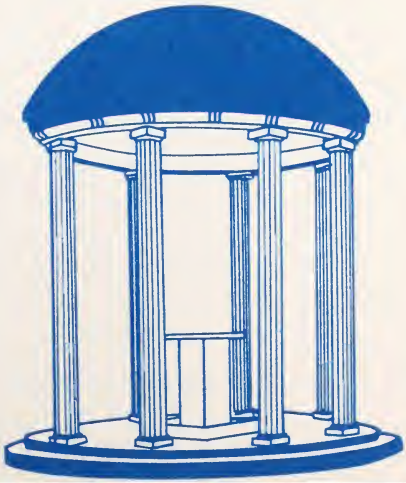
RECORD OF THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

August 1980 *1980-1982 Issue*

Department of Statistics



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RECORD OF
THE UNIVERSITY OF NORTH CAROLINA
AT CHAPEL HILL

August 1980 Number 903

DEPARTMENT OF
STATISTICS

(USPS 651-960)

The University of North Carolina
at Chapel Hill

Announcements for 1980-1981 and 1981-1982

THE UNIVERSITY OF NORTH CAROLINA

Sixteen Constituent Institutions

William Clyde Friday, B.S., LL.B., LL.D., D.C.L., *President*
Roy Carroll, B.A., M.A., Ph.D., *Vice President — Planning*
Raymond Howard Dawson, B.A., M.A., Ph.D., *Vice President — Academic Affairs*
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James L. Jenkins, Jr., A.B., *Assistant to the President*
John P. Kennedy, Jr., S.B., B.A., M.A., J.D., *Secretary of the University*
Arnold Kimsey King, A.B., A.M., Ph.D., *Assistant to the President*
Roscoe D. McMillan, Jr., B.S., *Assistant to the President for Governmental Affairs*
Jeanne Margaret McNally, B.S.N., M.A., Ph.D., *Associate Vice President — Academic Affairs*
Richard H. Robinson, Jr., A.B., LL.B., *Assistant to the President*
Robert W. Williams, A.B., M.A., Ph.D., *Associate Vice President — Academic Affairs*

The University of North Carolina was chartered in 1789 and opened its doors to students at its Chapel Hill campus in 1795. Throughout most of its history, it has been governed by a Board of Trustees chosen by the Legislature and presided over by the Governor. During the period 1917-1972, the board consisted of one hundred elected members and a varying number of *ex-officio* members.

By the act of the General Assembly of 1931, without change of name, the University was merged with The North Carolina College for Women at Greensboro and The North Carolina State College of Agriculture and Engineering at Raleigh to form a multicampus institution designated The University of North Carolina.

In 1963 the General Assembly changed the name of the campus at Chapel Hill to The University of North Carolina at Chapel Hill and that at Greensboro to The University of North Carolina at Greensboro and, in 1965, the name of the campus at Raleigh was changed to North Carolina State University at Raleigh.

Charlotte College was added as The University of North Carolina at Charlotte in 1965, and, in 1969, Asheville-Biltmore College and Wil-

mington College became The University of North Carolina at Asheville and The University of North Carolina at Wilmington respectively.

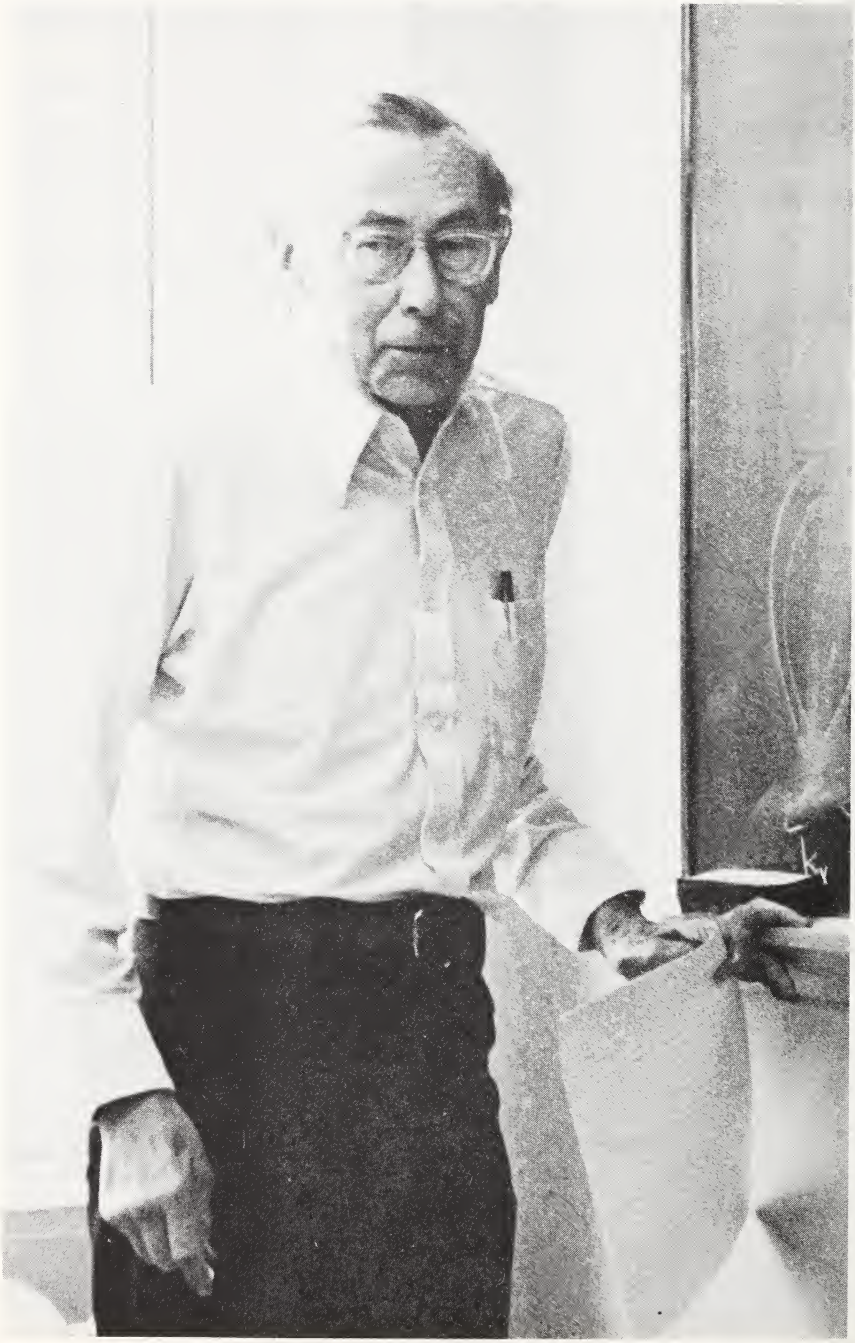
A revision of the North Carolina State Constitution adopted in November 1970 included the following: "The General Assembly shall maintain a public system of higher education, comprising The University of North Carolina and such other institutions of higher education as the General Assembly may deem wise. The General Assembly shall provide for the selection of trustees of The University of North Carolina. . . ." In slightly different language, this provision had been in the Constitution since 1868.

On October 30, 1971, the General Assembly in special session merged, without changing their names, the remaining ten state-supported senior institutions into the University as follows: Appalachian State University, East Carolina University, Elizabeth City State University, Fayetteville State University, North Carolina Agricultural and Technical State University, North Carolina Central University, North Carolina School of the Arts, Pembroke State University, Western Carolina University, and Winston-Salem State University. This merger, which resulted in a statewide multicampus university of sixteen constituent institutions, became effective on July 1, 1972.

The constitutionally authorized Board of Trustees was designated the Board of Governors, and the number was reduced to thirty-two members elected by the General Assembly, with authority to choose their own chairman and other officers. The Board is "responsible for the general determination, control, supervision, management, and governance of all affairs of the constituent institutions." Each constituent institution, however, has its own board of trustees of thirteen members, eight of whom are appointed by the Board of Governors, four by the Governor, and one of whom, the elected president of the student body, serves *ex officio.* The principal powers of each institutional board are exercised under a delegation from the Board of Governors.

Each institution has its own faculty and student body, and each is headed by a chancellor as its chief administrative officer. Unified general policy and appropriate allocation of function are effected by the Board of Governors and by the President with the assistance of other administrative officers of the University. The General Administration office is located in Chapel Hill.

The chancellors of the constituent institutions are responsible to the President as the chief administrative and executive officer of The University of North Carolina.



