Self-Study for Quality Enhancement Review and
University Graduate Policy Committee (GPC) Review

Department of Statistics
Florida State University
Fall 2012

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I. Overview

1. Describe the academic program, including the program's history, academic offerings, curricular focus, and organizational structure. In addition, comment briefly on the program's accomplishments, faculty, and research.

a). Program's history

The Department of Statistics was organized in September 1959 under the direction of Ralph Bradley, who was brought to the University to establish and organize the department. Initially the department was authorized to offer the Bachelor of Science and Master of Science degrees in statistics, with the doctoral program being initiated in 1961.

The department became a major training center in statistics in the 1960's with the funding of a biometry training program by the National Institute of General Medical Sciences, starting in 1962. Graduate enrollment was approximately 60 in 1965 and continued to number in the 50's into the mid 1970's. The decrease in enrollment was in response to national decisions in the mid-1970's to de-emphasize predoctoral graduate training.

Eminent faculty who joined the department in the early 1960's included Frank Wilcoxon and I. Richard Savage. They, with Ralph Bradley, formed the core of the initial major specialization in the department, nonparametric statistics. The appointments of Myles Hollander and Jayaram Sethuraman augmented this group. Another major impetus in reliability theory came with the appointment of Frank Proschan in 1971. Significant strength in the foundations of statistics was added to the department with the appointment of Dev Basu in 1976. The appointment of George Marsaglia in 1985 added strength to the department in computational statistics, particularly the development of random number generators and the assessment of their quality.

The department received major funding from the National Science Foundation and the State of Florida in the late 1960's and early 1970's that led to the development of specialization in probability, stochastic processes, reliability theory, and applied statistics. Major growth in the faculty occurred during this period, with the addition of 15 faculty in the period 1964-1975.

The Biostatistics program started in 2002 when Dan McGee joined the department. During the academic year 2002-2003, six new biostatistics courses were developed and added to the department's curriculum. The master program in Biostatistics was approved in 2006 and the Ph.D. program in biostatistics was approved in the spring of 2007, making it the first program of its kind at a Florida university. Currently, three professors, Dan McGee, Debajyoti Sinha, and Elizabeth Slate, focus their research and teaching in Biostatistics. All tenure-track faculty members in the department have doctoral directive status in both statistics and biostatistics, except Debdeep Pati who joined the department in August 2012. Dr. Pati's doctoral directive status should be approved early in the fall semester. By the spring semester of 2012, twenty-two students have been awarded the master of science degree in Biostatistics and nine students have been awarded Ph.D. in Biostatistics.

The department has hosted numerous special meetings and conferences over the years and faculty members have served the profession in numerous ways over the years as association officers and in journal editorial positions.

The first Master of Science degree was awarded in August 1961 and the first Ph.D. in 1966. To date a total of 471 Master of Science degrees and 208 Ph.D. degrees have been awarded.

The department recognizes its responsibility to provide education in statistical methods for undergraduate and graduate students in other disciplines. In the Spring, Summer, and Fall 2011 semesters, we taught over 300 sections of statistics courses to a total of 6224 students. In addition, we have provided statistical consulting services to members of the university community spanning over twenty departments and eight colleges through our Statistical Consulting Center since 1970.

The department has continued to receive substantial sums of external funding over the years and to publish widely in terms of both articles and books. Five of the department's professors have been named FSU Lawton Distinguished Professors: Ralph Bradley, I. Richard Savage, Frank Proschan, J. Sethuraman, and Myles Hollander.

b). Academic offerings and curricular focus

Academic offerings of the department are listed in Table 1.

Table 1. List of degree programs and the majors offered by level.

Major Name	Major Code	CIP Code	Degree Offered
Statistics	119310	270501	Bachelors
Statistics	119310	270501	Masters
Statistics	119310	270501	Doctorates
Major Name	**Major Code**	**CIP Code**	**Degree Offered**
Biostatistics	119311	261102	Masters
Biostatistics	119311	261102	Doctorates

The curricular focus of the department is based on the mission of the department that is to advance the science of statistics through innovative research, teaching, consulting, and service to produce high quality graduates with BS, MS, and PhD degrees, and to serve the Florida State University, the State of Florida, and the nation with statistical expertise.

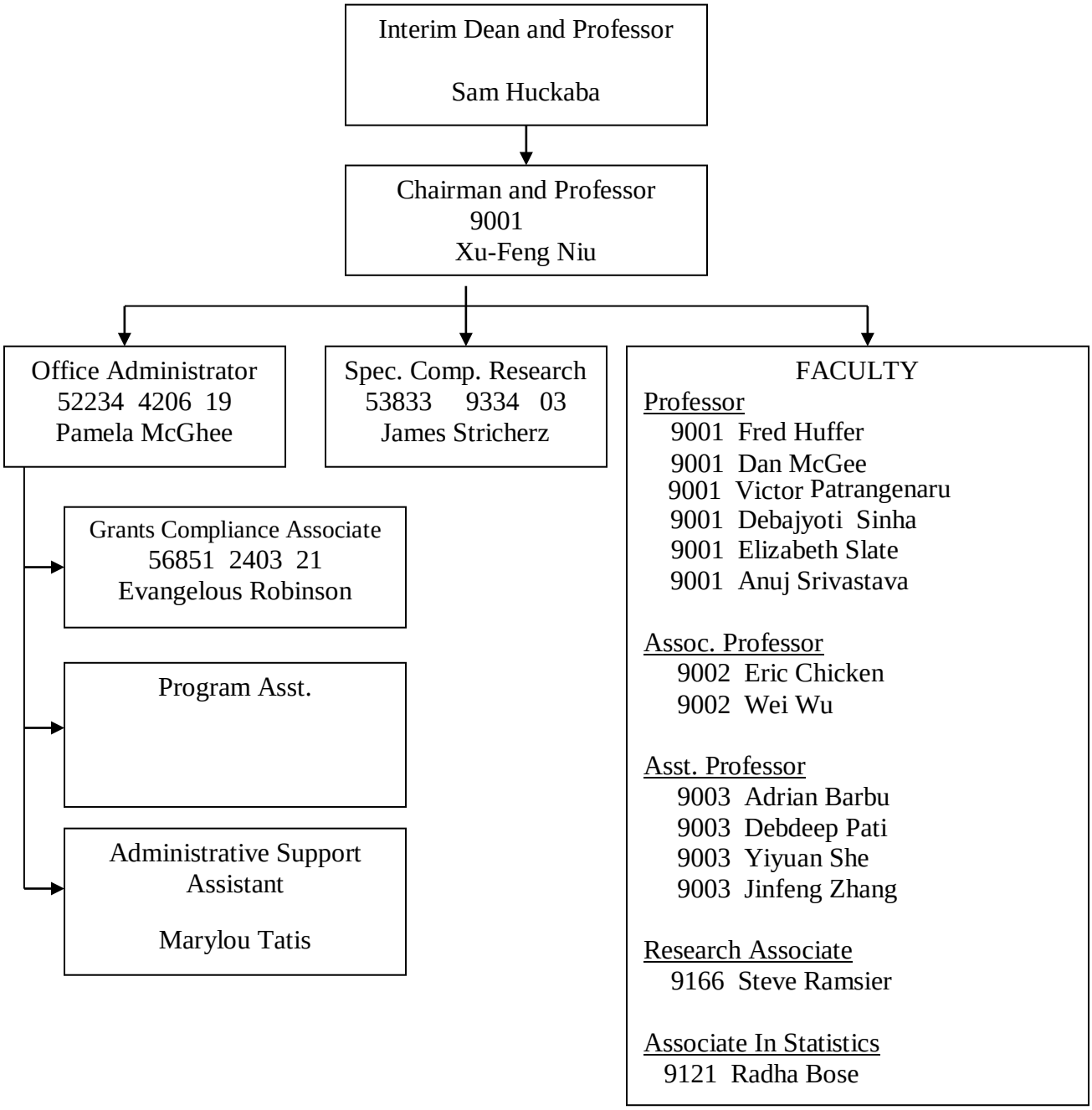
Activities in support of our mission:

- Advance statistical theory and methodology
- Support scientific research that uses statistics
- Give our students the ability to keep learning after they graduate
- Teach in a manner that engenders interest and enthusiasm for statistics
- Teach our introductory service course in a manner that students become statistically literate

- Provide service for the University, state and nation through our consulting center and through our roles in professional organizations and national advisory boards.

c). Organizational structure

Table 2. Department of Statistics Organizational Chart.
FSU College of Arts and Sciences
Department of Statistics



Notes: 1) Adjunct Professor Robert Clickner will teach two honor sections of STA2122 in the academic year 2012-2013.
2) Faculty demographics are given on page 2 of **Appendix-J** (Statistics Booklet 2012 prepared by the University).

d). Program's accomplishments, faculty, and research

The faculty of the Department of Statistics at FSU has a distinguished record of research and teaching. The department currently has 15 faculty members, among them four members (Dan McGee, Xu-Feng Niu, Debajyoti Sinha, Elizabeth Slate) have been elected Fellows of one or more professional statistical societies, and Anuj Srivastava is a senior member of IEEE. Faculty are very successful in obtaining grants from the National Science Foundation, National Institutes of Health, National Cancer Institute, National Security Agency, the Army Office of Research, and other agencies. In the history of the Department, five professors have been named Robert O. Lawton Distinguished Professor (Ralph Bradley, I. Richard Savage, Frank Proschan, J. Sethuraman, and Myles Hollander.), which is granted to only one of Florida State's more than 1,000 faculty each year. One professor has been named Distinguished Research Professor, seven faculty members have been given University Teaching awards, and two a University Advising award.

With the help of both the administration and our loyal alumni in the last five years, the department successfully recruited two named professors: Debajyoti Sinha (Ron & Carolyn Hobbs Endowed Chair/Professor) in 2007, and Elizabeth Slate (Duncan McLean and Pearl Levine Fairweather Professor) in 2011.

The department established its Biostatistics Master program in 2006 and Biostatistics Ph.D. program in 2007. In 201, we introduced two certificate programs in SAS data management and analysis, an undergraduate and a graduate version. All of these along with an emphasis on undergraduate education have greatly increased the departments enrollment.

We have experienced rapid growth in the number of graduate students and in total enrollment in the last 5 years (2007-2012). The number of graduate students enrolled in our degree programs has increased from 32 in 2005 to about 70 presently. The total student credit hours (SCH) of our department have increased steadily. The SCH for the department grew from 18,445 in 2010-2011 to 21,578 in 2011-2012, a 17.00% increase that is the fastest SCH growth rate in the college. The department graduated 9 Ph.Ds in 2010, 13 Ph.Ds in 2011, and 6 Ph.Ds in the spring semester of 2012, which are record numbers in the department's history. All students graduated in the last five years have found employment in academia, government, or industry.

2. Analyze the strengths and weaknesses of the program.

a). Strengths

The Department has established a tradition of excellence in the scholarly work of its faculty, effectiveness of its educational programs, and service to the university, the state, and the nation. Faculty are recognized authorities in their research areas and make significant contributions to

research, maintain ongoing research projects, and disseminate the results of their research. The Department has an excellent record in undergraduate and graduate teaching, research, service, and consulting. It is nationally recognized as a leader in the discipline. Faculty members are regularly active participants in major national and international professional association meetings. Faculty members are group leaders of national statistics research programs, members on national and international panels for grant applications, reviewers for statistics or probability journals, and members on organizing or program committees at international statistics or probability meetings. Faculty generated substantial amounts of external grant support in the last five years. The Department supports interdisciplinary collaborative research with several other University colleges and departments, including economics, computer science, psychology, biology, oceanography, meteorology, geography, mathematics, and several departments in the medical school.

Coupled with the creation of Biostatistics Master degree in 2006 and Biostatistics Ph.D. degree in 2007, the department has experienced a fast growing period in the last five years. The number of graduate students enrolled in the Master and Ph.D. programs of the department were 53 in 2007, 56 in 2008, 57 in 2009, 72 in 2010, and 69 in 2011. Our applications for enrollment in both statistics and biostatistics continue to grow. There were almost 200 applicants for the incoming class of Fall 2012 competing for an available 14 teaching assistant positions, roughly a 15:1 ratio.

b). Weaknesses

The major weakness of the department is its shortage of faculty. In contrast to the growth in our student credit hours, the continuing increase in teaching demand, and the growing number of graduate students, the department faculty lines have remained constant for the last 30 years. The department currently has 13 tenured and tenure-track faculty members and two teaching faculty members. This is the same size of faculty as it was in 1981, and less than in the 1970s. The major difficulty caused by our lack of faculty is the inability to offer needed graduate courses and an increased demand on the existing faculty to direct multiple PhD students. Several faculty members in the department are directing more than 5 Ph.D. students and teaching 3 or more courses a year, which we feel is an excessive demand on their time and reduces overall productivity. Additional faculty lines are needed if we are to continue to increase our graduate and undergraduate enrollment, continue and expand our outreach within and outside FSU, enhance our profile in the community, and continue to increase research collaboration and productivity.

The small size of our faculty directly affects the productivity of the department and hurts the national ranking of our programs. In Tables 3 and 4, based on the 2010 NRC rankings we list five universities as our peer group and five universities as our aspirational group, respectively. The 2012 faculty sizes are listed in the last column of the tables, which show that our department has the fewest number of faculty among the 11 institutions. The fact that our department is the only one among these to offer both statistics and biostatistics graduate programs further magnifies the deficit in our faculty size. In fact, five of the institutions listed in Tables 3 and 4 (Ohio State, Univ. of Iowa, Univ. of MN, Univ. of NC and Univ. of WI) have separate Biostatistics Departments on the same campus as the statistics department. Tables 3-4 include

only information from the statistics departments. The department of Statistics at Pennsylvania State University offers a Biostatistics "option" within the statistics PhD program.

Our department thus far has competed remarkably well with fewer faculty than our peer departments. However, the advantage in size that our peer departments enjoy continues to grow. This advantage will no doubt be clearly reflected in the future national ranking since our size has been stagnant for the last 30 years.

Table 3. NRC 2010 rankings of our peer group (public universities)

Institution, program	S-Rank High	S-Rank Low	Research High	Research Low	Students High	Students Low	Diversity High	Diversity Low	R-Rank High	R-Rank Low	2012 faculty size
Colorado State U. Statistics	31	48	17	38	33	55	45	57	19	43	17
Florida State U. Statistics	32	48	31	51	17	45	7	30	26	48	15
Ohio State U. Main Campus Statistics	23	42	14	36	41	57	15	41	10	37	26
Texas A&M U. Statistics	31	47	34	51	11	36	22	46	5	27	34
U. of Iowa Statistics	39	50	39	51	31	56	6	35	13	33	16
U. of Minnesota-Twin Cities Statistics	32	47	17	38	44	57	24	47	14	39	16

Notes: The National Research Council assessed programs according to 21 different criteria. The NRC's five major ratings are:
S-Rank: Programs are ranked highly if they are strong in the criteria that scholars say are most important.
Research: Derived from faculty publications, citation rates, grants, and awards.
Students: Derived from students' completion rates, financial aid, and other criteria.
Diversity: Reflects gender balance, ethnic diversity, and the proportion of international students.
R-Rank: Programs are ranked highly if they have similar features to programs viewed by faculty as top-notch.

Our aspirational group is North Carolina State University, Pennsylvania State University, University of Wisconsin-Madison, Purdue, University of North Carolina – Chapel Hill, all of which are also public universities.

Table 4. NRC 2010 rankings of our aspirational group (public universities)

Institution, program	S-Rank High	S-Rank Low	Research High	Research Low	Students High	Students Low	Diversity High	Diversity Low	R-Rank High	R-Rank Low	2012 faculty size
North Carolina State U. Statistics	16	27	15	29	27	53	7	33	3	13	47
U. of North Carolina at Chapel Hill Statistics	5	14	12	27	7	28	39	57	6	20	22
Purdue U. Main Campus Statistics	10	24	13	32	23	49	11	37	8	28	56
Pennsyl-vania State U. Statistics	5	14	7	18	14	41	4	21	8	30	33
U. of Wisconsin at Madison Statistics	5	15	3	11	22	48	7	32	3	19	20

3. What are the program's academic and organizational short and long-term goals and what plans are in place for reaching them? Evaluate the program's progress towards the stated goals. Cite the program's strategic plan, if applicable.

Statistics is a fast growing discipline with ever widening areas of application and statisticians are highly demanded in the current job market. On August 5, 2009, Steve Lohr, a reporter on technology, business, and economics, published an article in New York Times which was titled as "**For Today's Graduate, Just One Word: Statistics**." The article explained "Statistics" and careers related to the field of data analysis as the careers of the next decade. In the article, Lohr quoted Hal Varian, the chief economist at Google: "**I keep saying that the sexy job in the next 10 years will be statisticians. And I'm not kidding.**"

Most recently, Marie Davidian, William Neal Reynolds Professor of Statistics at North Carolina State University and president-elect of the American Statistical Association, and Thomas A. Louis, Professor of Biostatistics at the Johns Hopkins Bloomberg School of Public Health and retiring chair of the AAAS Statistics Section, published an article entitled "**Why Statistics**" in the Science magazine on April 6, 2012. In the article, the two authors commented: "**A dramatic increase in the number of statisticians is required to fill the nation's needs for expertise in data science. A 2011 report by a private consulting firm projected a necessary increase of nearly 200,000 professionals (a 50% increase) by 2018.** Graduates specializing in statistics

are equipped with skills that allow them to pursue diverse careers, and there has been a surge in applications for graduate education in these fields."

a). Program's academic and organizational short and long-term goals.