Kenan Professor Emeritus
Wassily Hoeffding

OFFICERS OF ADMINISTRATION

THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

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[2]Nelson Ferebee Taylor, LL.B., *Chancellor*
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Susan H. Ehringhaus, J.D., *Assistant to the Chancellor*
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Douglass Hunt, LL.B., *Vice Chancellor, Administration*
George Philip Manire, Ph.D., *Dean of the Graduate School and Vice Chancellor*
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Rollie Tillman, Jr., D.B.A., *Vice Chancellor, Development and Public Service*
———, *Vice Chancellor, Health Affairs*

INTRODUCTION

This brochure briefly describes the graduate programs offered by the Department of Statistics of The University of North Carolina at Chapel Hill.

The material in this brochure is a supplement to that found in the Graduate School Catalog of the University; some of the regulations of the Graduate School have been omitted here. Requests for a Graduate School Catalog should be sent to the Graduate School, The University of North Carolina at Chapel Hill, Chapel Hill, North Carolina 27514.

THE DEPARTMENT OF STATISTICS

The Department of Statistics was organized in 1946, at the instigation of Gertrude M. Cox, with Harold Hotelling as its first chairman. Through its emphasis on graduate training and research in the mathe-

1. Chancellor effective March 1, 1980. Vice Chancellor, Health Affairs, through February 29, 1980.
2. Resigned January 31, 1980.
3. Resigned April 30, 1980.
4. Effective May 1, 1980.

matical theory of statistics, the department has attained the stature of being one of the world's foremost centers of statistical research. Since 1948, over 100 Ph.D. degrees in Statistics have been awarded. Holders of these degrees have assumed positions of responsibility in many important statistical organizations, including the Executive Secretary and Program Secretary of the Institute of Mathematical Statistics, the Editor of the Annals of Mathematical Statistics, and the chairmen of the Departments of Statistics at several American universities. In addition, many professors at leading universities in the United States and abroad and senior statisticians in government and industry received their doctoral training in the Department of Statistics at The University of North Carolina at Chapel Hill.

Much fundamental work in experimental design, nonparametric inference, sequential analysis, renewal theory, coding theory, estimation, and hypothesis testing has originated here. The Institute of Statistics Mimeograph Series, which now includes over 1200 titles, contains the first results of many of the fundamental lines of research in the subject of mathematical statistics as it exists today.

An attractive feature of the department is its close connection with various other centers of statistical activity within the University. The Department of Statistics on the Raleigh campus, and the Department of Biostatistics at Chapel Hill, both offer a wide range of courses in applied statistics which may be combined with the more theoretically oriented courses in the Department of Statistics to suit individual needs and interests. The Departments of Mathematics, Computer Science, City and Regional Planning, Economics, and the Psychometric Laboratory, among others, provide opportunities for further training in areas related to statistics.

The department is located in two nearby air-conditioned buildings. Most of the faculty and secretarial offices are in Phillips Hall, with research faculty and graduate assistant offices in Smith Building.

The Brauer Library in Phillips Hall maintains an extensive collection of books and journals pertaining to statistics, mathematics, physics, and computer science. Additional materials in the main University Library are also available.

The University Computation Center is located in the basement of Phillips Hall. Batch process programs may be submitted there to be run on an IBM 360 Model 75, or an IBM 370 Model 155 II, which are located at the Computation Center, or an IBM 370 Model 165, which is located in the nearby Research Triangle Park. In addition the Department of Statistics has two terminals where faculty and students may program in conversation mode using APL 370, or a number of other programming languages.

Colloquia for presentation of research in both mathematical and applied statistics are held by the Departments of Statistics and Biostatistics. The Statistics Colloquium, which usually meets on alternate Monday afternoons throughout the academic year, is a forum for the presentation and discussion of recent developments and new ideas by visiting scholars and statistics faculty. All students are expected to attend the colloquia.

PH.D. PROGRAM

The statistics faculty offers a Ph.D. program for men and women who plan careers in university teaching and research, or in research with private or governmental organizations. The doctoral program is intended for individuals who have both the intellectual capacity and inclination for independent research and analytical thinking and who show promise of contributing to the further development of statistics and probability.

The philosophy of the department is that its Ph.D. graduates should be "broadly based" in statistical theory and practice, and at the same time be able to conduct basic research in some special area. In order to achieve this, course work consisting of a total of approximately 54 semester hours is normally required of students entering with a B.S. or equivalent degree. This will typically be reduced for students with prior graduate study in statistics or in a supporting area.

In the first year a student is normally expected to take a standard program of course work involving the mathematical methods of statistics, probability, statistical theory and practice (see below). This year of course work provides a broad base of coverage in probability and statistical areas. Courses in this series are normally omitted only on the grounds of prior knowledge and demonstrated competence in the subject material.

1. First year (all students)
   Fall 102, 112, 129, 134 Spring 111, 132, 135, 150
2. Advanced and specialized courses (by area)
   A. Inference 220, 221, 222, 231, 232
   B. Design 210, 251, 254, 255
   C. Multivariate Anaylsis 200, 260, 261, 262
   D. Probability 231, 235, 237, 331
   E. Communication Theory 140, 142, 242, 245
   F. Operations Research 180, 181, 232, 280

In the second year a student takes advanced courses of a more specialized nature. Six main areas of specialization are currently recognized: Inference, Probability, Design of Experiments, Multivariate Analysis, Communication Theory, Operations Research. A student wishing to specialize in a given area should take advanced courses in that area during the second and third years, prior to and during the research for the dissertation. Every student is required to take at least 21 semester hours

of advanced course work within the Department of Statistics. A detailed listing of the first-year program and typical advanced courses in each area are given on page 7.

All Ph.D. students are required to register for at least three semester hours of dissertation registration 394.

Nine hours of course work, at least six of which must be taken from courses in other departments, are required for all students as a "supporting program." Courses in statistics from outside departments will generally not fulfill this requirement unless such courses focus primarily on subject matter not available in our department. All courses must be approved by the curriculum committee. The supporting program may be regarded as a "formal minor" on approval of the minor department (or departments). Some of this work may be transferred from graduate work at another institution. In addition, three hours of credit may be applied to the supporting program if the student participates in an approved consulting project and writes a report to the curriculum committee summarizing his or her experience and the statistical lessons learned. The consulting project should ordinarily last a substantial period of time (e.g., summer employment), although each situation will be considered individually.

All graduate students in the Department of Statistics are required to perform some duties related to their academic program, such as grading, teaching, or consulting as part of their graduate education. Assignments are carefully controlled to avoid delaying academic progress.

Written Examinations

Doctoral students must pass the basic written examinations, consisting of three parts, each four hours in length, covering the material in the first-year courses. These are normally taken early in the fall semester of the second year. Parts I and II test a student's knowledge of theory and ability to solve mathematically formulated problems. Part III tests a student's ability to perform statistical calculations with data, and to work with practical problems which are not mathematically formulated. (Students with an undergraduate major in engineering, and with a sufficient background in complex variables and Fourier theory, may choose to be tested on Statistics 140, 142, and 252 instead of the first-year courses 111, 102, and 150.)

Oral Examinations

A doctoral candidate during the early stages of the research program must prepare an essay which shall include a description of the proposed dissertation topic, a review of the literature, and a bibliography connected with the proposed research and submit it to the doctoral examina-

tion committee for approval. Upon approval of the essay a preliminary oral examination (second doctoral examination) is arranged for the candidate. At this examination, the student may be questioned orally on his or her course work and particularly on any deficiencies disclosed by the written examinations. The student will then describe the thesis proposal and answer questions on it. A Ph.D. student who has passed this oral examination and who wishes to obtain an M.S. degree may do so without having to take the final oral examination normally required for the M.S. degree.

Students are expected to complete the preliminary oral examination no later than the end of the sixth semester. Exceptions to this timing rule may occur with permission of the curriculum committee, but in ordinary circumstances failure to complete this requirement will be taken as a lack of normal progress on the student's part.

The candidate will submit the disseration, when ready, to the members of the examination committee. At the final oral examination, the candidate will present research results and conclusions and will answer questions on these.

Language Requirements

Students may satisfy the foreign language requirements in one of the four following ways: Pass 102X in French, German, or Russian, and then pass a departmental examination designed to test ability to translate technical articles with the aid of dictionaries; or achieve the 60th percentile in the Graduate School Foreign Language Test and then pass a departmental translation test as described above; or achieve the 75th percentile in the Graduate School Foreign Language Test; or take course work in the Department of Computer Science as follows: two of COMP 113X, 114X, 116X, 118X, 120, 121, 130, 135, 140, 151, or others approved by the curriculum committee (these two courses may not be used as part of the student's other course work).

Time Required

The time required to complete the Ph.D., of course, varies depending on qualifications and initiative. Normally, 4 years are required (although one student has finished within 27 months).

M.S. PROGRAM

The department provides a wide variety of course sequences leading to the Master's (M.S.) degree. The basic philosophy is that this program should provide a broad training in statistical theory and practice, with the student being able to choose specialization in either applied work or

theory. Three semesters are regarded as normal time for the completion of all requirements for a degree.

Course Work for the M.S. Degree

The M.S. degree in statistics requires the satisfactory completion of 30 semester hours of course work. Each option in the M.S. program consists of a core of required courses, broadening courses in statistics, and two courses to be taken outside the Department of Statistics (these latter two must be approved by the Curriculum Committee).

I. *Applied Statistics option.*
The required courses are:
Track # 1 (STAT 126 is a prerequisite) 102, 104 (BIOS 164), 127, 129, 133, and one of 160, BIOS 166, PSYCH 139, or
Track # 2 102, 104 (BIOS 164), 133, 134, 135, and one of 160, BIOS 166, PSYCH 139.

The student will also be required to take two broadening courses in statistics which may be selected from 107, 129 (Track # 2), 150, 170, 180, 210, 260, or BIOS 171. Other courses may be substituted with permission of the Curriculum Committee.

Finally, students in the Applied Statistics option are expected to be familiar with a formal programming language (e.g., FORTRAN) as demonstrated by completion of approved graduate or undergraduate course work.

II. *Mathematical Statistics option.*
The required core courses are:
102, 129, 134, 135, and 150. The broadening course work consists of three additional courses in statistics chosen from either the list of broadening courses in the Applied Statistics option or:
112, 132 only as a sequence
140, 142 only as a sequence
Any 200-level statistics course
Other courses approved by the Curriculum Committee.

Examinations for the M.S. Degree

M.S. students in the Applied Statistics option must either pass (at the Master's level) Part III of doctoral written examinations or an examination covering courses 102, 127 (theory and practice), and one of 133 or 150. Students in the Mathematical Statistics option must pass an examination covering 129, 134, 135, and 150.

A "final oral" examination is given when a student's course work and thesis or essay are complete. This may involve questions on the student's course work or on the contents of the thesis or essay. The final oral ex-

amination is waived for a student who has passed a Ph.D. preliminary oral examination in statistics.

Thesis or Essay Requirement

All M.S. students in the Mathematical Statistics option are expected to write either a (short) thesis or an essay to demonstrate their capability for research, or their understanding of recent research papers in some area. This is normally done during the student's third semester, the topic and scope of the work being decided in consultation with the adviser. M.S. students in the Applied Statistics option are encouraged to write an essay or thesis which involves the analysis of a set of data.

ADMISSION, FINANCES, AND FINANCIAL AID

Prerequisites

Admission to the Graduate School is necessarily a selective process. Only applicants with academic records of high quality should seek admission. The minimal requirement is a Bachelor of Arts or Bachelor of Science degree from an accredited college or university in this country with an average grade of B or better, or its equivalent—based on a four-year curriculum—in a foreign institution.

The graduate curriculum in the Department of Statistics places strong emphasis on the mathematical theory of probability and statistics. A sound mathematical preparation is thus an essential prerequisite for admission. An applicant's mathematical background should include a one-year course in advanced (multivariable) calculus or real analysis, and at least a one-semester course in matrix algebra. Introductory courses in probability and statistics are desirable but not required.

Procedures

Application forms for admission and/or financial aid may be obtained by writing either to the Department of Statistics or to the Graduate School. A complete application must include at least the following:

1. The completed application forms in duplicate.
2. Two official transcripts of all previous undergraduate and graduate work.
3. Three references in duplicate (forms provided) from people familiar with the applicant's academic achievement and potential.
4. A nonrefundable application fee of $10.00. An applicant who has been offered admission reserves his place by the payment of a $25.00 nonrefundable deposit which is credited toward the first semester's tuition.

In addition to the above, the Department of Statistics strongly recommends that applicants submit the following material:

5. Test scores for both the Aptitude and Advanced Mathematics Graduate Record Examination.
6. A supplementary sheet providing brief course descriptions, including text titles where applicable, of all previous undergraduate and graduate courses in (a) probability and statistics, (b) mathematics above the level of elementary calculus, and (c) other courses of a mathematical nature, such as computer science, mathematical physics, etc.

7. A statement of areas of interest in probability and statistics, and of career goals.

The Graduate Record Examination is given at regular intervals throughout the academic year at most universities in this country and in many countries abroad. Information about this examination can usually be obtained from the dean's office of colleges or universities in this country, or by writing to Educational Testing Service, Princeton, New Jersey. Applicants for financial aid should take the examination no later than December for admission in the succeeding fall semester.

Students whose native language is not English are required to take the Test of English as a Foreign Language examination (TOEFL) administered by the Educational Testing Service.

Financial Assistance

The Department of Statistics offers a number of four-year graduate assistantships to graduate students each year. According to University practice, these awards carry eligibility for in-state tuition status. Assistantships are renewable each academic year, contingent on satisfactory progress toward a degree and availability of funds. Normally assistantships are not awarded to a student beyond the fourth academic year and are offered only to advanced students during the summer.

Applicants for financial aid are considered also for various fellowships and limited service awards for which recipients are selected on a competitive university-wide basis by the Graduate School. These awards include University Graduate Fellowships, National Science Foundation Fellowships, George E. Nicholson, Jr. Fellowships, Pogue Fellowships, and Morehead Fellowships. Stipends range from $4,300 to $5,000 for the academic year with tuition included in most cases.

Application for admission and financial aid may be made simultaneously simply by indicating on the admission application form a desire to be considered for financial aid.

Tuition and Fees

For full-time graduate students the current in-state rate for tuition and fees is $572.00 for the academic year. Recipients of certain appointments may be entitled to pay tuition at a lower rate at the discretion of the Board of Trustees. Tuition and fees for out-of-state students are presently $2,282.00 per year. Tuition and fees are due at registration. Accounts not paid in full by the last day of registration are subject to a late payment fee and the student's possible disenrollment.

Notice is given that upon proper authorization tuition and fees may be changed at any time.

Deadlines

The Department of Statistics does not admit students in the summer sessions and rarely admits students in the spring semester. The deadlines for application for admission in the fall semester are:

(a) February 1 for admission and financial aid.
(b) July 1 for admission only.

Further Information

For further information about graduate programs, admission procedures, and financial aid, address inquiries to:

Director of Graduate Admissions
Department of Statistics
The University of North Carolina at Chapel Hill
Chapel Hill, North Carolina 27514

The Department of Statistics welcomes applications for admission and aid from members of minorities. Admission and aid are awarded without consideration of race, sex, or creed.

Placement

Students in both the Ph.D. and M.S. programs will receive assistance with placement. The faculty, through their many professional contacts, are able to help students identify appropriate positions. The Chairman is often contacted by various academic, industrial and government organizations with job opportunities. These job opportunities are made available to all prospective graduates. Also, the university maintains an Office of Career Planning and Placement which is available to all prospective graduates.

DEGREES AWARDED

	M.S.	Ph.D.		M.S.	Ph.D.
1948-68	24	90	1974-75	5	2
1968-69	5	8	1975-76	4	6
1969-70	2	4	1976-77	5	7
1970-71	3	5	1977-78	7	1
1971-72	4	5	1978-79	5	8
1972-73	2	3	1979-80	6	2
1973-74	4	6			

RECENT DISSERTATIONS

Weak Convergence of Progressively Censored Likelihood Ratio Processes

Random Designs for Estimating Integrals of Stochastic Processes

Limiting Behavior of Certain Continuous Time-Parameter Stochastic Processes and Their Applications

On Queues and Stores with Nonhomogeneous Inputs

Rank Tests for Restricted Alternatives Problems in Multivariate Analysis

Smooth Nonparametric Regression Analysis

Towards Reconstruction of an Unpaired Random Sample

Statistical Analysis of Changes in Mortality Patterns with Reference to Actuarial Functions

Sampling Representation and Approximations for Certain Functions and Stochastic Processes

Quantile Estimation in Regenerative Processes

OPERATIONS RESEARCH AND SYSTEMS ANALYSIS CURRICULUM

The Department of Statistics is one of the core departments supporting the Operations Research and Systems Analysis (O.R.S.A.) Curriculum at the University. This Curriculum is a separate program offering the M.S. and Ph.D. degrees. In addition, degree candidates in statistics may elect a minor or supporting program in O.R.S.A.