Given the growth of the department in the face of very limited resources, we expect that we can keep this growth going only with additional faculty. We hope that the department grows to a mid-size department with 20 faculty members by the year 2018. With this size faculty we will be able to support over 75 under graduate majors and over 100 master and Ph.D. students. We plan to continue to enhance our excellent performance in research, teaching, and services in the next five years. The department was one of the top ten statistical programs in the nation in the 1980's. In the NRC rankings done in 1993, the department ranked 23. Our NRC ranking in 2010 is around the mid-thirties (33-34 based on the average of the five major ratings) among the 61 statistics and biostatistics programs in the nation on the NRC ranking list, which is the lowest ranking in the department's history. The ranking can at least partially be attributed to our lack of growth in faculty to accompany our growth in all other areas and partially due to the recent retirements of senior faculty members including Robert O. Lawton Distinguished Professors J. Sethuraman (retired in 2004) and Myles Hollander (retired in 2006). An enlarged faculty would support enhanced efforts in research, teaching, and services, the department NRC ranking should increase correspondingly.

The department long-term goal is to reach about 25 faculty members and over 120 master and Ph.D. students by the year 2023 (ten-year goal). We hope that at least two or more among faculty will be named distinguished research professors and/or Robert O. Lawton Distinguished Professors and that at least one of the younger faculty will receive a developing scholar award. By 2023, this junior group of faculty will become the main force of the department in research and teaching. With their efforts and assistance from senior faculty and future junior faculty, the department's research and teaching will reach a much higher stage and its NRC ranking could be expected to return to the mid-teens among the statistics and biostatistics programs in the nation.

b). Program's strategic plan for reaching the goals.

The department's Ph.D. program in biostatistics started in 2007 and is still in its initial stages of implementation. Based on the experience of other biostatistics programs in the nation, our biostatistics program should include 6-10 faculty members to open necessary courses and to engage in extensive collaborate. Due to the financial crisis and frozen hiring period of 2009-2011 at FSU, currently only three faculty members in the department, Dan McGee, Deb Sinha, and Elizabeth Slate, are fully devoted to the Biostatistics program. Although there is partial support from other faculty members, in order to fully develop this program and compete with other universities, additional faculty lines in Biostatistics will be required.

Specifically, the department's highest priorities in the next five to ten years are

1). To continue and enhance our programs in Biostatistics that we:
   (a) broaden our subject offerings
   (b) attract more graduate students in Biostatistics,
   (c) develop curriculum in biostatistics for undergraduates,

(d) create additional research interests for our faculty and graduate students,
(d) provide research, consulting, and teaching support to the Medical School, the Program in Epidemiology, Biology and other related areas.

2). To continue to enhance our Statistical Shape Analysis and Modeling Group (SSAMG, http://ssamg.stat.fsu.edu/) so that it becomes an established national center attracting both permanent and visiting faculty and creates additional research interests for our faculty, as well as our undergraduate and graduate students.

3). To continue to enhance our Department's emphasis in interdisciplinary research with other fields and departments including oceanography, meteorology, biology, psychology, computer science, mathematics, and the Medical School.

4). To develop and enhance our Statistical Consulting Center with additional faculty to support interdisciplinary research and garner more outside research support.

5). To continue to attract superior junior and senior faculty to
(a) broaden our program,
(b) replace departing faculty members, and
(c) nurture and stimulate our current faculty so that we can continue to make fundamental contributions to the methodology and theory of statistics.

The teaching demand for lower division courses and graduate courses in Statistics is increasing very fast university-wide. Besides enhancing research, increasing scientific publications, and generating more external grant support, the department is committed to provide excellent undergraduate and graduate teaching to the whole university. With additional faculty lines, we would like to focus on the following items in the next five to ten years.

1). Undergraduate Teaching: Given adequate resources, we would like to redesign our undergraduate curriculum by incorporating more online courses and by enhancing classroom teaching using web-assisted and software based teaching. Specifically, we recognize the need to emphasize both the foundations of statistical thinking, i.e. reasoning in the face of uncertainty, and the computational facility needed to learn from Big Data. Both are emerging requirements for careers in today's markets, even among those not traditionally viewed as quantitative. Some highlights of our planned enhancements include:

a. Develop and teach a totally redesigned version of STA 1013, “Statistics through Example”.

b. Introduce computing technology in our lower division teaching (e.g. STA 2122 and 2023 using SAS Enterprise Guide or SAS/Jmp statistical computing package).

c. Develop and teach a course in undergraduate research. The number of undergraduate students majoring in statistics has increased dramatically in the last two years. To continue this growth, upper division courses that stress undergraduate research need to be developed.

d. As the number of undergraduate majors continue to grow, it would be advantageous to split some 4000/5000 level joint courses to be taught separately as individual 4000 and 5000 level sections. This separation would better meet the needs of both the undergraduate and graduate students.

2) . Graduate Teaching and Advising:

Over the last two years, we introduced two certificate programs in SAS data management and analysis, an undergraduate and a graduate version. Certification requires four statistics courses, one required and three electives for completion. The graduate version, which was implemented in the fall of 2010, has had over 50 graduate students take the required courses and 17 certificates have already been issued. We will attempt to develop online versions of the courses that will enable distance learners to receive the certificate.

Over the last few years we have begun to offer many new courses in modern areas of statistics. These include machine learning, statistics for neuroscience, statistical genomics, nonparametric statistics on manifolds and its applications, and object data analysis. We will continue to explore the possibility of expanding into new areas including financial statistics and data mining. Specifically, the following options will be considered in the next five years:

a. Develop a second SAS oriented course to follow STA5066, possibly as a special topic course that could be repeated for credit.

b. Offer online masters in statistics or biostatistics.

c. Develop curriculum for addressing statistical methods for collaborative research in genomics, proteomics and related high throughput research areas in biology and medicine.

d. Develop curriculum in financial statistics and statistical data mining, including a course suitable for the SAS certificate program. (SAS Enterprise Miner is probably the most used commercial data mining package.)

II. Undergraduate Students

4. Analyze the undergraduate headcount enrollment and identify significant trends and issues with which the program must address.

The department offers Bachelor Degrees in Statistics, which requires 10 classes for a total of 33 credits. The curriculum of the degree is listed in the following.

a). Required Courses - Math

Three of the ten required courses are from the math department. Each of these required courses is a four credit class:

- MAC 2311 Calculus I
- MAC 2312 Calculus II
- MAS 3105 Applied Linear Algebra I

MAC 2312 has MAC 2311 as a prerequisite and MAS 3105 has MAC 2312 as a prerequisite. So, these three courses are generally taken in a sequence over three semesters: MAC 2311 is taken first, then MAC 2312, and finally MAS 3105.

b). Required Courses - Statistics

The remaining seven required courses are from the statistics department. Each of these required courses is a three credit class:

- STA 3024 SAS Data Programming and Statistical Analysis
- STA 4442 Introduction to Probability OR STA 4321 Mathematical Statistics
- Five STA electives at the 3000 level or above.

Even though the number of undergraduates enrolled in statistics is still small, the department has had a rapid increase in undergraduate headcount in the last five years (Table 5).

Table 5. Undergraduate Enrollment in the last five years.

Fall Headcount	**2007**	**2008**	**2009**	**2010**	**2011**	**% 5-Year Growth**
Undergraduate	19	16	18	29	31	63.16
Double Majors	3	1	2	9	4	

The undergraduate headcount is also given on Page 4 of **Appendix-J** (Statistics Booklet 2012 prepared by the University). The double major headcount is given in **Appendix-K** (Statistics Dual Degrees Awarded).

The main issue of the undergraduate program in statistics is its small size, which is partially due to the fact that traditionally statistics has been considered a graduate degree. The short-term goal of the department is to increase the undergraduate enrollment in statistics to about 100 by 2018. Several efforts will be implemented to reach this goal.

5. What efforts are made by the program to recruit, enroll, and retain high-quality students?

The State of Florida in recent years has focused on creating jobs and wants to put more funding to the STEM (Science, Technology, Engineering, and Mathematic) disciplines in State Universities, which provide a very good opportunity for the department to recruit, enroll, and retain high-quality students in statistics. In order to attract more undergraduate students to the statistics major, we plan to continue and enhance the following efforts:

a). Enhance our recruiting effort online and off-line.

On the department webpage, the current advertisement reads:

> **Be a Statistician**!
>
> Why?
>
> The major at FSU requires a mere 10 classes for a total of 33 credits
>
> - Statistician ranks number 3 on the best jobs list for 2009 from JobsRated.com
> - Statistician ranks number 4 on the best jobs list for 2011 from JobsRated.com
> - Median starting annual pay of $48,600 for statistics majors is 11th best among all undergraduate degrees (2009 PayScale.com College Salary Report)
> - Many of the required statistics courses count toward the completion of a certificate in ***SAS Programming and Data Analysis***. Starting annual pay for a SAS programmer is ***$45,000 to $60,000!*** (PayScale.com)
>
> Don't take our word for it. Read the recent article about statisticians from the New York Times!

We will continue to monitor the news and professional outlets for illustrations of the rewards and societal impact of careers in statistics and to share these on our web site. Each year over 6000 students from different departments and colleges of the university take service courses in statistics offered by the department. Faculty and graduate students teaching these courses will continue to serve as ambassadors for our field, incorporating in their teaching the excitement and broad relevance of statistics and encouraging enrollment in our major.

b). Continue to enhance the undergraduate SAS certificate program.

Started in 2010, The Florida State University Department of Statistics and SAS Institute jointly offer a certificate in ***SAS Programming and Data Analysis*** for undergraduate students. The certificate is earned by taking courses from the Department of Statistics and by creating a portfolio of SAS projects.

To earn the certificate, students need to complete the following course

- STA 3024 SAS Data Programming and Statistical Analysis and any three of the following courses:
- STA 4202 Analysis of Variance and Design of Experiments
- STA 4203 Applied Regression Methods
- STA 4664 Statistics for Quality and Productivity
- STA 4702 Applied Multivariate Analysis
- STA 4853 Time Series and Forecasting Methods

Developing and implementing the undergraduate SAS certificate program is one of main reasons for the rapid increase of undergraduate enrollment in statistics. So far, 14 students have been awarded the certificate. In our short-term plan, we will attempt to develop online versions of the courses on the list that will enable distance learners to receive the certificate.

SAS Certificate Holders (Undergraduates)

2012

Jeremy Harper (Spring)
Shayeon Hawkins (Spring)
Johnny Petit (Summer)

2011

Nicholas Alicea (Spring)
Rashad Aziz (Spring)
Madanha "Brian" Chibdu (Spring)
Michael Cremisi (Spring)
Leila Harriss (Summer)
Kwame Jones (Fall)
Breyn Kowal (Spring)
Rebecca Newton (Spring)
Chris Nichols (Spring)
Myung Woon Sohn (Summer)

2010

Guillermo Galeano (Fall)

c). Develop and teach a course in undergraduate research.

As mentioned in our short and long-term strategic plan, we will develop and teach a course in undergraduate research for the purpose of attracting and retaining high-quality undergraduate students. Students in this course will be involved in faculty's research projects and apply statistical techniques they learn from class to solve real world problems. This will also better prepare students to write an undergraduate thesis in pursuit of the Honors in Statistics distinction.

6. Describe the mechanisms in place to provide academic advising to students. Are improvements needed?

The mechanisms in place to provide academic advising to our undergraduates involve several stages. Because Statistics is considered an upper-division major, a freshman will be assigned an FSU *Advising First* advisor. This advisor is not major-specific and helps to guide the student in fulfilling the university's liberal studies requirements and prerequisites for the student's selected major. The *Advising First* advisor normally works with the student through his or her first two years or equivalent. It should be noted that even though a freshman initially declares a Statistics major, he or she still primarily works with the *Advising First* advisor. Often with this process a student who has not declared a major can explore different possibilities through his or her coursework during these two years and then choose a Statistics major, minor, and/or certificate.

When a student attains or approaches upper-division (junior) status, he or she now is under the advisement of the Department of Statistics. These students include students who declared the major at the beginning, declared during his or her freshman or sophomore years, students having equivalent credit (e.g., AP or IB), or transfer students. At this point it is strongly suggested that the Statistics majors make an appointment with a faculty advisor to map out a tentative plan of study so that the requirements for the major may be completed in a timely basis.

Currently, Steven Ramsier serves as the undergraduate director of the department with Yiyuan She assisting. Both provide academic advising to students on course selection for the major as well as minors, the SAS certificate offered by the department, evaluation of outside institution course equivalency, and other issues related to requirements. Every FSU major including statistics has an academic map that must be adhered to in order that the student stays on a timely path in attaining the Bachelor of Science in Statistics. At the request of the student, the director performs a graduation check which is a proactive method of giving the major feedback as to whether they are on track according to the map before major difficulties may occur. Many advising issues involve student adherence to the map and often the advisors help guide the student to stay on or get back on track to meet the milestones specified in the academic map. If a student does not meet a milestone then an academic hold is placed on his or her registration and the undergraduate director must approve a course of action in consultation with the student. Under the approval of the director, holds can be lifted. This is done by the department's program assistant. The program assistant supports the advisors in other issues such as registering students into courses, increasing course caps so that majors can get a seat in a key course, and scheduling advising meetings.

Once a Statistics major has applied for graduation in his or her final semester, the director performs the director performs a graduation clearance consisting of a final evaluation that all departmental requirements will be satisfied by the end of the semester. Paperwork is filed and students who will not meet the requirements are notified. A similar process is in place for the awarding of our department's SAS certificate. Minors are evaluated at the college-level.

Improvement of this process can be made on several fronts. Unlike other departments which have a dedicated, full-time academic advisor, the Department of Statistics relies on faculty member to do the advising. The other responsibilities of the faculty often do not allow them to meet with students on a timely basis. This is especially true during orientation and departmental preview sessions. Since the number of Statistics majors has grown dramatically in the last few years, it is a frequent occurrence that a student showing up at the department office with no

advisor available with whom to meet. Having a dedicated advisor on staff would help to prevent such situations. Such an advisor could provide much better availability, assume the paperwork duties for mapping issues and graduation clearances, and keep a more proactive watch on students' progress. The faculty could then serve in more of a support role specific to the disciple of statistics.

Our long-term plan is to identify and encourage talented undergraduate Statistics majors to participate in research. We will match students with faculty according to research interests and engage students in faculty-supervised research projects. Broad involvement among the faculty will provide a well-rounded experience for students and help them gain insights into the possibilities a statistical career can produce. Our first step to this end is to propose an undergraduate research course in which students and faculty are encouraged to participate.

7. Present any international agreements currently in place. How are they consistent with the program's mission?

The department currently does not have any international agreements in place. In our short and long-term plan, we may consider to recruit international undergraduate students majoring in statistics from Asia and Europe. For example, establish a joint major or exchange-student program with universities in China and India.

8. What systematic efforts does the program use to ensure its students are placed well and receive university, regional, or national recognition?

One of the Department's objectives for our undergraduate education is stated in the following:

By completion of the program, undergraduate majors will have gained the knowledge of the theories of statistics and the ability to apply statistical methods including the use of statistical software so that they are able to use the skills they have learned in the job force (academia, government, or industry) or in graduate study.

To assess this objective the Department administers exit survey at the end of each term to those students graduating with the Bachelor of Science in Statistics Degree. Our goal for students who complete the program successfully is that we expect 80% or more to gain employment in a related field or to be accepted into graduate school. Often respondents are double majors with their primary major being something other than statistics but usually there is a key statistical aspect involved in their careers. Survey results for the five year period beginning with the fall of 2007 are summarized below:

- 2007-2008: Eleven out of the thirteen (84.6%) of graduating statistics majors responded to the exit survey stating that that they already have a job (8) or are going to graduate school (3). Two students failed to answer the question. The jobs included an AP statistics high school teacher, actuarial positions, a pharmaceutical position, and a financial industry position. All three students planning to attend graduate school were all in Statistics programs.

- 2008-2009: Six out of the seven (85.7%) of graduating statistics major respondents stated that they already have a job (2) or are going to graduate school (4). One student stated that he or she was uncertain about future employment. One student obtained an actuarial position and the other will service in the U.S. Navy. Three of graduate school enrollees planned to pursue further statistical studies while the other planned to go to law school.

- 2009-2010: Seven out of the eight (87.5%) respondents to the statistics major exit survey stated that they expect to be employed in the field (3) or go to graduate school (4). Fields of employment included actuarial work, aviation in the U.S. navy, and teaching in a public school. Three students planned graduate studies in Statistics while one stated that he or she was heading to graduate but did not indicate the program.

- 2010-2011: Seventeen out of the nineteen (89.5%) of graduating statistics majors respondents stated that they already have a job (7), are actively searching for a job in a statistically related profession (4), or are going to graduate school (6). Two left the response blank. Besides graduate school, the positions mentioned included jobs in the actuarial field, the military, testing preparation services, and the State of Florida.

- 2011-2012: Six out of the seven (88.9%) of graduating statistics majors responded to the exit survey stating that that they already have a job (3), are actively searching for a job in a statistically-related profession (1), or are going to graduate school (2). One left the response blank. The graduate school-bound students were going to Statistics and Biostatistics programs. The other positions mentioned included jobs as a SAS Programmer/Data Analyst, options analyst, actuary, and actuarial assistant.

In summary, over the five year period from the fall of 2007 to the spring of 2012, 47 out of 54 graduating statistics majors responding to our exit survey either expected to be employed in a statistically related job or planned to enroll in graduate studies. This translates into an 87% success percentages which has exceeded our goal.

To ensure our students placed well and receive university, regional, or national recognition, we will continue to enhance the following ongoing efforts:

a. Use statistical packages in our undergraduate courses teaching and enhance students' computing skills which are essential for finding jobs in today's technology-oriented market. For example, the undergraduate SAS certificate program, the first of its kind to be offered in a statistics department in nationwide, gives our graduates advantages in the job market. Several certificate holder have already found well-paid job as SAS programmers.

b. Develop and teach undergraduate research courses in order to get students involved in faculty's research projects. This effort will give our students the ability to keep learning after they graduate.

III. Graduate Students

9. Recruitment/Enrollment/ Retention/Graduation data for all graduate degrees

a). Comment on the size of the graduate program and any trends in the graduate program statistics. Does the program's size create problems, is program growth (or shrinkage) a goal? Is retention a problem?

The department offers Master and Ph.D. in Statistics and Biostatistics. In the last five years (2007-2011), the department experienced a rapid increase in graduate student enrollments, from less than 40 in 2005 to about 70 during in the last two years. The graduate enrollment numbers in the last five years are given in Table 6, with the total numbers listed in the last row of the table.

Table 6. Graduate Enrollment in the last five years.

Fall Headcount	2007	2008	2009	2010	2011	% 5-Year Growth
Masters (Statistics 119310)	8	6	9	12	12	50
Doctorate (Statistics 119310)	35	38	29	39	36	2.85
Masters (Biostatistics 119310)	4	2	4	4	4	0
Doctorate (Biostatistics 119310)	6	10	15	17	17	183.33
Professional	0	0	0	0	0	0
Total	53	56	58	72	69	38.88

As mentioned in the department's short and long-term goals, statistics is a fast growing major in the science and math area and statisticians are highly demanded in the current job market. The Department hopes to grow to a mid-size department with 18-20 faculty members and over 100 master and Ph.D. students by the year 2018. In order to achieve our mission of producing more master and Ph.D. level statisticians and creating more employable graduates in Florida, our long-term goal is to reach about 25 faculty members and over 120 master and Ph.D. students by 2023.

There is no real retention problem in our graduate program since our graduates are highly sought after by employers in academic and industry. However, the robust job market for statisticians has caused some of our graduates to leave with a masters degree rather than continuing for the PHD. All of our graduates in the last five year have found employment.

The small size of the faculty is the major problem for the department's growth. Contrasting to the quickly increasing teaching demand and number of graduate students, the department faculty lines has remained constant for the last 30 years. Lack of faculty members in the department results in reduced graduate courses and excessive numbers of PhDs directed by individual faculty. Additional faculty lines are essential for the department to reach its goals and to

enhance its ranking in the nation. The department needs to increase its faculty size by five before 2018 and 10 by year 2023 in order to increase our outreach within and outside FSU, enhance our profile in the community, increase research collaborations and productivity, and increase recruitment of high-quality graduate students.

b). Comment on the diversity of the student body (gender and ethnicity).

Table 7. Graduate Enrollment in the last five years by gender and ethnicity

Gender/Ethnicity	**Fall 2007**	**Fall 2008**	**Fall 2009**	**Fall 2010**	**Fall 2011**
Female	**22**	**24**	**23**	**29**	**26**
American Indian/Native Alaskan	0	0	0	0	0
Asia/Pacific Islands	0	2	2	4	5
Black	3	3	3	5	4
Hispanic	0	0	1	1	1
White	4	4	4	6	5
Non-Resident Alien	15	15	13	13	10
Two or More Races	0	0	0	0	0
Not Reported	0	0	0	0	1
Male	**31**	**32**	**34**	**43**	**43**
American Indian/Native Alaskan	0	0	0	0	0
Asia/Pacific Islands	2	3	4	5	4
Black	9	8	7	7	5
Hispanic	1	3	6	7	8
White	10	8	12	15	18
Non-Resident Alien	9	10	5	9	8
Two or More Races	0	0	0	0	0
Not Reported	0	0	0	0	0

Graduate enrollment by gender and ethnicity of the department in the last five years is given in Table 7. More detailed information can be found on Pages 3-7 of **Appendix-J** (Statistics Booklet 2012 prepared by the University). The diversity of the department's student body is appropriate. For example, among the 69 graduate students enrolled in 2011, 26 are female (38%), 18 are black or Hispanic (26%) , and 18 are international students (26%).

c). Describe how recruiting is done. Include recruitment documents (brochures, etc.) and/or address for materials posted on the web.

Our graduate student recruitment strategy is multi-faceted and has consisted, over the past five years, of the following components:

1) Providing application materials online and providing an attractive website (created, maintained, and updated by our Office Administrator Pamela McGhee.) At the top of the webpage is:

> **All graduate applicants should apply online at http://admissions.fsu.edu/graduate/**
>
> **The online application system will ask you for information that is needed both by our department and by the university. For a preview of what the department will need, please go to: http://stat.fsu.edu/graduate/redbook/Apply.php**

2) email and telephone contacts between prospective students who identified statistics as an interest area in the GRE database

3) email and telephone contacts between graduates of our department asking them to encourage their bright undergraduate students and, where there is no Ph.D. program, their M.S. students to apply to our program

4) inviting top candidates for campus visits

5) our faculty and undergraduate advisor recruiting FSU undergraduates

6) Statistics Day at FSU

Components 1)–5) have been the most fruitful for us, generating an average of 10 new students per year over the past 5 years, representing a talented and diverse mixture of national and international students.

We lose students to competing universities for a number of reasons. One of the factors we cannot alter is our location; some non-Florida applicants choose to study at institutions in their home states. Another main factor that has hurt us in the past is our relatively small size and some candidates prefer to choose programs with larger number of faculty thus more choices for his/her dissertation advisor. Finally, our student stipends are not always competitive with our peer universities.

The administration is well aware of the differences between U.S. and international students in the sciences. Typically, but not uniformly, students whose first language is English tend to do better in teaching situations such as recitations. However, the probability of continuing on to the Ph.D. is higher for an international student than for a U.S. student. The Statistics Department has benefited from the rich mixture of U.S. and international components. That mixture is also prevalent on our faculty and it adds vibrancy and diversity to our program.

d). If the department operates graduate certificate programs or offers large graduate service courses these should be described.

The department offers a SAS certificate program for graduate students, which is a factor in helping the department attracting more high-quality graduate students and increases our overall graduate enrollment.

To earn the certificate, you must complete the course STA 5066 Data Management

Analysis with SAS and any three of the following courses:

- STA 5168 Statistics in Applications III
- STA 5172 Fundamentals of Biostatistics
- STA 5206 Analysis of Variance and Design of Experiments
- STA 5207 Applied Regression Methods
- STA 5238 Applied Logistic Regression
- STA 5244 Clinical Trials
- STA 5666 Statistics for Quality and Productivity
- STA 5707 Applied Multivariate Analysis
- STA 5856 Time Series and Forecasting Methods

All of these courses are three credits. Students must earn at least a B- in all four courses. A student portfolio must be created from select assignments from each course. Upon completion of the coursework and review of a student portfolio, the student's transcript will reflect completion of the certificate.

SAS Certificate Holders (Graduates)

2012

Rachel Becvarik (Summer)
Benjamin Filip (Spring)
Felicia Griffin (Spring)
Richard Kropacek (Spring)
Gretchen Rivera (Spring)
Ryan Scolnik (Spring)
Ben Silva (Spring)
Tang Yuanyuan (Spring)

2011

Emilola Abayomi (Fall)

Jennifer Geis (Fall)
Ester Kim (Spring)
Michael Lugo (Spring)
Daniel Osborne (Fall)
Hyehyung Shin (Spring)
Felicia Williams (Spring)

2010

Kelly McGinnity (Fall)
Jonathon Moody (Fall)
Tamika Royal-Thomas (Fall)

10. Placement data, and other quality indicators of the graduate programs

a). Report on placement of masters and doctoral graduates for the past five years.

1). Ph.D. Graduate Placement

During the period 2007-2011, the department produced 46 Ph.D. students, which is a record number in the department's history (for example, compared this with the 14 Ph.D. in the period 1998-2003 for our last QER in 2004). Among the 46 Ph.D. awarded, 9 of them received their doctorate degree in Biostatistics and 37 received their doctorate degree in Statistics. The department is pleased with the placement of our graduating Ph.D.'s in the past 5 years (see Table 8 for Placement of Doctoral Recipients 2007-2011, dissertation titles, and major professors)**.** Indeed, for the entire 53-year history of the Statistics Department, placement of our graduating Ph.D.'s has been a source of strength and pride. Of the 46 Ph.D.'s who received their degrees in the period 2007-2011, 19 went into academic positions (including Ohio State University, Coastal Carolina University, Florida A&M University, Texas Tech University, Yale University, Winston-Salem State University, and others) and 27 went into industry and/or private consulting. All of these positions provides the opportunity for the graduate to use the techniques and methods studied in graduate school and to extend and develop new methods based on their training.

Appendix-I lists the placement of Doctoral Recipients 2007(summer)-2012(Spring), dissertation titles, and major professors, their publications and awards received.

2). Master Graduate Placement

Appendix-I lists the placement of Master Recipients 2007(summer)-2012(Spring), with Masters in Statistics listed in sheet one and Masters in Biostatistics listed in sheet two.

The department is pleased with our placement of M.S. graduates in the last 5 years. Of the 69 M.S. graduates in the period, fifty continued their study and went into our Ph.D. program. Of these, 26 received their Ph.D. in the last five years and 24 of them are still working on their

Ph.D. Nineteen of the 69 M.S. graduates left our program after their graduation. Eight found jobs in industry or government agencies, five went into Ph.D. programs at other universities, and for the remaining six we do not yet have their placement data. Generally, our M.S. graduates get challenging positions where they use statistics and/or programming skills.

b). Comment on the data on graduate student publications/creative works, presentations, awards, fellowships and other quality indicators.

We are very proud of the high-quality graduates produced by the department in the last five years. Many Master and Ph.D. students in the department have published papers throughout the duration of their study in the department or within two years after their graduation. Several faculty members have provided funds for their students' conference travels and presentations. **Appendix-I** lists the placement of Doctoral Recipients 2007(summer)-2012(Spring), dissertation titles, and major professors, their publications (based on information we collected so far), presentations, and awards received.

Some examples and highlights of our graduates' achievements are given below.

1). Sebastian Kurtek, Graduated in the Spring Semester of 2012
Affiliation: Ohio State University, Dept. of Statistics
Thesis: Riemannian Shape Analysis of Curves and Surfaces
Major Professor: Anuj Srivastava

Publications: Sebastian has a strong record in publication, including four papers published and three submitted articles by peer-reviewed statistical journals, and eleven papers published and one in review by peer-reviewed conference proceedings with very low acceptance rates.

Main Awards Won:

- Florida State University 2011-2012 Graduate Student Research and Creativity Awards which is awarded to only five outstanding students each year.
- Best Paper Award. IEEE Workshop on Mathematical Methods in Biomedical Image Analysis (MMBIA), Breckenridge, CO. January, 2012. Selected from 39 accepted papers.
- Runner-Up to the Francois Erbsmann Prize for best paper and presentation by a young researcher. Information Processing in Medical Imaging (IPMI), Irsee, Germany. July, 2011. Selected from 63 accepted papers.
- Yongyuan and Anna Li Award for best graduate student presentation, Florida State University Department of Statistics. May, 2011.
- Student Presentation Award Second Prize, Florida Chapter of the American Statistical Association. February, 2009.

2) Jianchang Lin, Graduated in the Spring Semester of 2012.
Affiliation: Millennium: The Takeda Oncology Company
Thesis: Semiparametric Bayesian survival analysis using models with log-linear median
Professor: Debajyoti Sinha

Publications: Lin, J., Sinha, D., Lipsitz, S. and Polpo, A. (2012). Semiparametric Bayesian survival analysis using models with log-linear median. ***Biometrics.*** (in press).
Awards won: 1) one of 20 winners for the Biometric Society's Students Travel Award Competition for 2011 Spring Meeting, 2) 2012 SBSS Student Paper Competition for research on Bayesian methodology sponsored by the Section on Bayesian Statistical Science (SBSS) of the American Statistical Association (Jianchang Lin has been one of 4 winners of this competition to receive cash prizes and funding to present his paper in 2012 JSM), and 3) one of 10 finalists of ASA Biometrics Section's 2012 David P. Byar Young Investigator Award, given to a young investigator for best emerging work to be presented at the JSM.

3) Daniel E. Osborne, Graduated in 2012
Affiliation: Florida Agricultural and Mechanical University
Thesis: Nonparametric Data Analysis on Manifolds with Applications in Medical Imaging
Professor: Victor Patrangenaru

Publications: Dan has one revised paper submitted at the Journal of Multivariate Analysis, two papers submitted at refereed journals, one refereed proceedings papers accepted and one paper published in the Proceedings of the 2011 Joint Statistical Meetings.
Awards won: M. Clinton Miller III Outstanding Poster Award at the Summer Research Conference 2011 (Southern Regional Council on Statistics and the American Statistical Association). Yongyuan and Anna Li Student Presentation Award of the Department of Statistics in 2012.

4) Leif Ellingson, Graduated in 2011
Affiliation: Texas Tech University
Thesis: STATISTICAL SHAPE ANALYSIS ON MANIFOLDS WITH APPLICATIONS TO PLANAR CONTOURS AND STRUCTURAL PROTEOMICS
Major Professor. Victor Patrangenaru

Publications. Leif has a strong record in publication, including one paper published and three submitted articles by peer-reviewed statistical journals, and one paper published in JSM proceeding.
Awards won: R.A. Bradley Best Dissertation Award in 2011.

5). Vernon Lawhern, Graduated in 2011
Affiliation: U Texas, San Antonio
Thesis: Statistical Modeling and Applications of Neural Spike Trains
Major Professor: Wei Wu

Publications: Vernon has three articles published in peer-reviewed statistical journals.
Awards Won: American Statistical Association - First Prize in Student Paper Competition, February 2009; 2010 Yongyuan and Anna Li Presentation Award - Given to the Graduate Student who delivers the best student colloquium.

6). Jon Norton, Graduated in 2008
Affiliation: FDA-Center for Drug Evaluation and Research
Thesis: Spatiotemporal Bayesian hierarchical models, with application to birth outcomes
Professor: Xu-Feng Niu

Publications: Jon has one paper published in the *Journal of American Statistical Association*
Awards Won: First prize of student paper competition in the ASA Florida Chapter 2007 meeting at the University of West Florida; and R.A. Bradley Best Dissertation Award in 2008.

7). Jianghua He, Graduated in 2007
Email: jhe@kumc.edu
Affiliation: Kansas University Medical Center, Department of Biostatistics
Thesis: Time-Varying Coefficients Models for Longitudinal Aging Data"
Professor: Dan McGee and Xu-Feng Niu

Publications: Wendy (Jianghua) He published two papers on her dissertation research.
Awards Won: Best First Year Student in Theoretical Statistics in 2004; First prize of student paper competition in the ASA Florida Chapter 2006 meeting at Jacksonville; and Yongyuan and Anna Li Student Presentation Award of the Department of Statistics in 2006.

c). Comment on any contact with or outreach efforts to alumni.

We remain in contact with our alumni in the following ways:

1) Send department newsletter to alumni annually and inform alumni of new developments in the department such as new faculty hired, awards received by our students and faculty, recent Ph.D graduates, and other news.
2) Hold an annual alumni dinner at the Annual Joint Statistical Meeting, usually in late July or early August.
3) In 2009, the department held its 50^{th} Anniversary Celebration Conference**.** Wei Wu and Xu-Feng Niu served in the organizing committee. More than 50 alumni came back and participated in the celebration and about 30 alumni presented in the conference. The conference was held on April 17^{th} and 18^{th} of 2009 and was very successful.

11. Curriculum

a). Comment on the currency and adequacy of the curriculum. Are there difficulties in course scheduling and availability, enrollments. Describe the faculty teaching loads.