The study of O.R.S.A. involves the application of diverse topics in mathematics and statistics to problems of resource allocation. At Chapel Hill, specialization is possible in theoretic areas (for example, Mathematical Programming, Stochastic Processes) or through specific applications (such as Urban and Environmental Systems, Population Studies, Biological Sciences).

For further information and/or applications for admission and financial aid, please write to:

Chairman
Operations Research and Systems Analysis Curriculum
Smith Building
The University of North Carolina at Chapel Hill
Chapel Hill, North Carolina 27514

COURSES[1,2]

Courses for Undergraduates

*11 BASIC CONCEPTS OF STATISTICS AND DATA ANALYSIS (3). No prerequisite. Basic concepts and techniques of data analysis emphasizing the role of statistics in making inferences, predictions, and decisions from data. *Fall and spring.* Staff.

*11C BASIC CONCEPTS OF STATISTICS AND DATA ANALYSIS (3). Prerequisite, Math 22 or 31. Basic concepts and techniques of data analysis emphasizing the role of statistics in making inferences, predictions, and decisions from data. *Fall and spring.* Staff.

*12 BASIC CONCEPTS OF STATISTICS AND PROBABILITY (3). No prerequisite. An elementary introduction to probability and statistical inference. *Fall and spring.* Staff.

*Courses 11, 11C, and 12 may not be taken for credit if credit has been obtained for Economics 70, Psychology 30, or Statistics 23. Credit may be given for only one of courses 11, 11C, 12. Students with credit in Math 22, 31, or equivalents may not take course 11, but may take 11C.

23 ELEMENTARY PROBABILITY AND STATISTICS FOR BUSINESS (3). Prerequisite, Math 22 or 31. An introduction to probability and statistics with a special emphasis on applications in business. Handling of data, probability distributions, sampling, estimation, hypothesis testing. *Fall and spring.* Staff.

26 INTRODUCTION TO PROBABILITY FOR STATISTICS (3). An introduction to the theory and applications of probability. Topics covered include probability models, sample spaces, laws of probability, discrete and continuous random variables, probability distributions, expectation and variance, binomial and normal distributions, joint distributions, central limit theorem. *Fall and spring.* Staff.

27 INTRODUCTION TO STATISTICAL INFERENCE (3). Prerequisite, Statistics 26. An introduction to the theory and applications of statistical inference. Topics covered include sampling distributions, estimation, hypothesis testing, regression, correlation, nonparametric statistics, contingency tables. *Fall and spring.* Staff.

Courses for Graduates and Advanced Undergraduates

101 101X ELEMENTS OF PROBABILITY AND STATISTICAL INFERENCE (Biostatistics 150) (3). Prerequisite, integral calculus. Fundamentals of probability theory; descriptive statistics; fundamentals of statistical inference, including estimation and hypothesis testing. *Fall and spring.* Carroll, Ruppert, Chakravarti.

1. Names represent recent and anticipated instructors of these courses.
2. Years in which certain advanced courses are taught may differ from what appears on this list, depending on demand.

102 ELEMENTS OF STATISTICAL ANALYSIS (Biostatistics 151)
102X (3). Prerequisites for nonstatistics majors, Statistics 101, and, in fall, permission of instructor. Various topics in statistical methods, including applied regression analysis, analysis of simple experimental designs, data analysis, discrete multivariate data. *Fall and spring.* Carroll, Johnson, Ruppert.

104 SAMPLE SURVEY METHODOLOGY (Biostatistics 164) (3). Prerequisite, Statistics 101 or equivalent. *Spring.* Gillings.

107 LIFE CONTINGENCIES (Mathematics 167) (3). Prerequisite, Mathematics 32 or permission of instructor. Values of and premiums for annuities and assurances on one or more lives. Multiple decrement functions and their applications to pension funds and disability and accidental death benefits. *Spring.* Johnson.

111 METHODS OF MATHEMATICAL STATISTICS (3). Prerequisite, advanced calculus. Introductory treatment of special mathematical techniques of particular importance in probability and statistics, including complex variables, Fourier and Laplace transforms, elements of finite difference equations. *Spring.* Simons, Smith.

112 MEASURE AND INTEGRATION (3). Prerequisite, advanced calculus. Lebesgue and abstract measure and integration, convergence theorems, differentiation. Radon-Nikodym theorem, product measures. Fubini theorems. L^c spaces. *Fall.* Baker, Cambanis, Kallianpur, Leadbetter.

126 INTRODUCTION TO PROBABILITY (Mathematics 146) (3). Prerequisite, Mathematics 34. Introduction to mathematical theory of probability covering random variables, moments, binomial, Poisson, normal and related distributions, generating functions, sums and sequences of random variables, and statistical applications. *Fall and spring.* Baker, Cambanis, Kelly.

127 MATHEMATICAL STATISTICS (3). Prerequisite, Statistics 126 or equivalent. Functions of random samples and their probability distributions; introductory theory of point and interval estimation, and of hypothesis testing; elementary decision theory. *Fall and spring.*Carroll, Kelly, Johnson, Simons.

129 INTRODUCTION TO STOCHASTIC PROCESSES (3). Prerequisite for nonstatistics majors, Statistics 126, and, in fall, permission of instructor. Elementary theory and application of random process models; recurrent events, random walk. Markov chains. Poisson processes, birth-and-death processes, queueing processes, branching processes, Brownian motion, stationary processes. *Fall.* Begun, Kelly, Leadbetter.

132 INTERMEDIATE PROBABILITY (Mathematics 195) (3). Prerequisite, Statistics 112 or permission of instructor. Foundations of probability. Basic classical theorems. Modes of probabilistic convergence. Central limit problem. Generating functions, characteristic functions. Conditional probability and expectation. *Spring*. Leadbetter, Cambanis.

133 INTRODUCTION TO TIME SERIES ANALYSIS (3). Prerequisite, Statistics 126. Topics chosen from: Time series data analysis. Fitting parametric models, such as autoregressive models to time series. Spectral analysis. Filtering. *Spring*. Leadbetter.

134 INTERMEDIATE STATISTICAL THEORY I (3). Prerequisite, two semesters of advanced calculus. Fundamentals of probability and distribution theory including: axiomatic treatment of probability, independence, random variables, characteristic functions, convergence and approximation, common distributions. *Fall*. Kelly, Simons.

135 INTERMEDIATE STATISTICAL THEORY II (3). Prerequisite, Statistics 134 or equivalent. Fundamentals of statistical inference including: sufficient statistics, estimation, hypothesis testing, decision theory, various classical tests. Linear estimation, analysis of variance and regression are largely excluded (see Statistics 150). *Spring*. Simons, Chakravarti.

140 LINEAR SYSTEMS (3). Prerequisites, advanced calculus, elements of Fourier transforms theory; linear algebra and Lebesgue integration helpful. Introduction to linear spaces, including basic results on normed linear spaces, Hilbert space geometry, bounded linear operators. Linear system theory, including signal representations, impulse response, transfer functions, dynamical systems, state variable methods, elementary modern control theory. *Fall*. Cambanis, Leadbetter.

141 LINEAR OPERATORS AND OPTIMIZATION (3). Prerequisite, Statistics 140 or a knowledge of the basic theory of normed linear spaces and linear operators. Basic properties of compact operators. Dual spaces. Optimization in linear spaces, especially algorithmic methods. Optimization of functions and constrained optimization. *Spring*. Baker.

142 INTRODUCTION TO ESTIMATION AND DETECTION THEORY (3). Prerequisites, Statistics 129, 134, and 140. The Wiener-Kolmogorov and the Kalman-Bucy filtering theories. Modulation theory. Basic problems of detection theory. *Spring*. Cambanis.

150 ANALYSIS OF VARIANCE WITH APPLICATION TO EXPERIMENTAL DESIGNS (3). Corequisite, Statistics 135. Linear

estimation. Gauss-Markoff theorem. Sums of squares. Analysis of variance and simple factorial designs. Intrablock analysis of incomplete block designs. Balanced, lattice and Latin square designs. *Spring*. Carroll, Chakravarti, Johnson, Ruppert.

156 COMBINATORIAL MATHEMATICS (Mathematics 148) (3). Prerequisites, Mathematics 135 or 136, Mathematics 121, or permission of the instructor. Topics chosen from: Generating functions, Pólya's theory of counting, partial orderings and incidence algebras, principle of inclusion-exclusion. Möbius inversion, combinatorial problems in physics and other branches of science. *Fall*. Brylawski, Kelly.

158 INTRODUCTION TO GRAPH THEORY (Mathematics 149) (3). Prerequisite, linear algebra. Basic concepts of directed and undirected graphs. Connectivity, traversability, and factorization of graphs. Planar graphs. Extremal problems. Automorphism group of a graph. Matrix representations. Coloring problems and the chromatic polynomial. *Spring*. Kelly.

160 APPLIED MULTIVARIATE ANALYSIS I (Biostatistics 166) (3). Prerequisite, Statistics 102. Exploratory and inferential multivariate techniques and applications. *Spring*. Staff.

170 ORDER STATISTICS (3). Prerequisite, Statistics 127. Distribution and moments of order statistics. Estimation of location and scale parameters, censoring. Robust estimation. Shortcut procedures. Treatment of outliers. Extreme value theory. *Spring*. Carroll.

171 INTRODUCTION TO NONPARAMETRIC STATISTICS (Biostatistics 256) (3). Prerequisites, Statistics 102, and basic courses in statistical theory. Sign test, rank sum tests, rank correlation methods, order statistics. Kolmogorov-Smirnov goodness-of-fit tests. Fisher-Pitman randomization theory. K-sample tests, method of paired comparisons, power and asymptotic relative efficiency. *Fall*. Quade.

180 STOCHASTIC MODELS IN OPERATIONS RESEARCH (ORSA 180) (3). Prerequisite, Statistics 126. Introduction to queueing theory (substantial). Markovian sequential decision process, inventory theory and topics from stochastic linear programming, simulation, scheduling, game theory. Applications. *Spring*. Simons, Smith.

181 DETERMINISTIC MODELS IN OPERATIONS RESEARCH (MATH 151, ORSA 181) (3). Prerequisite, Mathematics 147. Linear, integer, nonlinear and dynamic programming, classical optimization problems, network theory. *Fall and spring*. Smith, Kelly.

Courses for Graduates Only

200 APPLIED MULTIVARIATE ANALYSIS II (2). Prerequisite, Statistics 102 or 135. Relations between multiple regression, analysis of variance, multivariate analysis and factor analysis. Principal components. Discriminant analysis. Canonical analysis. Scaling methods. Classification problems. Cluster analysis. *Spring*. Johnson.

210 DESIGN AND ANALYSIS OF EXPERIMENTS (3). Prerequisites, Statistics 102 and 150. The principles of the design and analysis of experiments. Randomized blocks. Latin and Graeco-Latin squares, factorial experiments.Confounding, fractional factorials, split plots, missing plots. Interblock analysis. Covariance analysis. Response surfaces. *Fall or spring*. (1981-1982 and alternate years.) Johnson, Chakravarti.

220 THEORY OF ESTIMATION AND HYPOTHESIS TESTING (3). Prerequisites, Statistics 132, 135. Bayes procedures for estimation and testing. Minimax procedures. Unbiased estimators. Unbiased tests and similar tests. Invariant procedures. Sufficient statistics. Confidence sets. Large sample theory. *Fall.* Simons.

221 SEQUENTIAL ANALYSIS (3). Prerequisites, Statistics 132 and 135. Hypothesis testing and estimation when the sample size depends on the observations. Sequential probability ratio tests. Sequential design of experiments. Optimal stopping. Stochastic approximation. (1981-1982 and alternate years.) *Spring*. Simons.

222 NONPARAMETRIC INFERENCE (3). Prerequisites, Statistics 132, 135, and 112. Estimation and testing when the functional form of the population distribution is unknown. Rank, sign, and permutation tests. Optimum nonparametric tests and estimators, Robust procedures. (1981-1982 and alternate years.) *Spring*. Ruppert.

223 STATISTICAL LARGE-SAMPLE THEORY (3). Prerequisites, Statistics 132 and 135. Asymptotically efficient estimators; maximum likelihood estimators; maximum probability estimators. Asymptotically optimal tests; likelihood ratio tests. (1980-1981 and alternate years.) *Spring*. Ruppert.

231 ADVANCED PROBABILITY (3). Prerequisites, Statistics 132, 112. Advanced theoretic course, covering topics selected from: weak convergence theory, central limit theorems, laws of large numbers, stable laws, infinitely divisible laws, random walks, martingales. (1980-1981 and alternate years.) *Fall*. Kallianpur, Simons, Smith.

232 GENERAL THEORY OF STATISTICAL DECISION (3). Prerequisites, Statistics 135 and 112. Selected topics in the general

theory of statistical decisions, based on the work of Abraham Wald. *Spring*. (1980-1981 and alternate years) Staff.

235 STOCHASTIC PROCESSES (3). Prerequisites, Statistics 112 and 132. Advanced theoretic course including topics selected from: Foundations of stochastic processes. Renewal processes. Stationary processes. Markov processes, martingales, point processes. *Fall*. (1981-1982 and alternate years.) Baker, Cambanis, Leadbetter.

237 TIME SERIES ANALYSIS (3). Prerequisites, Statistics 112, 132. Analysis of time series data by means of particular models such as autogressive and moving average schemes. Spectral theory for stationary processes and associated methods for inference. Stationarity testing. *Spring*. (Alternate years.) Leadbetter.

242 PROBABILITY IN LINEAR SPACES (3). Prerequisites, Statistics 112, elements of theory of normed linear spaces. Results from linear topology. Borel structures. Probability measures on Borel sets of separable Banach spaces. Characteristic functionals. Extension of cylinder set measures. Gaussian measures. Orthogonality and equivalence of measures. *Spring*. Baker.

245 ADVANCED TOPICS IN STATISTICAL COMMUNICATION THEORY (3). Prerequisite, Statistics 242. Applications of probability in linear spaces to problems in information theory, signal detection, and sample path analysis of stochastic processes. *Fall*. Baker.

251 COMBINATORIAL PROBLEMS OF THE DESIGN OF EXPERIMENTS (3). Prerequisite, Statistics 150. Finite fields and finite geometries. Construction of orthogonal Latin square and balanced incomplete block designs. Difference sets. *Fall*. Chakravarti.

252 INFORMATION THEORY (3). Prerequisite, Statistics 134. Transmission of information, entropy, message ensembles, discrete sources, transmission channels, channel encoding and decoding for discrete channels. *Spring*. Chakravarti.

253 ERROR CORRECTING CODES (3). Prerequisite, Statistics 251, or permission of the instructor. Linear codes and their error-correcting capabilities. Hamming codes. Reed-Miller codes. Cyclic codes. Bose-Chaudhuri codes. Burst error corrections. Majority logic decoding. *Spring*. Chakravarti.

254 SPECIAL TOPICS IN THE DESIGN OF EXPERIMENTS I (3). Prerequisite, Statistics 150. Factorial experiments. Confounding, construction and analysis of symmetrical and fractional factorial designs. Orthogonal arrays. Asymmetrical factorial designs. Response surface designs, second and third order rotatable designs. Mixture designs. Recent developments. *Fall*. Chakravarti.

255 SPECIAL TOPICS IN THE DESIGN OF EXPERIMENTS II (3). Prerequisite, Statistics 251. Combinatorial properties and construction of balanced group divisible and partially balanced designs. Impossiblity proofs. Orthogonal Latin squares of non-prime power orders. Orthogonal arrays. Asymmetrical fractionally replicated designs. Recent developments. *Spring*. Chakravarti.

260 MULTIVARIATE ANALYSIS (3). Prerequisite, Statistics 135 and matrices. Multivariate normal distributions. Related distributions. Tests and confidence intervals. Multivariate analysis of variance, covariance and regression. Association between subsets of a multivariate normal set. Theory of discriminant, canonical, and factor analysis. *Fall*. Chakravarti, Johnson.

261 ADVANCED PARAMETRIC MULTIVARIATE ANALYSIS (3). Prerequisite, Statistics 260. Distribution problems involved in the normal theory analysis of general multivariate linear models including the growth curves. Roy's union-intersection principle and its role in multivariate analysis. An introduction to zonal polynomials and orthogonal groups. *Spring*. (1980-1981 and alternate years.) Sen, Chakravarti.