The department offers the following degrees:

1) Combined Bachelor's/Master's Degree in Statistics.
2) Master of Science in Applied Statistics
3) Master of Science in Mathematical Statistics
4) Master of Science in Biostatistics
5) Doctor of Philosophy in Statistics

6) Doctor of Philosophy in Biostatistics

The curriculum of each degree is given in **Appendix-G** (Student Handbook), including a plan of study, core courses and possible elective courses. **Appendix-M** (Statistics Graduate Courses 2007-2012) presents the list of all the courses offered in the last five years, including when they were offered, name of the instructor, and enrollment in each course.

We are very pleased with the cutting edge directions that our graduate research and curriculum are pursuing. We regularly teach many advanced topics courses. Recent examples include modern courses on computational methods in statistics created and taught by Anuj Srivastava and Wei Wu, nonparametric statistics on manifolds and applications, and object data analysis by Victor Patrangenaru, high-dimensional data analysis and model selection by Yiyuan She, wavelets by Eric Chicken, machine learning and image analysis by Adrian Barbu, and Statistical Genomics by Jinfeng Zhang. Dan McGee, Deb Sinha, and Elizabeth Slate are teaching the biostatistics courses, including Applied Logistic Regression, Applied Survival Analysis, Longitudinal Data Analysis, Controlled Clinical Trials, Topics in Medical Consulting, Statistical Issues and Methods in Epidemiology, and Advanced Methods in Epidemiology.

The department has broadened its appeal by adding more applied program options. Major steps here have been developing a biostatistics program within the department and collaborating with other departments to develop interdisciplinary programs of study at both the masters and doctoral levels. Students have the opportunity for study in outside areas such as biology, meteorology, oceanography, financial mathematics, law, education, medicine, and computing. This provides unusual flexibility for a graduate student to work in a field of subject matter interest and focus on how statistics can be used to advance research in that discipline.

The masters programs of the department are designed to prepare a student for a professional career as a statistician in industry or government. The combined BS/MS degree in Statistics is designed for academically strong students who wish to pursue an accelerated program that culminates in receiving a Master of Science in Applied Statistics in five years. Undergraduate students may apply as early as the second semester of their sophomore year. The *Applied Statistics* option is a program that is aimed at developing applied statisticians or statistical consultants at the M.S. level. This program emphasizes statistical methodology and consulting.

With more of an emphasis upon probability theory and statistical inference, the *Mathematical Statistics* option prepares graduates to function as statisticians at the M.S. level, and is geared toward students wanting a foundation for continuing on into the Ph.D. degree program.

The Master of Science in biostatistics prepares graduates for employment in private, academic and public sector research and health care settings. The degree emphasizes the application of statistical principles, processes, and analytic methods to design, implement, and analyze health related studies including both experimental (clinical trials) and observational (epidemiological) studies.

Students in the PhD in Statistics degree program tailor their academic programs to be consistent with their individual career objectives. Programs can be designed to prepare graduates for careers in research and/or teaching, for careers emphasizing the application of statistics or for careers requiring the development of new statistical methodology. The major factor that distinguishes the doctoral from the master program in Statistics is its emphasis on preparing students for careers not only in the application of statistics but for careers requiring the development of new statistical methodology. Individual programs are designed to prepare graduates for careers in teaching and research in the academic, government, or corporate setting. Typically, students entering the graduate program without any prior graduate work in statistics begin by selecting coursework in the *Mathematical Statistics* option of the M.S. degree. Therefore, a *Mathematical Statistics* option M.S. degree or its equivalent is considered the precursor to the doctoral program. The program offers even greater flexibility for the student in pursuit of the doctorate in statistics. Concentrations are offered solely in the department in three areas: (1) probability theory and stochastic processes, (2) statistical inference, and (3) applied statistics. Students may also choose the interdisciplinary option, concentrating in an area outside the department. Therefore, the doctoral program is also distinguished from the masters program by having even a greater number of alternative directions in which a student may pursues his or her degree.

The Doctor of Philosophy Degree in Biostatistics prepares students for specialized careers in academia, industry, and government. Program graduates will find themselves sought after by employers in such varied areas as biotechnology, public health, pharmaceuticals, AIDS research, epidemiology, insurance, food sciences, and agribusiness. With an aging US population, the development of new drugs, and advances in the understanding of biological functions at the level of individual genes and proteins, the need for more people trained to design studies and analyze data from these research areas continues to increase.

The Doctor of Philosophy Degree in Biostatistics and in Statistics has seven common required core courses, listed in Table 8.

Table 8. Common Required Courses for Ph.D. in Statistics and Biostatistics

Course Number	Course Name
STA 5106	Computational Methods in Statistics **I**
STA 5166	Statistics in Application **I**
STA 5167	Statistics in Application **II**
STA 5326	Distribution Theory
STA 5327	Statistical Inference
STA 6346	Advanced Probability and Inference I
STA 6448	Advanced Probability and Inference II

The Ph.D in Statistics requires three other core courses:

1) STA5107 Computational Methods in Statistics **II;**
2) STA5168 Statistics in Application **III;**
3) STA6648 Advanced Topics in Probability and Statistics.

The Ph.D in Biostatistics requires three different core courses:

1) STA5179 Applied Survival Analysis;
2) STA5244 Fundamentals of Clinical Trials;
3) STA5934 Longitudinal Data Analysis.

The typical assignment of teaching load in the department for a faculty member is four courses per year and an aspiration assignment is three courses per year when the faculty member has outside funded research that supports at least one research assistant or when the faculty member directs five or more Ph.D. students. A junior-level tenure-track faculty typically receives teaching assignments in three-hour upper level undergraduate and lower level graduate courses with approximately 15 to 40 students and sometimes lower level undergraduate service courses with approximately 60 students. Lower level undergraduate service courses are either three- or four-hour courses. They are generally taught in large lecture format by the Associate in Statistics with supporting recitation sections, with a few 60 student sections being taught by graduate students. Senior faculty members normally are assigned to more advanced three-hour graduate courses with approximately 5 to 15 students. Senior tenured faculty members with decreased research productivity are often assigned an additional course to teach per year and/or additional service duties in the department.

As mentioned in our short- and long-term goals, the main difficulty in course scheduling and availability is the small size of the department. In contrast to the diversity of the degree programs offered, the rapidly increasing teaching demand and growing number of graduate students, the number of departmental faculty lines has remained flat for the last 30 years. The lack of growth in our faculty size results in relatively heavy teaching loads and reductions in the number of graduate courses. Several faculty members in the department are directing more than 5 Ph.D. students, which we feel is an excessive demand on their time. Additional faculty lines are badly needed if we are to pursue our goals of broadening our course offerings and attracting more high-quality graduate students.

b). Will distance learning play a role in your enrollment planning at either the undergraduate or graduate level?

We have taught STA 3032 as a distance learning course for eight years, and we have expanded our online and distance learning course offerings in our curriculum somewhat in the last two years. We plan to continue to build this capability in the future using a transition model for the process. We first transition our courses from a classical in-class lecture-only course to a web-assisted course that provides reinforcement of and supplements to classroom materials and then transition the web-assisted course into a fully online course offering. The online sections provide several features not available with in-class courses, among which is meeting the needs of students with scheduling problems as well as those students who are off campus.
To enhance our ability to offer online courses, particularly at the undergraduate level, we obtained funding to purchase a university-wide site license for the SAS/JMP software. The use of the software will greatly facilitate the teaching of introductory and non-major statistics courses both in-class and on-line.

In preparation for offering online sections, we developed extensive web-based learning materials using the JMP software (stat.fsu.edu/tutorials). The usefulness of this preparation is recognized by JMP. They provide a link to our materials on the JMP Software Learning Library homepage: (http://www.jmp.com/academic/learning_library.shtml)

So far, the expansion of our online offerings has included four courses. We have offered online sections of three courses: STA 2023 (Fall 2011, Spring 2012, Fall 2012), STA 3032 (Fall 2011, Fall 2012 and summers continually beginning 2004), and STA 5066 (Fall 2011, Spring 2012, Summer 2012, Fall 2012). STA 5238 is scheduled to include an online section in the Spring 2013 semester.

Last year 100 students enrolled in our online sections. For the academic year 2012-2013, we will at least double this enrollment and foresee the enrollment increasing annually beyond this as we offer additional online courses and the students become aware of the offerings. In preparation for expanding our online course offerings, we have done the necessary paperwork and received permission to teach several other classes online (STA 1013, STA 2122, STA 5206, STA 5207, STA 5666, STA 5702, and STA 5707). We additionally have submitted the necessary forms and are awaiting permission for STA 5172 and a proposed undergraduate upper division analogue to be offered online.

Currently, the department is short-handed and needs to add more faculty to offer different types of courses at the undergraduate and graduate levels. Over the next five years we plan to establish the capability for students to receive our graduate SAS certificate entirely through online courses. The same capability for the undergraduate SAS certificate will become available within the following two years.

12. Advising and professional preparation of graduate students

a). Explain how student advising is done.

1). Advisors and Committee Formation

Ph.D. students in the department are supervised by their major professors and committee. The advisor provides academic counsel to the student, advises the student in the preparation of a program of study (see below), and approves the program of study. At no time will a student be without a department advisor. Master's students and students who have not yet been admitted to PhD candidacy will be advised by a tentative advisor and the graduate director.

Students who have passed the PhD qualifying examination should choose a faculty member to direct their dissertation. This selection of a major professor is a decision based upon mutual research interests of the students and their major professors. The department webpage contains faculty information and indicates research interests. Students usually indicate their interests to the faculty member with whom they wish to work. Assuming the faculty member agrees, the student then forms a new supervisory committee to replace the one formed during their first term at FSU. Members of the doctoral supervisory committee are selected in consultation with the major professor subject to certain constraints. In addition to the major professor, the supervisory

committee must have at least three other members: two other faculty members from the department and a tenured faculty from outside the department. All committee members must have graduate faculty status. The composition of the committee will reflect the student's research interests and areas of concentration. The composition of the committee is flexible and may be altered at the discretion of the student. Approval of the doctoral supervisory committee by the department chair is required. The doctoral supervisory committee assumes responsibility for the student's academic advisement. It advises the student in the preparation of a doctoral program of study (see below) and must approve it.

Each year an assessment of the progress of the student is made by the student's Advisor and the committee. The entire committee conducts the PhD essay examination and the dissertation defense.

2). Program of Study

A student must have on file with the department an approved program of study at all times. This document represents an agreement between the student and the department delineating the course requirements the student must take to satisfy the requirements for a degree. The program of study may be amended at any time with the mutual consent of the student and their advisor. In preparing a program of study, the student must be aware of the degree and residence requirements established by the department and by the university.

These forms are available from the department secretary and the department webpage. The forms should be typed and signed by the student's committee members and by the department chair. The original is placed in the student's folder in the department office. A copy is made for the major professor who uses it in future course advising. The student is responsible for updating this document annually.

b). Describe the "milestone steps" in the degree program (diagnostic exams, preliminary exams, prospectus, etc) and how these are administered. What are the success rates on these exams?

The "milestone steps" in the Ph.D. program consist of Qualifying Examination, Essay Examination, and Dissertation Defense.

1). Qualifying Examination

This written examination is offered at the beginning of each spring semester. Doctoral students must take the examination on or before the spring semester of the second academic year of work in the department. The examination is prepared, administered and graded by the graduate student evaluation committee. This committee forwards student performance on the examination to the graduate director and department chair to be used in the student's annual evaluation .

The examination will be graded as passed or failed. Students pursuing the PhD who receive a grade of "failed," may retake the examination, one additional time, the following year. Copies of past qualifying exams are available.

The PhD qualifying exam is oriented toward problem solving. The material covered on the exam is taken from the first seven courses of the required core courses. Students intending to take this exam must register for STA 8964 for the spring semester. A student should register only once for this examination (and the dissertation defense). If the examination is not completed, a grade of "I" will be assigned until the examination is concluded. Upon successful completion of the examination, a grade change will be submitted assigning a grade of "P".

2). Essay Examination

After successful completion of the PhD qualifying examination, the student must begin to consider a suitable topic for a dissertation. As an intermediate step between the qualifying examination and the dissertation, PhD students are required to submit an essay that doubles as a proposal for a dissertation topic.

After consultation with the major professor, the student selects a topic and begins initial investigation of the topic to determine whether a thesis in the area is desired. Following this preliminary investigation, the student writes an essay that is limited to 30 typewritten pages. The essay contains:
(1). A literature review of the problem, stating what is known about it to date
(2). Some preliminary research results
(3). A plan for future research

Additionally, all PhD students will take an exam based on their essay. This examination is conducted in two parts.
(1). A 40-50 minute oral presentation of the student's essay given to the entire Department of Statistics.
(2). An oral examination by the student's supervisory committee. This part of the examination will immediately follow the seminar presentation. It is "closed door" and is conducted orally by the student's supervisory committee to determine success in formulating a research area and ability to do research in that area.

3). Dissertation Defense

The dissertation defense is the last department examination for a PhD candidate. This defense follows the same two-part procedure as the essay examination:
(1). A 40-50 minute oral presentation of the student's dissertation given to the entire Department of Statistics as part of the department's colloquium series. All members of the university's graduate faculty are invited to attend the seminar.
(2). An oral examination. This closed-door part of the thesis defense immediately follows the presentation and is administered by the student's supervisory committee.

Academic courtesy requires that the dissertation be submitted to each member of the supervisory committee and to the department chair at least four weeks prior to the date of the oral examination. Individual committee members may have their own requirements or policies regarding timing and it is the student's responsibility to ensure that each committee member's

requirements are met and that each member has an adequate opportunity to read the dissertation. The defense must be completed at least four weeks prior to the date on which the degree is to be conferred.

c). Provide statement on professional preparation of students for academic or non-academic roles including teaching and research.

To be prepared to take their places as professionals in academic or non-academic roles after they complete their degrees, graduate students must learn both technical and interpersonal skills while in graduate school. The Statistics Department addresses the technical preparation of our students in the wide range of statistics courses available to our students. Our department has uniquely positioned itself in the nation in the level of education it makes available to its graduate students in the interpersonal skills required to be an effective professional.

For the purpose of developing interpersonal skills during their study, students in the department are encouraged to participate in the activities of the Statistical Consulting Center of the department, which is a research assistance facility for the students, faculty, and staff at FSU. The Center is primarily run by students pursuing graduate degrees in the program. Consultants are supervised by the Center's faculty director, Steven Ramsier. The Statistical Consulting Center is a free service for members of the FSU community. When requested, clients from outside the FSU community are given at least a one-hour consultation if a consultant is available. The Statistical Consulting Center expanded its services in 2009 by holding walk-in hours to assist clients on a first-come first-serve basis. Currently, the Consulting Center clients consist mostly of graduate students in outside departments requiring statistical assistance with thesis work but have recently been expanding to serve outside faculty research with statistical support. Services include but are not limited to:

- Translating research questions and hypotheses into statistical terms
- Designing sampling procedures
- Choosing appropriate statistical methods
- Interpreting computer output
- Phrasing statistical results
- Referring clients to other statistical help

The most frequent statistical ideas used by students in the consulting center are t-tests, ANOVA, basic linear regression, logistic regression, Chi-square, factor analysis, power analysis, sample size calculations, and survey data analysis. The Consulting Center is able to advise clients concerning relevant functions of computer packages such as SPSS, SAS, and Excel, but does not perform a client's actual analysis.

The teacher development process in the department helps the students to develop invaluable interpersonal skills so that they can explain statistical principles to persons with a wide variety of backgrounds, under diverse conditions. More detailed information on teacher preparation may be found in Question 16 below.

The research activities that graduate students do either as a research assistant on a faculty member's grant or as a part of their own dissertation work serve to prepare our students for the research requirements that are a part of both academic and non-academic career paths. The weekly departmental colloquia also assist in this preparation by exposing students to many different researchers studying a wide variety of topics.

Our graduate students also make presentations in our colloquium series, as well as at the meetings of the Florida Chapter of the American Statistical Association and the Southern Regional Council on Statistics, when possible.

13. Resources for graduate training.

a). Explain how students are supported, comment on the fraction of students supported on personal funds, teaching assistantships and grants and fellowships. Give stipend levels and comment on how they compare with national averages and how student funding impacts the program's quality indicators. Are there trends in the support data over the last five years?

The department provides financial support for many of its graduate students. The two main ways in which students are funded are through teaching assistantships and research assistantships. In 2011, 53 of the 69 graduate students (77%) were supported by either TA or RA, while 16 of the students (23%) were supported on their own personal or governmental (international) funds.

The exact amount of graduate teaching assistantship stipends depends on the duties assigned with the amount of the stipend increasing as the duties become more advanced from grader ($12,600 Fall-Spring = $646.15 biweekly in 2011-2012), to recitation instructor ($14,700 Fall-Spring =$753.84 biweekly in 2011-2012), to instructor ($16,800 Fall-Spring = $861.53 biweekly in 2011-2012). The average stipend level in 2011-2012 is about $14,700 for the fall and spring semester, which is much lower than the national stipend averages around $17,817 in an academic year for graduate students in statistics (2011-2012 Graduate Assistant Stipend Survey, done by Institutional Research & Information Management, OKLAHOMA STATE UNIVERSITY.)