262 INTRODUCTORY NONPARAMETRIC MULTIVARIATE ANALYSIS (3). The problem of symmetry in the multivariate case. Nonparametric MANOVA in one-way classifications. Robust rank order estimation in MANOVA. Large sample properties of the tests and estimates. Tests of independence. *Fall*. (1981-1982 and alternate years.) Sen.

263 ADVANCED NONPARAMETRIC MULTIVARIATE ANALYSIS (3). Prerequisite, Statistics 262. Nonparametric inference in multifactor multiresponse experiments. Robust procedures in general linear models including the growth curves. Nonparametric classification problems. *Spring*. (1981-1982 and alternate years.) Sen.

280 ADVANCED STOCHASTIC METHODS OF OPERATIONS RESEARCH (3). Prerequisites, Statistics 132 and 180. Topics chosen from: renewal theory; queues with random arrivals; inequalities for queues; priority systems; theory of reservoirs; stochastic inventory problems. *Spring*. (1981-1982 and alternate years.) Smith.

300 SEMINAR IN STATISTICAL LITERATURE (1 each). Prerequisite, Statistics 135. *Fall and Spring*. Staff.

302 SEMINAR IN STATISTICAL DATA ANALYSIS (Var.). Prerequisite, Statistics 102. *Spring*. Staff.

310 311 SEMINAR IN THEORETICAL STATISTICS (3 each). Prerequisite, Statistics 135. *Fall and spring*. Staff.

321 322 SPECIAL PROBLEMS (3 each). Prerequisite, permission of the instructor. *Fall and spring*. Staff.

331 ADVANCED RESEARCH (3 each) Prerequisite, permission of
332 the instructor. *Fall and spring.* Staff.

393 MASTER'S THESIS (3 or more). Prerequisite, permission of the student's adviser. *Fall and spring.* Staff.

394 DOCTORAL DISSERTATION (3 or more). Prerequisite, permission of the student's adviser. *Fall and spring.* Staff.

400 GENERAL REGISTRATION.

THE GRADUATE FACULTY

CHARLES R. BAKER, *Professor.* B.S. (1957), University of Southwestern Lousiana; M.S. (1963), Ph.D. (1967), University of California at Los Angeles.

Major Areas of Interest: Statistical Communication Theory, Stochastic Processes.

JANET BEGUN, *Assistant Professor.* B.A. (1975), M.A. (1978), Ph.D. (1980), University of Rochester.

Major Area of Interest: Statistical Inference.

RAJ CHANDRA BOSE, *Kenan Professor Emeritus.* B.A. (Hons., 1922), Punjab University; M.A. (1924), Delhi University; M.A. (1927), D. Litt. (1947), Calcutta University. Member, National Academy of Sciences, International Statistical Institute. Fellow, Institute of Mathematical Statistics, National Institute of Science (India); Honorary Fellow, Royal Statistical Society. Member of Editorial Board, Journal of Combinatorial Theory.

STAMATIS CAMBANIS, *Associate Professor.* B.S. (1966), National Technical University (Athens, Greece); M.A. (1968), Ph.D. (1969), Princeton University.

Major Areas of Interest: Statistical Communication Theory, Stochastic Processes.

RAYMOND J. CARROLL, *Associate Professor.* B.A. (1971), University of Texas at Austin; M.A. (1972), Ph.D. (1974), Purdue University.

Major Areas of Interest: Ranking and Selection, Sequential Analysis, Statistics of Accounting.

INDRA MOHAN CHAKRAVARTI, *Professor.* B.Sc. (1948), M.Sc. (1950), D. Phil. (1958), University of Calcutta. Fellow, Institute of Mathematical Statistics; Member, International Statistical Institute.

Major Areas of Interest: Design of Experiments, Combinatorics, Information and Coding Theory.

WASSILY HOEFFDING, *Kenan Professor Emeritus.* Ph.D. (1940), University of Berlin. Member, National Academy of Sciences, International Statistical Institute. Fellow, Institute of Mathematical Statistics, American Statistical Association.

Major Area of Interest: Statistical Inference.

NORMAN LLOYD JOHNSON, *Alumni Distinguished Professor.* B.Sc. (Math., 1936), B.Sc. (Stat., 1937), M.Sc. (1938), Ph.D. (1948), D.Sc. (1963), University College, London. Fellow, Institute of Mathematical Statistics, Institute of Actuaries, American Statistical Association. Member, International Statistical Institute.

Major Areas of Interest: Multivariate Analysis, Statistical Inference.

GOPINATH KALLIANPUR, *Alumni Distinguished Professor.* B.A. (1945), M.A. (1946), University of Madras; Ph.D. (1951), The University of North Carolina. Fellow, Institute of Mathematical Statistics. Member, International Statistical Institute, Fellow, Indian Academy of Sciences.

Major Areas of Interest: Probability, Stochastic Processes.

NORMAN KAPLAN, *Adjunct Associate Professor.* B.S. (1966), Case Institute of Technology; M.S. (1967), Ph.D. (1970), Stanford University.

Major Area of Interest: Stochastic Processes.

DOUGLAS G. KELLY, *Associate Professor.* A.B. (1961), Princeton University; A.M. (1967), Ph.D. (1967), Indiana University.

Major Areas of Interest: Probability, Combinatorics, Real Analysis.

MALCOLM ROSS LEADBETTER, *Professor.* B.Sc. (1953), M.Sc. (1955), University of Otago (New Zealand); B.A. (1958), M.A. (1962), University of Cambridge; Ph.D. (1963), The University of North Carolina at Chapel Hill. Member, International Statistical Institute. Fellow, American Statistical Association, Institute of Mathematical Statistics.

Major Areas of Interest: Probability, Stochastic Processes.

BARRY MARGOLIN, *Adjunct Professor.* B.S. (1963), City College of New York; M.A. (1964), Ph.D. (1967), Harvard University. Fellow, American Statistical Association; Member, International Statistical Institute.

Major Area of Interest: Design and Analysis of Experiments.

DAVID RUPPERT, *Assistant Professor.* A.B. (1970), Cornell University; M.A. (1973), University of Vermont; Ph.D. (1977), Michigan State University.

Major Areas of Interest: Stochastic Approximation, Robust Statistics, Linear Models.

PRANAB KUMAR SEN, *Adjunct Professor.* M.Sc. (1957), Ph.D. (1962), Calcutta University. Fellow, American Statistical Association, Institute of Mathematical Statistics; Member, International Statistical Institute.

Major Area of Interest: Multivariate Analysis.

GORDON D. SIMONS, *Professor and Chairman.* B.A. (1960), M.A. (1964), Ph.D. (1966), University of Minnesota.

Major Areas of Interest: Sequential Analysis, Statistical Inference, Probability Theory.

WALTER LAWS SMITH, *Professor.* B.A. (1947), M.A. (1951), Ph.D. (1953), University of Cambridge. Fellow, Cambridge Philosophical Society, Institute of Mathematical Statistics, American Statistical Association. Member of International Statistical Institute.

Major Areas of Interest: Probability, Stochastic Processes.

LIVING IN CHAPEL HILL

The University and Chapel Hill

The University of North Carolina at Chapel Hill is the oldest state supported university in the United States, first opening its doors in 1795. It is part of The University of North Carolina, which has 16 campuses across the state. Chapel Hill—a cosmopolitan town of about 27,000—blends a mild climate, a relaxed southern atmosphere, pine-covered hills, and the charm of a college town with such cultural advantages as an excellent theater, a symphony orchestra, a planetarium, and an art museum. Most of the larger cities in North Carolina are nearby; the Carolina beaches, the Cape Hatteras National Seashore, the Great Smoky Mountains National Park, and the Blue Ridge Mountains are but a few hours drive away. Basketball, football, year-round golf, swimming, and other athletic attractions are always in abundance in Chapel Hill.

Graduate students frequently participate in professional, cultural, and intellectual activities involving the three major universities in the area—UNC-CH, Duke University, and North Carolina State University at Raleigh. It is not unusual for students to attend plays, concerts, or sports events in Durham and Raleigh, to go for hikes along the Eno and Little Rivers near Durham, or to attend seminars at one of the universities that involve participants from all three and from the Research Triangle.

The University, which now has about 20,000 students, is one of the South's leading academic institutions and prides itself on being among the front rank of American universities. Students come to Chapel Hill from all over the world. Within the University, several departments, including the Department of Statistics, have received international recognition.