It is well known that the whole nation is suffering a financial crisis and economic slowdown with Florida as one of the worst hit states in the nation financially. The graduate stipend level of the department has not increased in the last 5 years. In addition, graduate students in Florida public universities have to cover their own medical insurance and pay academic fees. For example, student financial responsibility for Fall 2011 and Spring 2012 are $1,189.08 for Florida residents and $1,730.16 for non-residents. The low stipend level accompanied by the required payment of fees definitely impairs the department's chances of recruiting high-quality graduate students.

1). Types of Support

Teaching assistantships are the most common type of support. These are half-time appointments. Students are paid a salary in return for 20 hours of work each week during the fall and spring semesters. Limited teaching assistantships are available each summer.

Research assistantships are supported with funds from research contracts or grants, generally from agencies outside the university, held by department faculty. Students receiving such support assist faculty members with their research programs. Usually a student combines duties under this assistantship with their dissertation work, but the exact duties are established by the faculty member providing support.

In recognition of the differing degrees of responsibility of the above tasks, the amount of stipend provided to a student depends on the duties assigned. There are three levels of stipend in the department. The highest pay is reserved for students lecturing their own courses. The medium level is attained by those who teach recitation sections or work in the Statistical Consulting Center, and the third level is for the remaining students. Research assistant pay is determined by the faculty member supplying the salary.

Other avenues of support include competitive assistantships and fellowships available through the university and employment in other departments. For example, we usually have 2-3 students funded by the School of Medicine to assist on research projects there. More general types of support include loans and grants and are administered through the university's office of Student Financial Aid. We also support students through FSU's Program in Interdisciplinary Computing (PIC). For example, the department provided PIC three teaching Assistants in the Spring semester of 2012.

2). Restrictions on Support

Recipients of federal fellowships or traineeships or university fellowships must abide by the conditions of these awards. International graduate students must observe employment restrictions associated with visas issued. These regulations usually confine employment to appointments supportive of their field of study. Graduate students holding assistantships in the department or other units of the university must obtain permission for additional employment from the director of the project providing the assistantship, the faculty advisor or dissertation director, and the department chair. Any outside employment unrelated to the discipline or deemed to substantially lengthen the time to completion of the degree program may not be approved.

b). Provide statements on space facilities, equipment, library and other resources available to graduate students. Are there facilities and resources needed for students in the program that are not currently available or are difficult to access? If so, are their plans for obtaining these resources?

1). Space facilities

The Department of Statistics occupies the entire 2nd floor of the Oceanography – Statistics Building (OSB) and most of the first floor of OSB. (A suite of administrative offices consuming 736 sq. ft. on the first floor is occupied by the Department of Oceanography.) In addition, the college provides 4 more offices in the Biology unit-one building used for graduate student offices.

Our total space is adequate for the department's current size. But our assigned space location is

inadequate. The 4 graduate students' offices in the Biology unit-one building are about a five-minute walk to the OSB building, which is not optimum for the faculty and students to work together and not helpful for educational purposes, for research, and for creating a cooperative spirit.

In the next five years, our building space will not be adequate for a faculty of size 20, the number we need if the department is to compete successfully with other institutions. For example, North Carolina State and the University of North Carolina at Chapel Hill, two of our aspirational departments, have 47 and 22 statisticians, respectively. To accommodate 6 or 7 more faculty, the department would need more space.

2). Library Resources

The Statistics Department maintains the Frank Wilcoxon Memorial Library which serves as a study area and source of much of the historical statistical literature for faculty and students. Named in memory of chemist and statistician Frank Wilcoxon, who had a half-time appointment in our department form 1960 – 1965, this library houses books, journals, technical reports, and dissertations of department doctoral graduates.

3). Computing Resources:

Our most important equipment is our computers and related support systems. We have a variety of computing resources, managed by the department computer specialist James Stricherz. We have a total of 75 computers provided by the University in OCO releases, technology fee funds, and by faculty contracts and grants. These resources provide our students and faculty with extensive computing capabilities.

Table 9. Department of Statistics Computers

Windows (XP, Vista or 7)	65 (3.0 GHz Pentium 4 CPU thru Core i5 processors)
Linux	10 desktops and servers (Intel and AMD processors)

Of the machines listed in Table 9, we have seven that can be classified as servers, including two dedicated to teaching support. Additionally, we have 16 printers in offices for faculty and staff and 5 public printers for everyone including one color printer.

In addition to our computing resources, we have an excellent copier. It is a Toshiba e-STUDIO 720 digital imaging black and white copier, purchased in 2008. It does 3-hole punching, sorts, has a regular stapler and a saddle stitch stapler, it can handle 11 x 17 inch paper and has a large capacity tray so the staff does not have to add paper constantly. This copier is connected to our network so select people can send copy jobs directly to the copier from their computers. Additionally, this copier also doubles as a document scanner and can send the scanned documents to either a computer or via email to a recipient.

14. Faculty Research/Creative Activity

Faculty members in this department have a very strong record in research/creative activity. Faculty make significant contributions to research, maintain ongoing research projects, and disseminate the results of their research. This activity supports the instruction program through weekly colloquia, grants that fund graduate student positions in the department, and consulting projects in which students serve the needs of others while gaining practical experience in applying course content.

One example of our faculty's outstanding research is the achievements obtained by Anuj Srivastava in the last five years, who is head of the Department's Statistical Shape Analysis and Modeling Group and has been very successful in obtaining external grants. In the last five years Anuj and his CO-PIs received grant support over 1.5 million dollars. Besides receiving substantial external grant support, in the last five years Anuj was also very productive in paper publication, with 22 papers published in Peer-Reviewed journals, 36 papers appeared in Peer-Reviewed Conferences with Proceedings, and two book chapters. Anuj is an outstanding mentor for graduate students and junior faculty members. In the last five years he directed 6 Ph.D. students and received the University Graduate Faculty Mentor Award in 2008. One of the Ph.D. students he directed, Sebastian Kurtek, had three papers published or accepted and three submitted articles by peer-reviewed statistical journals, and nine papers published and one in review by peer-reviewed conference proceedings with very low acceptance rates. Under Anuj's supervising, Sebastian received several awards during his study in this department including the prestigious FSU 2011-2012 Graduate Student Research and Creativity Awards which is awarded to only five outstanding students each year.

Anuj's significant contribution to the field of computer vision is well recognized by the nation. He is a Senior Member of IEEE and was the Keynote Speaker, International Workshop on 3D Object Retrieval (in conjunction with ACM-MM conference) at Florence of Italy in 2010. He served as the Section Editor, Image Processing, Elsevier's Signal Processing References and the Guest Editor for Special Issue of IEEE Transactions on Pattern Analysis and Machine Intelligence on Shape Modeling (2009-2010).

Dan McGee's served as the department's chairperson in 2005-2011. The biostatistics program was established under his leadership and supervision during the period. Dan is a fellow of the American Statistical Association and of the American Heart Association Council on Cardiovascular Disease and an elected member of the International Statistical Institute. Dan has attracted graduate students in our program to do dissertation research. Several students who were inclined to stop their studies at the MS degree have decided to continue and work with Dan as a result of the excitement he has generated for research in Biostatistics. In the last five years, Dan directed and co-directed 13 Ph.D. students and he received the University Graduate Faculty Mentor Award in 2009. Besides heavy chair duties and teaching, Dan maintains his research program and continues to actively seek grant funding in the last five years. He was a co-investigator on numerous grant proposals to a wide variety of funding sources including the Veterans Administration, the National Institutes of Health, the American Diabetes Association, and FSU CRC grants. Recent proposals include a K-23 award and an ADA award (Dr. Kim Driscoll, PI) that will examine methods to improve monitoring the use of insulin pumps in

adolescents with Type 1 diabetes, a proposal for an interdisciplinary research award to the Patient Centered Outcomes Research Institute (Dr. Heather Flynn, PI), an ongoing R-01 funded by NIH to examine post-discharge adverse events (Dr. Dennis Tsilimingras, PI), and an ongoing R-01 (NIH funded) grant examining methods to prevent obesity in school children (Dr. Suzanne Johnson, PI) .

At the request of the Medical School, he is transforming one of our courses, STA 5172, to be suitable for online presentation to students in two of their programs, the Bridge Program (a graduate program to prepare students for entering Medical School) and the PhD in Interdisciplinary Health Sciences. The course, originally titled "Statistics for Epidemiology," was renamed "Fundamentals of Biostatistics," and the level made suitable for non-statistics majors. Dan also consults both at the University and in industry. Dan has an adjunct appointment in the Department of Biomedical Science and an office in the Medical School where he spends one day a week being available to provide statistical advice on call to the researchers there.

Under Dan's leadership and with substantial help from Steve Ramsier, the department in 2009 completed and received approval for two new certificate programs in SAS programming and data analysis, one at the undergraduate level and another at the graduate level. SAS is the most commonly used statistical data analysis software in the world. These two new certificate programs have helped to attract more undergraduate students to the statistical field and enhanced the job placement ability of our graduate students. Undergraduate student enrollment in the department has dramatically increased from less than 10 in 2005 to more than 35 in 2010 and 2011.

As another example of our outstanding faculty in research and creative activity, we would like to cite Deb Sinha who the department recruited in 2007 as the Ron & Carolyn Hobbs Endowed Chair/ Professor. Deb's main research interests are (1) Survival analysis; (2) Bayesian Biostatistics; (3) Modeling Cancer relapse and prevention data; (4) Cure rate survival data; (5) Longitudinal data; (6) Semiparametric empirical Bayes. Deb is a distinguished scholar in the statistical profession. He is Elected fellow in American Statistical Association (2006) and Elected fellow in the Royal Statistical Society, UK (1999). Deb is currently serving as an Associate Editor for Journal of the American Statistical Association (2005-present), Editorial board member (since 1999) for *Lifetime Data Analysis*, Springer-Verlag, and an Associate Editor for Biometrics (2008-present).

Since he joined the department in 2007, Deb's research productivity has been exceptional. In the last five years, Deb's research was supported by The National Institutes of Health (NIH) and National Cancer Institute (NCI). He published 31 articles in Peer-Reviewed statistical journals, including 3 papers in the *Journal of American Statistical Association*, 4 papers in *Journal of the Royal Statistical Society*, 4 papers in *Biometrics*, 2 papers in the *Annals of Applied Statistics*, and one paper in *Biometrika*. Deb directed five Ph.D. students in the last five years and his students have been publishing papers and receiving many rewards. For example, one of Deb's Ph.D. students, Jianchang Lin who graduated in the spring semester of 2012, received several national awards including being one of 20 winners of the Biometric Society's Students Travel Award Competition for 2011 Spring Meeting, the 2012 SBSS Student Paper Competition for research

on Bayesian methodology sponsored by the Section on Bayesian Statistical Science (SBSS) of the American Statistical Association (Jianchang Lin was one of 4 winners of this competition to receive cash prizes and funding to present his paper in 2012 JSM), and one of 10 finalists of ASA Biometrics Section's 2012 David P. Byar Young Investigator Award, given to a young investigator for best emerging work to be presented at the JSM.

15. Summary of the program's strengths and weaknesses

Graduate application, admission, and enrollment information in the last five years is summarized in Tables 10a and 10b. More detailed information is given in **Appendix-E (Enrollment and Completion Tables).**

Table 10a. Graduate Enrollment and Admissions Summary Data (2007-2011), Statistics

Year	Total # Applied	Domestic Applied	Total # Admitted	Domestic Admitted[(1)]	Total # Enrolled	Domestic Enrolled[(2)]
2007	136	12 (9%)	18	10 (83%)	8	5 (50%)
2008	90	13 (14%)	22	10 (77%)	5	3 (30%)
2009	101	13 (13%)	16	10 (77%)	7	6 (60%)
2010	133	20 (15%)	19	17 (85%)	12	11 (65%)
2011	112	22 (20%)	23	13 (59%)	11	7 (54%)

Table 10b. Graduate Enrollment and Admissions Summary Data (2007-2011), Biostatistics

Year	Total # Applied	Domestic Applied	Total # Admitted	Domestic Admitted	Total # Enrolled	Domestic Enrolled
2007	11	6 (55%)	6	6 (100%)	5	5 (83%)
2008	22	6 (27%)	7	5 (83%)	2	2 (40%)
2009	28	10 (36%)	11	7 (70%)	6	5 (55%)
2010	44	12 (27%)	8	7 (58%)	6	5 (75%)
2011	32	13 (41%)	6	6 (46%)	4	4 (67%)

Notes: (1): Domestic Admitted # / Domestic Applied #;
(2): Domestic Enrolled # / Domestic Admitted #;

A great strength of our department is the quality and background of our graduate students. Through the five academic years, 2007 to 2011, total graduate applications (completed applications) received ranged from 90 to 136 for statistics and from 11 to 44 for biostatistics, respectively, with an increasing trend observed in the biostatistics applications. On average about 14% of the applicants in statistics were U.S. citizens and 86% were international in origin. For the biostatistics program, on average about 37% of the applicants were U.S. citizens and 63% were international in origin. For the statistics program, on average 76.2% of the U.S. citizen and 7.5% of the international applicants were admitted. For the biostatistics program, on average 71.4% of the U.S. citizen and 7.6% of the international applicants were admitted. For

enrollment, on average 51.8% of U.S. citizens admitted in statistics enrolled in the graduate program over the past five years and 30.8% of internationals admitted to the graduate program in the statistics over the past five years. For the biostatistics program, on average 64% of U.S. citizens admitted enrolled in the graduate program over the past five years. In the last five years, only 2 of 21 enrolled in the biostatistics program were international students enrolled, which shows that the creation of the biostatistics program in the department is more beneficial to domestic students so far.

Our graduate program in statistics continues to attract top international students who excel in graduate coursework and research. We are also cognizant of the university's mandate to enroll a larger number of U.S. citizens into our program and have directed our admission considerations toward that goal. As the data reveal, we have a good track record of extending offers to the majority of U.S. applicants and more recently having the majority accepting the position. As the competition for U.S. applicants is intense, the data show that we are successful in enrolling students who submit applications. The challenge is to increase the pool of U.S. students who apply. Through the dramatic revamping of our program's applied track and the establishment of our biostatistics program, we have broadened the reach of the department to attract more U.S. applicants.

There are some tradeoffs relative to proportion of U.S. and international graduate students. In the program's coursework and research activities, we generally find international students perform at high levels but student evaluations of their work as classroom instructors in our undergraduate service courses tends to be lower than for U.S. students. There have been several notable exceptions to these general tendencies over the past five years. We think a proper balance must be maintained between U.S. and international students to meet both our program and service course objectives, and this remains a year-to-year challenge depending on the applicants. This also becomes an issue in job placement. U.S. citizens who have graduated from our program have had excellent job placement, which bolsters our department's reputation. With more restrictions on the placement of international graduates, there have been more variable results.

We are cognizant of the university's request to emphasize recruiting US citizens, for many reasons including the fact that it costs four times as much to support an international student than to support a US student. We compete intensely with the other US departments for strong US students. Our international applicants are excellent, especially from China and India.

16. Describe the teaching expectations and requirements for graduate students. How many classes do graduate students teach? When do they begin teaching? Discuss the extent and efficacy of graduate student instructional training and evaluation.

Graduate students play an essential role in the teaching mission of the department. Most of our graduate students are supported as Teaching Assistants and they are called upon to perform a combination of the following duties:
(1). Lecture in low-level statistics courses (STA 1XXX, 2XXX).
(2). Teach recitation sections of low-level statistics courses.

(3). Grade homework, projects, and exams for lower and upper level undergraduate and graduate level courses.
(4). Assist FSU students at the Strozier Library statistics help desk.
(5). Assist faculty with course-related tasks.
(6). Assist faculty in the Statistical Consulting Center.

Assignment of graduate students to differing duties is based on department need and student preference. There are several university requirements that must be met before a graduate student may teach. These requirements are set forth in the document, University-wide Standards for Teaching Assistants at Florida State University. This document is maintained by and available from the Office of Graduate Studies. Additionally, a TA must pass the departmental course *Teaching in the Discipline* before teaching. We also have a statistics teaching manual giving additional expectations for our TAs. This document is available online for our students in blackboard.

The department has a very extensive and effective process for graduate student instructional training and evaluation. Components of this process include a three day session before the fall semester that is designed to prepare graduate students for the basic challenges they will encounter as teaching assistants. Topics covered include:

a. service as a grader (first year or second year for international students),
b. service as a Help Room teaching assistant,
c. service as a recitation instructor (first year for domestic and second year for international students),
d. the course STA 5934: Becoming a Statistics Educator which focuses on helping recitation instructors develop additional skills, knowledge, and abilities so that they will be successful as solo instructors, and
e. service as solo instructors (usually second year for domestic students and third year for international students).

In the department, a graduate student eligible to be a solo instructor usually teaches two sections of STA 2023 Introduction to Business Statistics, or STA 2122 Introduction to Applied Statistics. Their performance is evaluated by the university teaching evaluation system each semester. In the department, graduate instructors are supervised and evaluated by Steve Ramsier, who is in charge of teaching assignments to graduate students, and Wei Wu, the Graduate Director of the department.