Housing

The University maintains housing for single graduate students in Craige Graduate Center, a seven-story coeducational residence hall on South Campus. Craige has single and double rooms arranged by a suite system. Kithens and lounges are located on each floor. Its other facilities include a laundry, game rooms, coffehouse, snack bar, computer terminals, and seminar/study rooms.

Meals are served in nearby Chase Cafeteria five days a week. Many restaurants are within walking distance of the residence halls and the main campus.

The University also operates apartments for family student housing at modest cost in Odum Village, one mile south from the center of the campus. The University owns 76 one-bedroom unfurnished apartments, 160 two-bedroom unfurnished apartments, and 70 two-bedroom furnished

apartments. Early application for these apartments is essential.

Information about Craige Graduate Center may be obtained by writing the Department of University Housing, Contracts Office, Carr Building, The University of North Carolina at Chapel Hill, Chapel Hill, N.C. 27514.

Information about Odum Village may be obtained from the Manager, UNC Family Student Housing, Odum Village, Branson Street, Chapel Hill, N.C. 27514.

The University Health service offers medical and psychological services and maintains a well-appointed infirmary. Students who require specialized services may receive them at N.C. Memorial Hospital, located on campus, at standard charges.

Students may use the University athletic facilities at no additional charge. These include indoor and outdoor swimming pools, tennis, handball and basketball courts, fields for softball and touch football, and an 18-hole golf course.

UNIVERSITY POLICIES AND REGULATIONS

Residence Status for Tuition Payment[1]

General. Every applicant for admission is required to make a statement as to his or her length of residence in North Carolina. The tuition charge for legal residents of North Carolina is less than for nonresidents. To qualify for in-state tuition a legal resident must have maintained his or her domicile in North Carolina for at least twelve months immediately prior to his or her classification as a resident for tuition purposes. In order to be eligible for such classification, the student must establish that his or her presence in the State during such twelve-month period was for purposes of maintaining a bona fide domicile rather than for purposes of mere temporary residence incident to enrollment in an institution of higher education.

Domicile. Domicile means one's permanent dwelling place of indefinite duration, as distinguished from a temporary place of abode; synonymous with "legal residence."

Burden of Proof and Statutory Prima Facie Evidence. The burden of establishing facts which justify classification of a student as a resident entitled to in-state tuition rates is on the applicant for such classification. For a student to be classified a resident for tuition purposes, the balancing of all the evidence must produce a preponderance of the evidence supporting the assertion of in-state residence. Proof of residential status is controlled, initially, by two statutorily prescribed and complementary evidentiary beginning points, which are stated in terms of prima facie evidence:

a. If the parents or court-appointed legal guardian of the student (without reference to the question of whether the student is a minor or an adult) are not domiciliaries (legal residents) of North Carolina, under the Statute this fact constitutes prima facie evidence that the student is not a domiciliary (legal resident) of North Carolina, unless the student has lived in this State the five consecutive years prior to enrolling or reregistering. The student must assume the burden of overcoming the prima facie showing by producing evidence that he or she, independently, is in fact a domiciliary (legal resident) of North Carolina, in spite of the nonresident status of his or her parents:

b. Conversely, if the parents of the student are domiciliaries of North Carolina under the Statute, this fact constitutes prima facie evidence that the student is a domiciliary of North Carolina. This prima facie evidence

1. The information in this section comes from three sources (i) North Carolina General Statutes, Sec. 116-143.1; (ii) *A Manual to Assist the Public Higher Education Institutions of North Carolina in the Matter of Student Residence Classification for Tuition Purposes, August 1979;* (iii) Chancellor's Rules and Procedures for Residence Classification of Students for Tuition Purposes.

may also be overcome by other evidence of legal residence. If the student has neither parents nor legal guardian, the prescribed prima facie evidence rule cannot and does not apply.

Statutory Exceptions

a. *Grace Period.* By virtue of the provisions of G.S. 116-143.1, if a student has been properly classified as a resident for tuition purposes, a change in that student's state of residence thereafter does not effect in all cases an immediate automatic loss of entitlement to the in-state tuition rate. To qualify for the grace period, the following conditions must be satisfied:

1. The student must have been properly classified as a resident for tuition purposes, on the basis of a valid finding that the student in fact was a legal resident of North Carolina and had been such for the requisite twelve-month period prior to classification.

2. At the time of subsequent change of legal residence to a state other than North Carolina, the student must have been enrolled in a public institution of higher education in North Carolina.

The extent of this grace period, during which the in-state rate is applicable in spite of the fact that the student is not a legal resident of North Carolina, is twelve months from the date of change in legal residence, plus any portion of a semester of academic term remaining, as of the expiration date of the twelve-month period, in which the student is enrolled.

b. *Qualifying Periods for Spouses.* By virtue of the provisions of G.S. 116-143.1, the prescribed twelve-month period of legal residence required for entitlement to classification as a resident for tuition purposes may be shortened on the basis of the marital status of the student, in specified circumstances. If a student otherwise can demonstrate compliance with the fundamental statutory requirement that he or she be a legal resident of North Carolina, the second statutory requirement relating to duration of residence may be satisfied derivatively, in less than twelve months, by reference to the length of the legal residence of the spouse of the student, if the spouse has been a legal resident of the State for the requisite twelve-month period.

Married Persons. The domicile of a married person, irrespective of sex, is determined by reference to all relevant evidence of domiciliary intent. No person is precluded, solely by reason of marriage to a person domiciled outside of North Carolina, from establishing or maintaining legal residence in North Carolina. No person is deemed, solely by reason of marriage to a person domiciled in North Carolina, to have established or maintained a legal residence in North Carolina. The fact of marriage

and the place of the domicile of his or her spouse are deemed relevant evidence to be considered in ascertaining domiciliary intent.

Minors. A minor is any person who has not reached the age of eighteen years. The domicile of a minor is that of the father. With a few exceptions noted below, this presumption is virtually irrebuttable. If the father is deceased, the domicile of the minor is that of the surviving mother. If the parents are divorced or legally separated, the domicile of the minor is that of the parent having custody by virtue of a court order; or, if no custody has been granted by virtue of court order, the domicile of the minor is that of the parent with whom he or she lives; or, if the minor lives with neither parent, in the absence of a custody award, the domicile of the minor is presumed to remain that of the father.

In determining residence status for tuition purposes, there are two exceptions to the above provisions:

1. If a minor's parents are divorced, separated or otherwise living apart and one parent is a legal resident of North Carolina, during the time period when that parent is entitled to claim, and does claim, the minor as a dependent on the North Carolina individual income tax return, the minor is deemed to be a legal resident of North Carolina for tuition purposes, notwithstanding any judicially-determined custody award with respect to the minor.
2. If, immediately prior to beginning an enrolled term, the minor has lived in North Carolina for five or more consecutive years in the home of an adult relative (other than a parent) who is a legal resident of North Carolina, and if the adult relative, during those years, has functioned as a de facto guardian of the minor, then the minor is considered a legal resident of North Carolina for tuition purposes. If a minor qualified for resident status for tuition purposes under this provision immediately prior to his or her eighteenth birthday, then, when he or she reaches the age of eighteen, he or she will be deemed to be a legal resident of North Carolina of at least twelve months' duration.

Even though a person is a minor, under certain circumstances the person may be treated by the law as being sufficiently independent from his or her parents as to enjoy a species of adulthood for legal purposes. The consequence, for present purposes, of such circumstances is that the affected person is presumed to be capable of establishing a domicile independent of that of the parents; it remains for that person to demonstrate that a separate domicile in fact has been established. The circumstances recognized as having the potentially emancipating effect are:

1. Marriage of the minor person.
2. Parental disclaimer of entitlement to the minor's earnings and the

minor's proclamation and actual experience of financial independence from his or her parents, with the actual establishment and maintenance of a separate and independent place of residence.

Aliens. An alien holding a visa which will permit eventual permanent residence in the United States is subject to the same considerations with respect to determination of legal residence as a citizen. An alien abiding in the United States under a visa conditioned at least in part upon intent not to abandon a foreign domicile (B,F,H, and J visas) cannot be classified as a resident. An alien holding a visa issued for a purpose which is so restricted as to be fundamentally incompatible with an assertion by the alien of bona fide intent to establish a legal residence (C and D visas) cannot be classified as a resident. A refugee or orphan from the Republic of Vietnam, Laos or Cambodia, paroled into the United States after March 31, 1975, who has abided in this state for twelve consecutive months may receive in-state tuition privileges.

Military Personnel. The domicile of a person employed by the Federal Government is not necessarily affected by assignment in or reassignment out of North Carolina. Such a person may establish domicile by the usual requirements of residential act plus intent. No person loses his or her in-state residence status solely by serving in the armed forces outside of the State of North Carolina.

Property and Taxes. Ownership of property in or payment of taxes to the State of North Carolina apart from legal residence will not qualify one for the in-state tuition rate.

Change of Status. A student admitted to initial enrollment in an institution (or permitted to re-enroll following an absence from the institutional program which involved a formal withdrawal from enrollment) is classified by the admitting institution either as a resident or as a nonresident for tuition purposes prior to actual matriculation. In the absence of a current and final determination by the admitting institution that the student is a resident for tuition purposes, relative to the term of initial enrollment or re-enrollment, the student is classified a nonresident for tuition purposes prior to actual matriculation. A residential classification once assigned (and confirmed pursuant to any appellate process invoked) may be changed thereafter (with a corresponding change in billing rates) only at intervals corresponding with the established primary divisions of the academic calendar.

Transfer Students. When a student transfers from one North Carolina public institution of higher education to another, he or she is treated as a new student by the institution to which he or she is transferring and must be assigned an initial residential classification for tuition purposes.

The transfer into or admission to a different component of the same institution (e.g., from an undergraduate to a graduate or professional program) is not construed as a transfer from one institution to another and thus, does not by itself require a reclassification inquiry unless (1) the affected student requests a reclassification inquiry or (2) the transfer or enrollment occurs following the lapse of more than one quarter, semester, or term during which the individual was not enrolled as a student.

Responsibility of Students. Any student or prospective student in doubt concerning his or her residence status must bear the responsibility for securing a ruling by stating his or her case in writing to the admissions officer. The student who, due to subsequent events, becomes eligible, for a change in classification, whether from out-of-state to in-state or the reverse, has the responsibility of immediately informing the Office of Admissions of these circumstances in writing. Failure to give complete and correct information regarding residence constitutes grounds for disciplinary action.

It is the responsibility of the student to pay tuition at the rate charged and billed while an appeal is pending. In effect, the student who is classified as a nonresident at the time of tuition billing pays the nonresident rate. Conversely if a student is classified as a resident at the time of billing, he or she pays the resident rate. Any necessary adjustments in the rate paid will be made at the conclusion of the appeal.

If a student, who has been found to be a nonresident for tuition purposes, receives an erroneous notice from an institutional officer identifying the student as a resident for tuition purposes, the student is not responsible for paying the out-of-state tuition differential for any enrolled term beginning before the classifying institution notifies the student that the prior notice was erroneous.

If a student is classified a resident for tuition purposes after submitting falsified residentiary information or after knowingly withholding residentiary information, the student's application for in-state tuition status is fraudulent. The institution may re-examine any application suspected of being fraudulent, and, if warranted, will change the student's residence status retroactively to the beginning of the term with respect to which the student originally made the fraudulent application. If this occurs, the student must pay the out-of-state tuition differential for all the enrolled terms intervening between the fraudulent application and its discovery. Further, knowing falsification of responses on a resident status application may subject the applicant to disciplinary consequences, including dismissal from the institution.

Appeals of Rulings of Admissions Officers. A student appeal of a classification decision made by any admissions officer must be filed by

the student with that officer in writing within fifteen working days after the student receives notice of the classification decision and is transmitted to the Residence Status Committee by that officer, who does not vote in that committee on the disposition of such appeal. The student is notified of the date set for consideration of the appeal and, on request of the student, he or she is afforded an opportunity to appear and be heard by the Committee. Any student desiring to appeal a decision of the Residence Status Committee must give notice in writing of that fact within 10 days of receipt by the student of the decision of the Residence Status Committee, and the basis for such appeal, to the Chairman of the Residence Status Committee, and the Chairman promptly transmits the appeal to the State Residence Committee.

A complete explanation of the Statute and the procedures under the Statute is contained in *A Manual to Assist the Public Higher Education Institutions of North Carolina in the Matter of Student Residence Classification for Tuition Purposes.* This *Manual* and other information concerning the application of this law is available for inspection in the Admissions Offices of the University.

All students are responsible for knowledge of the contents of the Statute and the *Manual.*

Students or prospective students who believe that they are entitled to be classified residents for tuition purposes should be aware that the processing of requests and appeals can take a considerable amount of time and that applications for classification should not be delayed until registration, when the number of applications make impossible accelerated handling.

NOTICE ON "DIRECTORY INFORMATION" TO ALL STUDENTS OF THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

The University of North Carolina at Chapel Hill has routinely made public certain information about its students. Some typical ways this has been done include the following: names of students who are selected by the various honorary societies, who receive scholarships, who make the Dean's List, who hold offices, or who are members of athletic teams are frequently made public. To facilitate campus communication the University annually publishes the *Campus Directory*. Some professional and graduate school student groups publish directories of students in their departments or schools. The annual commencement program publishes the names of persons who have received degrees during the year.

The Family Educational Rights and Privacy Act defines the term "directory information" to include the following categories of information: the student's name, address, telephone listing, date and place of birth,

major field of study, participation in officially recognized activities and sports, weight and height of members of athletic teams, dates of attendance, degrees and awards received, and the most recent previous educational agency or institution attended by the student. The University will make public information about each student *limited* to these categories in ways such as those described above. Of course, information from all these categories is not made public in every listing. The *Campus Directory*, for example, publishes only names, addresses, and telephone numbers.

Students who do not wish to have any or all of such "directory information" made public without their prior consent must notify the Office of Records and Registration, The University of North Carolina at Chapel Hill, of this fact in a signed and dated statement specifying items that are not to be published. This notice must be received by the Office of Records and Registration by the end of the registration period for the semester or session of first enrollment, or, after an absence, of re-enrollment, and by the end of each fall registration period thereafter.

Nondiscrimination Policy

The University of North Carolina at Chapel Hill is committed to the principle of equal opportunity. It is the policy of this University not to discriminate on the basis of race, sex, color, national origin, religion, or handicap with regard to its students, employees, or applicants for admission or employment. Such discrimination is also prohibited by federal law. Any complaints alleging failure of this institution to follow this policy should be brought to the attention of the Assistant to the Chancellor.

UNIVERSITY CALENDAR

1980-1981

Fall Semester, 1980

August 20-22, Wednesday-Friday	Registration.
August 25, Monday	Classes begin.
September 1, Monday	Holiday.
September 26, Friday	Last day for submitting an application for a degree and an application for admission to candidacy for the master's degree and last day for submitting an application for doctoral degree for December graduation.
October 12, Sunday	University Day.
October 17, Friday	Fall recess begins at 5 p.m.
October 22, Wednesday	Classes resume at 8 a.m.
November 8, Saturday	Written examinations for master's candidates for December graduation may not be taken after this date.
November 18, Tuesday	Last day to *drop* a course.
November 26, Wednesday	Thanksgiving recess begins at 1 p.m.
December 1, Monday	Classes resume at 8 a.m.
December 5, Friday	Last class day.
December 8, Monday	Reading Day.
December 12, Friday	Final signed copies of doctoral dissertations and master's theses for candidates for the December graduation must be filed in the Graduate School by this date.
December 9-18 Tuesday-Saturday Monday-Thursday	Final course examinations.

Spring Semester, 1981

January 12-13, Monday-Tuesday	Registration.
January 14, Wednesday	Classes begin.
January 30, Friday	Last day for submitting an application for a degree and an application for admission to candidacy for the master's degree and last day for submitting an application for doctoral degree for May Commencement.
March 6, Friday	Spring recess begins at 5 p.m.
March 16, Monday	Classes resume at 8 a.m.
April 11, Saturday	Written examinations for master's candidates for May Commencement may not be taken after this date.
April 16, Thursday	Last day to *drop* a course.
April 20, Monday	Holiday.
April 24, Friday	Final signed copies of doctoral dissertations and master's theses for candidates for the May Commencement must be filed in the Graduate School by this date.
April 30, Thursday	Last class day.
May 1, Friday	Reading day.
May 4-13 Monday-Saturday Monday-Wednesday	Final course examinations.
May 17, Sunday	Commencement.

Special Deadlines for Admission Applications

July 1	Last day for submitting application for admission to the Fall Semester.
November 1	Last day for submitting application for admission to the Spring Semester.
February 1	Last day for submitting application to qualify for fellowship or assistantship consideration for the Fall Semester.