17. Describe the orientation process and the annual review process for new graduate students.

Each fall semester the department and the university host new graduate student orientation in the week before classes start. In the first day of orientation, Graduate Director and Chair of the department will provide new students information about the department. The first-day orientation in the department usually consists of the following parts:

- Department chair remarks
- Program requirements (Presented by the Graduate Director of the department)

- Course selection and basic advising (Given by the student's tentative advisor).

In the second day, FSU Graduate School will host its New Graduate Student Orientation. For example, this year the graduate school's orientation will be on Tuesday, August 21, 2012 in the New Classroom Building (HCB). The day's events will include a general orientation session led by Dean Nancy Marcus, a BBQ on the Union Green, and focused sessions in the afternoon on topics of interest, including *Funding Basics, Fellowships, Grants, and Awards* and *Steps to the Degree for Thesis/Dissertation Students.* Tours of the FSU Campus and Scholars Commons will be offered in the morning and an Informational Fair with tables from campus/community offices and organizations will run from 10:00 AM until 1:00 PM. In addition, the Congress of Graduate Students is organizing a tour of Tallahassee, which will take place after the last afternoon session and culminate in an evening luau.

On Wednesday and Thursday of the orientation week new graduate students in the department are required to attend a two day teaching conference for graduate student teaching assistants (TAs) conducted by the Graduate Schools' Program for Instructional Excellence (PIE). This conference is an orientation for FSU TAs and is free to participants. The focus of the conference is on policies and services of the University as they relate to teaching. In the conference TAs learn strategies, methods, and tools for teaching; understand the role of the TA as a student, instructor, and apprentice; learn about University policy issues such as academic integrity and sexual harassment, and have procedures in place to address such issues; and network with experienced TAs and FSU faculty.

In the last day of the orientation week, the department faculty will present their research to new graduate students for the purpose of increasing communication between faculty and students. The department Student Advisory Committee (SAC) will meet the new graduate students too in that day, provide advises to them, answer questions from their new friends.

Each year a graduate student progress evaluation is conducted. This is a review of the academic performance of each graduate student. Students are informed whether or not their progress is satisfactory and are expected to remedy any deficiencies noted. The review is used by the department chair in decisions pertaining to the continuation of students in the program. Students not making timely and satisfactory progress toward their intended degree will not be continued in the department. The review is performed by the graduate director or, for students admitted to PhD candidacy, their dissertation major professor and supervising committee.

VI. Faculty

18. Are there adequate faculty to ensure students, especially those with committees, receive adequate attention and ensure faculty have adequate time for research and creative endeavors? Does the program have an adequate number of faculty to teach its degrees, majors, and certificates?

As we summarized in Question 2, the major weakness of this department is a lack of faculty. In contrast to the diversity of our programs offered in statistics and biostatistics, the rapidly

increasing teaching demand and number of graduate students, the number of department faculty lines has remained constant (13 tenure-track members and 2 non-tenure track members) for the last 30 years (since 1981). Lack of faculty members in the department results in a reduced number of graduate courses being offered. Several faculty members in the department are directing more than 5 Ph.D. students and teaching 3 or more courses a year, which we feel is an excessive demand on their time and affects productivity. As a consequence of our small size, the department's NRC ranking has decreased in the last 30 year from one of top-10 program in the nation to its mid-thirty ranking in 2010.

As we proposed in our short- and long-term goals in Question 3, additional faculty lines are needed if we are to continue to increase our outreach within and outside FSU, enhance our profile in the community, increase research collaborations and productivity, and increase recruitment of high-quality graduate students. The department short-term goal is to become a mid-size department with 20 faculty members and over 100 master and Ph.D. students by the year 2018 and the department long-term goal is to reach 25 faculty members and over 120 master and Ph.D. students by the year 2023 (ten-year goal). Specifically, additional faculty members need to be added to the following areas of the department in the next five to ten years:

1). **Four to six additional faculty members are needed** to continue and enhance our programs in biostatistics. With these additional faculty we will be able to broaden our course offerings, attract more graduate and undergraduate students, create diversity in the research of our faculty, and provide research, consulting, and teaching supports to the Medical School, the Program in Epidemiology, Biology and other related areas.

2). **Two to three additional faculty members are needed** to continue and enhance our Statistical Shape Analysis and Modeling Group so that it becomes an established national center attracting both permanent and visiting faculty and creates additional research interests for our faculty, as well as our undergraduate and graduate students.

3). **Two to three additional faculty members are needed** to continue and enhance our Department's thrust into interdisciplinary research with other fields and departments and to strengthen our consulting services to the university and community.

4). **Two to three additional faculty members are needed** to continue and enhance our undergraduate and graduate teaching, including developing online and distance learning courses, undergraduate research courses, and online SAS certificate programs and masters degrees.

19. Discuss upcoming faculty retirements and the impact on the program. Report on the retention of faculty and the yield of recent recruiting efforts. How does the program ensure that there is an adequate, diverse, and talented applicant pool? Comment on faculty recruitment efforts and the philosophy towards the role of non-tenured and non-tenure track faculty.

The department lost 9 faculty members since its last review in 2003-2004. Five senior faculty of the department, Fred Leysieffer, Pi-Erh Lin, Doug Zahn, Jayaram Sethuraman, and Myles Hollander, retired during the period 2003-2007. In addition, we lost Ian McKeague to Columbia,

KaiSheng Song to University of North Texas, and Florentina Bunea and Marten Wegkamp to Cornell during the period 2004-2012. Our losses were at least partially due to salary differences and the deteriorating financial conditions in the Florida public university system.

With the help of both the administration and our loyal alumni in the last six years (2006-2011), we were able to add eight new faculty members: Victor Patrangenaru and Wei Wu in 2006, Adrian Barbu, Debajyoti Sinha, and Jinfeng Zhang in 2007, Yiyuan She in 2008, Elizabeth Slate in 2011, and Debdeep Pati in 2012. Among the eight new faculty, the two named professors, Debajyoti Sinha (Ron & Carolyn Hobbs Endowed Chair/ Professor) and Elizabeth Slate (Duncan McLean and Pearl Levine Fairweather Professor), were recruited with the help from our loyal alumni.

For new faculty recruiting, the department is committed to diversity. Women and minority candidates are particularly encouraged to apply. Candidates with interests in all areas of statistics are invited to apply. Candidates are required to have strong commitments to excellence in teaching and research. For example, in the 2011-2012 academic year, the department was authorized to recruit for one position at the rank of assistant professor. Total 132 candidates applied for the position, including fresh Ph.Ds and postdoctoral fellows. In the department, the Executive Committee (Eric Chicken, Dan McGee, Xu-Feng Niu, Elizabeth Slate, and Deb Sinha in 2011-2012) serves as the Search and Screening Committee. The committee members read the files of the candidates and with inputs from other faculty members each committee member chooses his/her top-five candidates to form the "short list" of the candidates. In the 2011-2012 recruiting process, seven candidates from Stanford, U. of Chicago, U. of Minnesota, Texas A&M, Purdue, Duke, and North Carolina U. at Chapel Hill were interviewed by the department. The department successfully recruited Dr. Debdeep Pati, a fresh Ph.D. from Duke University and definitely one of the top-ten candidates in statistics in the nation.

The department expects its non-tenured faculty members to contribute to teaching and service. Research Associate Steve Ramsier and Associate in Statistics Radha Bose, have exceptional records in teaching and services. Both have received outstanding teaching awards from the University.

In the next five years, the department does not anticipate more than one faculty member retiring. The main challenge the department will face is the retention of its current faculty and the recruiting of new faculty members.

20. What efforts are made by the program to mentor and support new faculty members?

In the department, non-tenure members have a lighter teaching load compared with tenured members, currently these faculty members teach two courses in each academic years in their first five years. For each non-tenured faculty member, the department assigns a senior faculty member as the mentor of the junior member to provide advises on publications, grant applications, and teaching. The current junior faculty and their mentors are: Debdeep Pati with Deb Sinha, Yiyuan She with Dan McGee, Jinfeng Zhang with Xu-Feng Niu, and Adrian Barbu with Anuj Srivastava.

Each year the department's FESIC (Faculty Evaluation and Salary Increase) committee carefully reads materials prepared by all faculty, documenting their annual productivity. During its annual meeting, usually held in February or March, the committee also discusses, in depth, the progress of non-tenured faculty members in terms of their research, teaching, and service. Based on this discussion, the committee makes recommendations to the chair on the general satisfaction with the progress of the faculty member toward achieving tenure. The chair then writes the review letter to the candidate taking into account the advice and recommendations of the FESIC committee. The chair presents the letter to the faculty member and answers any questions he/she may have. The letter from the chair becomes a part of the official record documenting progress toward tenure. Should the faculty member be nominated for promotion and tenure, these letters become a part of the promotion and tenure binder.

The third year review is the most important review for new, junior faculty. During the candidate's third year the committee and the chair spend more time reviewing the faculty member's progress and discussing the probability that the department will recommend them for tenure and promotion after two additional years. The procedure then follows that of all other years, described above.

For promotion and tenure, the department chairman in conjunction with the candidate typically selects 4 people for outside letters. The names come from a list suggested by the candidate and the department's Promotion and Tenure Committee. The criteria for choosing among the names are prestige in the field and knowledge of the candidate's work. We use the standard university letter to solicit a letter of recommendation. We expect to receive comments on the candidate's performance relative to his or her peers and a statement of whether the candidate would merit promotion and/or tenure at the writer's institution.

21. What systematic efforts does the program employ to ensure that faculty are nominated for appropriate university, regional, and national awards?

At the university level, FSU Faculty Awards Programs include
1) Named Professorships
2) Robert O. Lawton Distinguished Professor
3) Developing Scholar Awards
4) Distinguished University Scholar Awards
5) Distinguished Research Professor Awards
6) Honors Thesis Mentor Award
7) Graduate Faculty Mentor Awards
8) University Teaching Awards
9) University Undergraduate Advising Awards

The department executive committee and Chair nominate faculty for awards in 1) to 7) based on a faculty's evaluation and achievements. Awards in 8) and 9) are usually nominated by students who take the faculty's courses.

For example, Graduate Faculty Mentor Awards are sponsored annually by the Graduate School and this award honors faculty mentors whose dedication to graduate students and commitment to excellence in graduate education and mentoring have made a significant contribution to the quality of life and professional development of graduate students at Florida State University. Recipients shall have demonstrated outstanding mentoring practices and an overall commitment to graduate education at Florida State University. Anuj Srivastava and Dan McGee were nominated and received this award in 2008 and 2009, respectively. Fred Huffer and Xu-Feng Niu were nominated in 2010 and 2011.

At the national level, new fellows in statistical society are nominated by other fellows. For example, in the American Statistical Association (ASA), a person must be a current member of ASA and with continuous membership for three years in order to be eligible for nomination. The designation of Fellow has been a superlative honor in ASA for more than 90 years. According to the association by-laws, each year the Committee on Fellows can elect no more than one-third of one percent of the total ASA membership as Fellows. Individuals are nominated for the honor by fellow members and must have an established reputation and made outstanding contributions in some aspect of statistical work to be selected. In 2008 Xu-Feng Niu was nominated by Dan McGee and awarded this fellowship for his influential contributions to statistical methodology and application, especially time series and spatial statistics, environmental data analysis; and for service to the profession.

22. Analyze faculty productivity. (a) How is faculty productivity assessed by the program?(b) How does the program make assignments? (c) What is the availability of external funding to support faculty research? (d) Analyze doctoral supervision loads and their distribution among the faculty. To what extent are doctoral supervision loads equitable and sustainable?

(a). How is faculty productivity assessed by the program?

Faculty productivity is assessed each year by the department's FESIC (Faculty Evaluation and Salary Increase) committee based on publications, external grants, and other research activities. The committee reads materials prepared by all faculty, documenting their annual productivity during its annual meeting, usually held in February or March. Table 11 lists faculty's publications , presentations, and Ph.D. students directed in 2007(Summer)-2012(Spring). In term of publication, Anuj Srivastava and Deb Sinha have the highest productivity among our faculty members. Elizabeth Slate joined the department in 2011. Among the 31 peer-reviewed papers she published in the last five years, nine of them were published after she joined FSU.

Table 11. Faculty Productivity: Publications, Presentations, and Ph.D. Students Directed in 2007 (Summer)-2012(Spring)

Name	Peer-Reviewed journals	Peer-Reviewed Conferences	Proceedings	Book Chapters	Presentations	PhD students Directed And Co-directed
Adrian Barbu	7	17	0	2	11	0
Eric Chicken	13	1	3	1	2	3
Fred Huffer	6	1	1			7
Dan McGee	13					13
Xu-Feng Niu	6	1	3		3	10
Victor Patrangenaru	10	1	3		26	3
Debdeep Pati	2				11	0
Yiyuan She	9	1			16	2
Debajyoti Sinha	31				8	5
Elizabeth Slate	33	1			8	0
Anuj Srivastava	25	36		2	23	6
Wei Wu	13	2			20	1
Jinfeng Zhang	13	7	1		**9**	3

(b) How does the program make assignments?

The typical assignment of teaching load in the department for a faculty member is four courses per year but the assignment is three courses per year when the faculty member has outside funded research which supports at least one research assistant or when the faculty member direct five or more Ph.D. students or provides significant service to the department. Since 2008, non-tenured faculty members are teaching two courses per year in the first five years for the purpose of supporting these junior facultys' research and teaching development.

(c) What is the availability of external funding to support faculty research?

In the last five years, the Department has been very successful in obtaining external grant and contract support, with grants from NIH, NSF, NCI, NSA, Army Research Office, AFOSR, MSP, FDEP, and Florida Geological Survey. Table 12 lists funding activity of our faculty in 2007(Summer)-2012(Spring). We are happy to point out that the research of all our junior faculty members (Wei Wu, Adrian Barbu, Yiyuan She, and Jinfeng Zhang) are now supported by external grants.

Appendix-O (Excel file) lists the numbers of proposals submitted by faculty members (Sheet 1), numbers of proposals funded by federal agencies and state departments (Sheet 2), and the amounts awarded (Sheet 3) during the period from Summer of 2007 to Spring of 2012. Faculty in the department submitted 155 proposals in the period, with an average of 32 per year. Of the 155 proposals 87 were funded. The total amount of awards during the period was $9,887,690, with $4,405,442 for department faculty as PIs and $5,482,268 for department faculty ac CO-PIs. Using $500,000 PI amount as a benchmark, the major grant contributors over the past five years have been Anuj Srivastava and Deb Sinha. It should be noticed that J. Sethuraman contributed about $300,000 grant funding to the university as an emeritus professor of the department.

Table 12. Faculty Productivity: External Contracts and Grant Supports in 2007(Summer)-2012(Spring)

Name	Agency, Title, and Amount
Adrian Barbu	1. Barbu, A. G. (Aug 2011–Jan 2013). *SEE on a Unified Foundation for Representation, Inference and Learning.* Funded by DARPA. Total award $131,485. 2. Barbu, Adrian G. (PI). (Oct 2009–Sep 2010). *Cooperative Systems: Task Allocation for Heterogeneous A.* Funded by Florida A&M University. Total award $15,269. 3. Srivastava, Anuj (PI), Klassen, E. P., & Barbu, A. G. (Sep 2009–Aug 2012). *MCS: Research on Detection and Classification of 2D and and 3D Shapes in Cluttered Point Clouds.* Funded by National Science Foundation. Total award $400,000. 4. Barbu, Adrian G (PI). (Aug 2009–Apr 2010). *Landmark Detection Using Discriminative Anatomical Network and Active Random Fields.* Funded by Siemens Corporate Research. Total award $30,934. 5. Srivastava, Anuj (PI), & Barbu, A. G. (Apr 2009–Mar 2012). *Statistical and Semantic Approaches for Object, Activity and Intent Recognition.* Funded by University of Maryland College Park. Total award $317,084. 6. Barbu, A. G. (May 2008–Aug 2008). *Robust Classification Using Marginal Space Fusion.* Funded by FSU. Total award $16,000.
Eric Chicken	1. Sub-Contractor. Evaluation of the Impacts of Storm Surge Flooding on the Water Quality of the Nearshore Environment and on Coastal Aquifers in Sewered and Un-sewered Communities. Florida Department of Environmental Protection contract RM100, NOAA contract NA09N0S4190076. Total award $217K. (2010) 2.Co-PI. Using the Woodville Karst Plain as a pilot for establishing a hydrological observatory and a water data center based in Tallahassee. Florida Geological Survey contract GW258. Total award $685K. (2005 – 2008)
Dan McGee	1. Tsilimingras, Dionyssios (PI), McGee, D. L., Agens, J. E., Jr., Quintero, S. M., & Bellamy, G. R. (Sep 2011–Sep 2012). *Identifying Adverse Events After Discharge from a Commun*. Funded by Agency for Healthcare Research & Quality. (R01HS018694). Total award $491,568. 2. Rosado, Javier I (PI), Hernandez, A., McGee, D. L., Johnson, S. B., & LaJoie, S. N. (Jul 2009–Dec 2011). *A Measurement Of Obesity: BMI Screenings Across Two Sett*. Funded by Robert Wood Johnson Foundation. (NONE). Total award $74,266. 3. Johnson, Suzanne B (PI), Lynn, S., & McGee, D. L. (Apr 2009–Mar 2013). *Impact of School-Based Body Mass Index (BMI) Screening*. Funded by National Institute of Child He. (R01HD058869). Total award $2,129,035.
Xu-Feng Niu	1. Environmental Data Analysis and Statistical Consulting," Principal Investigator and Project Manager, Funded by the Florida Department of Environmental Protection. $174,250, 2007-2013. 2. Statistical Models for Predicting Resource Needs and Establishing Individual Budgets for Individuals served by the Florida Agency for Persons with Disabilities," Principal Investigator and Project Manager, Funded by the Florida Agency for Persons with Disabilities. $40,000, 2009-2010. 3.Toward Establishing a Research and Educational Center for Data Assimilation," Co-Principal Investigator, with XiaoLei Zou, Department of Meteorology. Funded by FSU Cornerstone Program, $100,000, 2005-2007.
Victor Patrangenaru	1. Patrangenaru, V. (Jul 2011–Jun 2014). *Collaborative Research: New Directions in Nonparametric*. Funded by National Science Foundation. (1106935). Total award $93,856. 2. Patrangenaru, V. (Jul 2008–Sep 2012). *Collaborative Research: Nonparametric Theory on Manifold*. Funded by National Science Foundation. (0805977). Total award $132,000. 3. Patrangenaru, Victor (PI). (Apr 2008–Apr 2010). *Statistical Analysis on Manifolds and 3D Surface*. Funded by National Security Agency. (H98230-08-1-0058). Total award $61,079. 4.Patrangenaru, Victor (PI). (Aug 2006–Aug 2007). *Collaborative Research: Statistical Analysis On Manifold*. Funded by National Science Foundation. (0652353). Total award $15,277.

Yiyuan She	1. National Science Foundation, CCF-1116447, CIF:Small:Collaborative Research: Compressed Sensing for Coherent Designs under Gaussian/Non-Gaussian Noise, 2011-2014, $251,000, PI (&Lead PI) 2. Committee on Faculty Research Support Award, Florida State University, 2010-2011, $14,000 3. First Year Assistant Professor Award , Florida State University, 2009-2010, $17,000
Debajyoti Sinha	1. CO-INVESTIGATOR (35%) 2012-2015: ACTIVE: Analyzing National Complex Sample Surveys for **Epidemiologic Studies of Cancer; Grant R01CA60679-01A1, Sponsor: National Cancer Institute** 2. Sinha, Debajyoti (PI). (Dec 2007–Jun 2013). *Deb Song Research Support*. Funded by FSU Foundation. (F00276). Total award $168,230. 3. Sinha, Debajyoti (PI). (Sep 2007–Jul 2012). *Semiparametric Bayesian Survival Analysis*. Funded by National Cancer Institute. (R01CA069222). Total award $822,263. 4. Co- investigator (25%) (2004-07), "Statistical methods in Cardio-toxicity Studies of AIDS Patients", Sponsor: National Institute of Health, Grant R01 AI060373-01A1. 5. Co-investigator (2006-7/2007), Source:NIH/NCI PI: C.Carter; "The Impact on Dragon Boat Racing on Cancer Survivorship"
Elizabeth Slate (After 2010) **Joined FSU in 2011**	1. Hill, E (PI), & Slate, E (FSU PI). (2012–2014). *Statistical Models for Multiplex Immunoassay Data in HPV-Related HN Ca Research*. Funded by National Institutes of Health, National Institute of Dental and Craniofacial Research. (R03DE021775). Total award $194,817. 2.Yao, H (PI), & Slate, EH (FSU PI). (2012–2017). *Integrating biomechanics and cell biology to understand TMJ pathology*. Funded by National Institutes of Health, National Institute of Dental and Carniofacial Research. (R01DE021134). Total award $1,974,625. 3. Bandyopadhyay, D (Co-PI), REICH, BRIAN J (Co-PI), & Slate, EH (Co-I/consultant). (2011–2012). *Robust Spatial Models for Clustered Periodontal Data*. Funded by National Institutes of Health/National Institute for Dental and Craniofacial Research. (1R03DE021762). Total award $300,000. 4. Bandyopadhyay, D (PI), Cai, B (Co-PI), & Slate, EH (Co-I/consultant). (2011–2013). *Robust nonparametric methods with variable selection for clustered dental data*. Funded by National Institutes of Health, National Institute of Dental and Craniofacial Research. Total award $300,000. 5. Kirkwood, K (PI), & Slate, EH (FSU PI). (2011–2016). *Post-transcriptional regulation of periodontal disease*. Funded by National Institutes of Health, National Institute of Dental and Craniofacial Research. (1R01DE021423). Total award $1,840,000. 6. Huang, Y (PI), & Slate, EH (Co-I). (2010–2011). *The Effect of Statin on Diabetes-Associated Periodontal Inflammation*. Funded by National Institutes of Health, National Institute of Dental and Craniofacial Research. (5R01DE016353). Total award $380,000. 7. Oates, J (PI), & Slate, EH (Co-I). (2010–2014). *Unique Biomarkers of Lupus Nephritis Pathology and Response to Therapy*. Funded by Veteran's Administration. Total award $600,000. 8. Yao, H (PI), & Slate, EH (Co-I). (2009–2011). *Biomechanical Characterization of Human Cartilaginous End-Plate*. Funded by National Institutes of Health, National Institute of Arthritis and Musculoskeletal and Skin Diseases. (1R03AR055775). Total award $146,961. 9. Yao, H (PI), & Slate, EH (Co-I). (2009–2011). *Biophysical Modeling of Fluid and Solute Transport in the TMJ Disc*. Funded by National Institutes of Health, National Institute of Dental and Craniofacial Research. (5R03DE018741). Total award $222,656.
	1. Srivastava, Anuj (PI), & Wu, W. (Jul 2012–Jun 2015). *A New Paradigm in Registration, Analysis and Modeling of*. Funded by National Science Foundation. (1208959). Total award $250,000. 2.Zhang, Jinfeng (PI), & Srivastava, A. (Jul 2012–Apr 2013). *Elastic Shape Analysis for Protein Structure Alignment*. Funded by National Institute of General. (R21GM101552). Total award $202,141. 3. Srivastava, A. (2012–2015). *RI Small Collaborative Research: Ontology Based Perceptual Organization of Audio-Video Events Using Pattern Theory*. Funded by National Science Foundation. (IIS 1217515). Total award $247,000. 4. Srivastava, Anuj (PI), Klassen, E. P., & Barbu, A. G. (Sep 2009–Aug 2012). *MCS: Research on Detection and Classification of 2D and*. Funded by National Science Foundation. (0915003). Total award $400,000.

Anuj Srivastava	5. Srivastava, Anuj (PI), & Barbu, A. G. (Apr 2009–Sep 2012). *Sparse Representation-Based Object And Activity*. Funded by University of Maryland Colleg. (Z891901). Total award $443,750. 6. Srivastava, A., & Barbu, A. (2009–2012). *Statistical and Semantic Approaches for Object, Activity, and Intent Recognition.* Funded by Office of Naval Research. (N00014-09-1-0664). Total award $450,000. 7. AFOSR FA9550-06-1-0324 (PI for FSU, Co-PI of the project) : 2006- 2011, $500K Title : Integrated Fusion, Performance Prediction and Sensor Management for Automatic Target Exploitation. Other Universities : Ohio State (lead), MIT, Boston Univ., and Univ. Of Michigan. 8. NSF Computing and Communicating Foundations (as Co-PI) : 2005- 2008, $470K PI : W. Mio, other Co-PI : X. Liu Title : Algorithmic Riemannian Geometry for a Statistical Analysis of Images 9. ARO Single Investigator Program (as PI) : 2004-07, $323K Co-PIs : X. Liu and W. Mio Title : Research on Statistical Shape Theory with Applications in Image Understanding. 10. ARO Workshop Grant (as PI) : 2006 - 2007, $21K Title: ARO Workshop on Challenges and Opportunities in Mathematical Image Analysis and Understanding
Wei Wu	1. NSF DMS-1208959, 07/2012 - 06/2015. $250,000, Anuj Srivastava (PI) and Wei Wu (Co-PI), "A new paradigm in registration, matching, and alignment problems in functional data", 2. NSF IOS-1146607, 03/2012 - 02/2014, $350,000, Frank Johnson (PI), Richard Bertram, Richard Hyson, and Wei Wu (Co-PIs), Title: "Spatial organization of a neural network for serial-order behavior". 3. NSF IIS-0916154, 09/2009 - 08/2012, $136,000, Wei Wu (PI), Title: "RI:Small: Statistical decoding models to improve the performance of motor cortical brainmachine interfaces". 4. NIH R01 DC002035, 05/2009 - 04/2011, $572,000, Frank Johnson, Richard Bertram, and Wei Wu (PIs), Title: "Cell survival in a neural circuit for learning". 5.) FSU COFRS Award, Summer 2009, $14,000, Wei Wu (PI), Title: "Neural decoding of hand motion using state-space models with hidden states". 6. FSU Planning Grant, 12/2007 - 11/2008, $12,000, Wei Wu (PI), Title: "Motor cortical decoding of target-directed hand motion". 7. FSU FYAP Award, Summer 2007, $16,000, Wei Wu (PI), Title: "Real-time adaptive decoding in motor cortex".
Jinfeng Zhang	1. Elastic shape analysis for protein structure comparison, PI, with Co-PI, Anuj Srivastava NIH 1R21GM101552-01, $368,278, 06/01/2012 -05/31/2014. 2.Chromatin structural changes linking drugs of abuse with HIV reactivation, Co-PI (PI: Dr. Jonathan Dennis, Biology, FSU), NIH 1R01DA033775-01, $1,769,229, 04/01/2012 – 03/31/2017. 3.COFRS, FSU, $16,000, 2010, PI. 4. FYAP, FSU, $16,000, 2008, PI.

(d) Analyze doctoral supervision loads and their distribution among the faculty. To what extent are doctoral supervision loads equitable and sustainable?

The numbers of Ph.D. students directed by faculty members in the period of 2007(Summer) to 2012(Spring) are given in the last column of Table 11. From the distribution, we can see that five senior members of our faculty directed about 80% of our doctoral students in the last five years, with Dan Mcgee directed and co-directed 13 Ph.Ds, Xu-Feng Niu directed and co-directed 10

Ph.Ds, Fred Huffer directed and co-directed 7 Ph.Ds, Anuj Srivastava directed and co-directed 6 Ph.Ds, and Deb Sinha directed 5 Ph.Ds. With the development of our junior faculty members such as Adrian Barbu, Eric Chicken, Yiyuna She, Wei Wu, and Jinfeng Zhang, the distribution of doctoral supervision loads in the department will become more equitable and thus sustainable in the next five years.

23. How are the efforts of non-tenure track faculty assessed?

Research associate Steve Ramsier and Associate in Statistics Radha Bose are non-tenure track faculty in the department. Their performance in teaching and service is evaluated annually by the department's Faculty Evaluation and Salary Increase Committee (FESIC). The evaluation process is the same as that for tenure-track faculty members.

24. How does the program supervise and train teaching assistants and adjuncts?

Teaching assistants training and supervising have been addressed in Question 16.

In the last five years, the department appointed 6 adjunct professors, five of them assist the department in research such as serving in Ph.D. students' supervising committees. None of the six adjunct professors taught a class in the department, however Professor Robert Clickner will teach two honors sections of STA2122 in the academic year 2012-2013.

Dr. Robert Clickner has an excellent research/teaching record. He received his Ph.D. in this department in 1972 under the supervision of J. Sethuraman. He was a tenured professor at Temple University from 1972 to 1979, where he directed three Ph.D. students. From 1981 to 1984, Robert was an adjunct associate professor at George Washington University where he taught graduate and undergraduate courses in statistics. Dr. Clickner recently retired from Westat, where he was an Associate Director and a senior statistician with more than 39 years of experience in the development, implementation, operations, and management of statistical and environmental research projects. Dr. Clickner has presented numerous invited papers before universities, professional and technical organizations, and international institutes. He has developed and conducted international workshops on methodologies for human exposure assessment field studies. Dr. Clickner has been a member of the Board of Councilors of the International Society of Exposure Science and is currently the co-chairman of the organizing committee for the 2011.

25. How is teaching effectiveness assessed by the program and what program efforts have been shown to improve the quality of instruction? Please use specific examples.

Teaching effectiveness of graduate students and faculty members in the department is mainly assessed by the university's teaching evaluations which consist of four sections:

- Section A. Student Information (4 questions);
- Section B. Course & Instructor Details (13 questions);
- Section C. Overall Course & Instructor Assessment (5 questions);

- Section D. SUSSAI (State University System Student Assessment of Instruction) (8 questions).

The teaching evaluations are conducted in each semester. Data of the evaluations for faculty and teaching assistants in the last five years are provided in **Appendix-C**.

For the three major service courses, STA 1013 Statistics By Example, STA 2023 Introduction to Business Statistics, and STA 2122 Introduction to Applied Statistics, we have received feedback from both students taking courses and instructors teaching them that students would prefer a more unified presentation of the course contend with less variation among the sections. We have addressed this by putting Steve Ramsier, Undergraduate Director of the department, in charge of the three courses. In addition, we have instituted large lectures in each of the courses with recitation sections. We have also instituted a pre-fall semester program to prepare our teaching assistants for teaching these sections. We observe our recitation instructors during the semester and help them to improve the effectiveness and efficiency of their sections.

V. Curriculum

26. Comment on the currency and adequacy of the undergraduate curriculum. Are there difficulties in course scheduling and availability? How are undergraduate students engaged in research?

To evaluate the currency of our undergraduate program, we refer to the "Curriculum Guidelines for Undergraduate Programs in Statistical Science" put forth by the American Statistical Association. Adhering to the guideline principles, our undergraduate curriculum provides great flexibility for statistics majors, minors, and outside majors accommodating a variety of student goals. We service undergraduates wishing to continue on to graduate school and prepare future business and government professionals to apply sound statistical principles in their work. Our curriculum not only provides a strong foundation in the theoretical aspects of statistics but also provides a rich experience in working with (producing, analyzing, and interpreting) data.

The skill set that we offer to the undergraduate statistics major aligns with the American Statistical Association guidelines. The major requires statistical topics (statistical theory, modeling, and design or studies), mathematical topics (calculus and linear algebra), probability, computational topics (programming and statistical software application), and non-mathematical topics (liberal studies including effective writing and presentation skills and collaborative teamwork). Majors also have opportunities to experience application areas as they are required to minor in another field of study.

Our department's undergraduate course offerings compare favorably to our peer and aspirational universities. An FSU student has the opportunity to get exposure to many statistical areas that are only taught at the graduate level at other institutions. These courses include nonparametric statistics, advanced computational statistics, quality control, applied multivariate statistics, and time series. Undergraduate courses not offered by our department that are offered by peer and aspirational universities appear mostly to be services courses that for the most part are offered by other departments at Florida State. These include actuarial science, econometrics, and statistics

in specific fields such as agriculture, social sciences, behavioral research, and physical sciences. A few programs offered a second mathematical statistics course and a linear models course, however most content in these courses overlaps with our course offerings. A comparison of undergraduate course offerings with two peer [Texas A&M University (TAMU), University of Minnesota (UMN)] and two aspirational [NC State University (NCSU),University of North Carolina (UNC)] universities is given below:

Undergraduate Course Offerings

FSU	TAMU	NCSU	UMN	UNC
Concepts	X	X	X	
Bus. Stat.		X		
Intro	X	X	X	X
Stat/Biology	X			
Intermediate	X	X	X	X
Engineering Stat.	X	X		
Comp. Stat. 1	X	X		
Comp. Stat. 2				
ANOVA/Exp. Dsgn.		X		
Regression	X	X		
Survey	X			X
Math Stat	X	X	X	X
Probability		X	X	X
Nonparametric				
Quality Control		X		
Multivariate				
SAS Data and Anal		X		
Time series				

Offerings Not at FSU	Stat for Ag. Stat for Soc. App. Problems	Behav. Res. Data Econ. Eng. Stat. 2 Prob. Phys. Sci. Math Stat 2	Math Stat 2	Actuarial

Because most of our objectives for service courses center on statistical reasoning, graduate teaching assistants become exposed to a broadened approach to teaching statistics. For many graduate teaching assistants this involves a paradigm shift from a purely mathematical focus to a bigger picture of statistical application. We believe this will serve our graduate teaching assistants well later in their professional careers.

A large number of undergraduates in service courses are taught in large-lecture formats by experienced, award-winning instructors. The large-lecture courses have weekly one-hour recitations facilitated by graduate teaching assistants. This provides a more consistent level of instruction and allows more time for the graduate teaching assistants to perfect their teaching craft under the guidance of the more accomplished instructors. The recitation sessions also allow closer supervision by the lead instructor and provide an excellent opportunity for instructional improvement.

We have created a "3+2" program to enable our undergraduate majors to earn the BS and MS degrees in Statistics in five years.

In addition to course work, our undergraduates have access to the Statistical Shape Analysis and Modeling Group and the Statistical Consulting Center.

The faculty make a concerted effort to recruit our superior undergraduates for our graduate program. As is to be expected, some students wish to go elsewhere for graduate studies but the department has had a good track record of retaining talented undergraduates from our program.

All 3000- and 4000-level courses are taught by faculty in the department. STA 2023, and 2122 are taught in large lecture courses by our Associate in Statistics Radha Bose and Research Associate Steve Ramsier, with recitation sections taught by graduate student teaching assistants. With increasing demand for these courses, we ask experienced TAs to teach sections of 60 students. Such TA's have had experience as recitation instructors and have benefited from additional training via the Teaching Workshop held in the springs, originally developed by Doug Zahn (retired) and is currently facilitated by our teaching faculty.

27. To what extent is distance learning used to deliver courses?

This question has been addressed more fully in Question 11 (b) above, but to summarize, many of the graduate courses in the graduate SAS certificate have been implemented or are currently under development for distance learning. Several undergraduate service course and SAS certificate course have been approved with one currently being implemented and the others planned to be rolled out in the next few semesters.

28. How does the program relate to other teaching and research units on campus? Consider units that the program currently interacts with as well as other units with which there may be potential for interaction. Are program offerings spread too broadly over different majors, certificates, or other activities?

One of the teaching and training options offered by the department is an interdisciplinary option in the PhD program. This has been successful. In recent years we have graduated PhD students who have exercised the interdisciplinary option in economics, epidemiology, finance, and psychology. In the last five years, seven PhD students wrote their dissertations in the interdisciplinary option. They are Muffasir Badshah, Zhi Li, Moeti Ncube, Anqi Tang, and Feng Zhao in Finance, Kunle Olumide in Law, and Jihyung Shin in education. Two students

(Xue Huang and Steve Chung directed By Xu-Feng Niu) are currently pursuing the interdisciplinary option in Finance.

We have worked closely with the biology department to create a course for undergraduates: STA 2171 Statistics for Biology. We also have worked closely with the psychology department to modify STA 2122, Introduction to Applied Statistics, to better suit the needs of their undergraduates.

The department currently is enhancing and broadening our program in biostatistics to

- Enhance the scope of our research and attract strong students and faculty,
- Support research in the FSU School of Medicine, and
- Support a new program in epidemiology being developed in the College of Social Science.

We have developed an interdisciplinary institute, the Statistical Shape Analysis and Modeling Group led by Anuj Srivastava, in which joint research is done by faculty and graduate students from statistics, mathematics, and computer science.

The Statistical Consulting Center is a resource to the university. It provides consulting support to graduate students and faculty across the university for Masters theses, PhD dissertations, and faculty research projects, with the goal of enhancing the quality of the statistical work done in all these projects.

There is also extensive collaboration of the statistics faculty on research projects with faculty in other departments, including Eric Chicken with the FSU Geophysical Fluid Dynamics Institute, Dan McGee, Deb Sinha, and Elizabeth Slate with the medical school, XuFeng Niu with Biology and Meteorology, Victor Patrangenaru with Computer Science, Anuj Srivastava with Computer Science and Mathematics, Wei Wu with Psychology, and Jinfeng Zhang with Biology.

29. If applicable, how does the program monitor and assess the performance of the program's instructional efforts at the Panama City, Florida, campus?

Not applicable. The department has not been involved in the instructional efforts at the Panama City, Florida, Campus, in the last five years.

30. To what extent do doctoral students and adjuncts support the teaching mission of the program?

The primary goals of graduate assistants' contribution to the teaching mission are to enhance the teaching productivity of the department, to meet FTE targets, to maintain effective levels of instruction in undergraduate service courses, and to develop their instructional skills so that they may advance in their profession.

In the last five years, Associate in Statistics Radha Bose and Research Associate Steve Ramsier have assumed a co-leadership role in the teaching and coordination of two of our large lecture service courses: STA 2122 "Introduction to Applied Statistics" and STA 2023 "Fundamental Business Statistics". An objective of large-lecture formats is to provide a more consistent level of

instruction and allow direct mentoring of graduate teaching assistants as they assist the large-lecture students with weekly one-hour recitations. For example, the classes Radha taught in 2011 Spring and Fall semesters were:

(1) STA 2023 – 1 x 12 sections Spring 2011 enrollments 495
(2) STA 2122 – 1 x 6 sections Spring 2011 enrollments 244
(3) Teaching in the Statistics Discipline Workshop (co-led with Dr. Ramsier) Spring 2011 enrollments 15

(4) STA 2023 - 1 x 12 sections Fall 2011 enrollments 486
(5) STA 2122 – 1 x 6 sections Fall 2011 enrollments 250
(6) STA 2023 – 1 online section Fall 2011 enrollments 17

The senior, Ph.D.-level, Research Associate (Steve Ramsier) also contributes by teaching upper-level undergraduate and graduate courses, thus providing the department added flexibility in offering courses that benefit students.

In the last five years (2007-2011) we have not had adjunct professors teach courses. However, supported by the college, Adjunct Professor Robert Clickner will teach two honor sections of STA2122 in the academic year 2012-2013.

VI. Resources

31. Analyze the adequacy of the physical facilities utilized by the program.

Physical facilities utilized by the program have been addressed in Question 13, part b): Provide statements on space facilities, equipment, library and other resources available to graduate students. Are there facilities and resources needed for students in the program that are not currently available or are difficult to access? If so, are their plans for obtaining these resources?

32. Identify any programmatic concerns with information technology.

In recent years the department has been upgrading its information technology supported by technology fees from the college and university. For example, in 2011 the department received $13,810.28 from technology fee funds to create two computer training labs in OSB 214 and 205. The computer training labs allow students to use their own laptops in the classroom/lab. They are now used as classrooms for online classes and when not used for teaching they function as computer help rooms where students may come for help with installing statistical software and their coursework that uses this software. Both rooms are currently set up for screen capture (OSB 215 is also set up for full video capture). In the spring semester of 2012, the department submitted a proposal to the college and requested funds to purchase equipment that enhance online teaching classrooms OSB 205 and OSB 215, which was also approved.

There are not any programmatic concerns with information technology in the department now.

33. How adequate are the library resources to support the program? Identify "gaps" in holdings and/or databases.

This question has been addressed in Question 13, part b): Provide statements on space facilities, equipment, library and other resources available to graduate students. Are there facilities and resources needed for students in the program that are not currently available or are difficult to access? If so, are their plans for obtaining these resources?

34. How does the program support (stipend, health insurance supplements, travel to meetings, etc.) is provided to graduate teaching and research assistants compare to other comparable programs? To what extent are contract and grant and private dollars available to supplement state support? Analyze and identify any issues that the program must address.

As mentioned in question 13, the graduate students' average stipend level of the department in 2011-2012 is about **$14,700** for the fall and spring semester, which is much lower than the national stipend averages around **$17,817** in an academic year for graduate students in statistics.

It is well known that the whole nation is suffering a financial crisis and the economic slowdown in Florida has been one of the worst in the nation. The graduate stipend level of the department did not increase in the last 5 years. In addition, graduate students in Florida public universities have to cover their own medical insurance and pay academic fees. For example, student financial responsibility for Fall 2011 and Spring 2012 are $1,189.08 for Florida residents and $1,730.16 for non-residents. The low stipend level hurts the department's chance to recruit high-quality graduate students.

Due to the recent years' financial crisis in the nation, the current levels of funding for the department operational budget and infrastructure support are of grave concern. The department operational budget decreased from about $75,000 to $45,000 over the last five years due to the financial crisis, while the number of graduate students in the department increased from less than 40 to about 70 during the same period. The department is facing tremendous difficulties under these constraints and is only able to partially support a student attending a national conference in their graduation year (up to $500). Students' travel to meetings in the last 5 years were mainly supported by faculty's contracts and grants. For example, Debajyoti Sinha and Anuj Srivastava often supported students under their supervision attending national and international meetings in the last five years.

35. Analyze the implications of class size in this program for the educational experiences of the students and the instructional challenges for the faculty.

In the department, STA 1013, 2023, and 2122 are taught in large lecture courses by our Associate in Statistics Radha Bose and Research Associate Steve Ramsier, with recitation sections taught by graduate student teaching assistants. On occasion when the demand for one of these courses is very large, we ask an experienced TA to teach a section of 60 students.

Instructional challenges of teaching large undergraduate classes are overwhelming. Radha Bose and Steve Ramsier have made major contributions to the undergraduate teaching in our department, improving both the content and delivery. They are clearly very effective in planning, organizing, and managing the teaching of three large lectures with more than 20 recitation sections and directing the efforts of 6-9 teaching assistants each semester. They have continually sought to improve not only their own teaching, but also that of the entire department. They have continued working to improve the syllabi in our undergraduate service courses to make them more student-friendly by avoiding any ambiguity permitting all students to have a clear understanding of what to expect in each course. Their class notes has been extremely successful in raising attendance and participation as well as raising the amount of time spent on completing tasks outside the classroom. This system has been so popular that it has also served to raise student grades and to bring in higher student evaluations.

For graduate teaching, one main problem is teaching undergraduate/graduate combined courses due to diversity of our programs and small faculty size. Since students from different levels and departments have different backgrounds in statistics, it is quite hard to meet the demands of all students in the classes. In the last five years, several faculty members got low students' evaluations when they taught this kind of courses, partially due to lack of teaching experience. In our short and long-term goals, with increases in the number of faculty we propose to split some 4000/5000 level joint courses to be taught separately as individual 4000 and 5000 level sections. This separation would better meet the needs of both the undergraduate and graduate students.

VII. Assessment

36. How has the program compiled and used feedback from students, alumni, and employers? To what extent does the program use this information to make curricular and programmatic changes?

In 2003, we did a survey of the students who have graduated from our program since 1997. We have conducted a survey this year for updated information from our students, alumni, outside reviewers. The survey results are given in Appendix-H1 (Surveys of current students, graduates, alumni)

Although the number responding in the 2003 survey was small, responses are informative and helpful. For example, we have taken steps to improve our course offerings, partially due to student requests and partially due to supporting our thrust in Biostatistics. Students have requested more emphasis on applications, including courses on applied survival analysis and clinical trials. We now have such courses. Students have expressed a desire for more hands on data sets which are now quite prevalent in our courses, including the several biostatistics courses designed and taught by Dan McGee and Deb Sinha. Students have requested more familiarity with computer software and corresponding increases have been made; for example more use of R/Splus and SAS in Dr. Niu's Statistics in Applications, I, II, III and use of SAS in Dr. McGee's Statistics in Epidemiology, Applied Survival Analysis, Clinical Trials, Applied Logistic Regression, Topics in Medical Consulting, and Advanced Methods in Epidemiology.

37. Consider the findings and recommendations from the previous self-study. How did the program address previous findings and recommendations? What are the significant changes in the program since the previous review?

In our last self-study done in 2003-2004, we identified the following six main challenges faced by the department:

1) *The first challenge is to replace the five senior faculty who have or will soon retire. A related challenge is to create new faculty positions in order to do more than maintain the status quo. We will need the help of both the administration and our loyal alumni to accomplish this. As we have indicated in various parts of this report, we are competing with various departments like the University of Florida that has 41 faculty compared to our 15. Additional faculty are essential to the growing of a dynamic department that is ascending in the NRC ranks.*

Five senior faculty of the department, Fred Leysieffer, Pi-Erh Lin, Doug Zahn, Jayaram Sethuraman, and Myles Hollander, retired during the period 2003-2007. In addition, we lost Ian McKeague to Columbia, KaiSheng Song to University of North Texas, Florentina Bunea and Marten Wegkamp to Cornell during the period.

Only five faculty members remain in the department from our previous review in 2003-2004: Eric Chicken, Fred Huffer, Dan McGee, Xu-Feng Niu, and Anuj Srivastava. With the help of both the administration and our loyal alumni in the last five years, we were able to add eight new faculty members: Victor Patrangenaru and Wei Wu in 2006, Adrian Barbu, Debajyoti Sinha, and Jinfeng Zhang in 2007, Yiyuan She in 2008, Elizabeth Slate in 2011, and Debdeep Pati in 2012. Among the eight new faculty, the two named professors, Debajyoti Sinha (Ron & Carolyn Hobbs Endowed Chair/ Professor) and Elizabeth Slate (Duncan McLean and Pearl Levine Fairweather Professor), were recruited with the help from our alumni.

As discussed in the department's short and long-term plan in this study, additional faculty lines are badly needed for the growth of the department in the next five to ten years and for improving the national ranking of the department.

2) *An important activity for the department is to develop the biostatistical program to ride the momentum that Dan McGee has created by coming here with NIH grants and by creating of several new biostatistical courses. Biostatistics is a burgeoning field that is attracting many Ph.D. and M.S. graduates. Dixon and Legler (2003), in a recent article in <u>STATS</u> (Dixon, D. and Legler, J., "Careers in Biostatistics: High Demand and Rewarding Work", 37, 3-7, 2003), describes the high level of demand for biostatisticians and the importance of the subject to our society and nation. The American Statistical Association (ASA), founded in 1839 and currently with over 16,000 members, has a section on biometrics and a section on biopharmaceutical statistics. These are two of the largest sections in ASA. Figure 1 of Dixon and Legler (2003) plots the number of employment positions advertised in <u>Amstat News</u> (the membership magazine of ASA) during the years 1990-1994. The data are from DeMets et al. (1998) (DeMets, D.L., Woolson, R., Brooks, C., and Qu, R., "Where the Jobs are: A Study of <u>Amstat News</u> job*

advertisements, The American Statistician, 52 (4), 303-307, 1998). The plot shows an increasing trend in the academic and industrial sectors. That trend continues to date. Dixon and Legler (2003) note that in the period 1990-1994 most of the Ph.D.-level positions were in academia with 29% in biostatistics and biometrics. Dixon and Legler report that in the October 2002 issue of Amstat News, there were ads for approximately 90 Ph.D. positions in statistics, of which 48 were for biostatistics. In the June, 2003 Amstat News, the following organizations advertised for biostatisticians: AMGEN, Baylor College of Medicine, Baylor Research Institute, Bristol-Myers Squibb, The Cambridge Group, Emory University, George Washington University, IMS Health, IVAX, Marshfield Clinic, Mayo Clinic, Merck Research Laboratories, NIH/NCI, Ohio State University, Roswell Cancer Institute, Royal Group of Hospitals, Smith Hanley, Stata Corporation, Takeda Pharmaceuticals, University of Miami, University of Pittsburgh, and Wake Forest University School of Medicine. As an illustration of the current prominence of biostatistics in the profession and workplace, in the academic year 2002-03, the Department of Statistics at Florida State had six Ph.D. students earn their degrees. Four of these six students have accepted a position that features work in biostatistics and medical consulting. Their positions are at the Kansas University Medical School, Medtronic, University of East Carolina, and the University of Rochester.

The department established its Biostatistics Master degree in 2006 and Biostatistics Ph.D. degree in 2007, which is a milestone of the department's program development. The two new programs are the main factor for the rapid growth of the department in the last five years, with the number of graduate students increased from less than 40 in 2005 to about 70 in 2010 and 2011. By the spring semester of 2012, five students graduated with Master Degree and nine graduated with Ph.D. form the two programs.

As discussed in our short and long-term plan, we will continue to enhance and develop our Biostatistics programs in the next five to ten years. Based on the experience of other biostatistics programs in the nation, a biostatistics program usually need at least 6-10 faculty members to open necessary courses and to engage in extensive collaborate research with the medical school. We need to add at least five more biostatisticians in our program to strengthen the current three-member biostatistics group (Dan McGee, Deb Sinha, and Elizabeth Slate).

3) *The Laboratory for Computational Vision (LCV) is actively pursuing high-impact and challenging research topics using ideas from statistics, geometry, and imaging. Current and future research and education are increasingly interdisciplinary and this laboratory is a focal point for such an effort on our campus. It boasts sophisticated imaging equipment including 3D scanning and thermal imaging. In recent years, it has received significant external funding (e.g., NSF FRG grant awarded to less than 10% of applicants) and attention (e.g., article in SIAM News), and has attracted graduate students to our Ph.D. program. Using a blend of statistics and geometry, LCV has already carved out a niche for itself in the area of computer vision. However, with appropriate recruiting and administrative support, this facility can potentially be among the best in the state in the next five to ten years. Success in such interdisciplinary research requires a team of highly energetic, ambitious, and broad-minded researchers. We need to reach a critical mass in our efforts so that in the future we can not only retain*

our existing focus but also attract bright new faculty and students. Over the next few years, we will focus on strengthening faculty for LCV and related areas, and will regularly update the equipment available for research.

Since our previous review in 2003-2004, the Laboratory for Computational Vision (LCV*)*, now called the Statistical Shape Analysis & Modeling Group, continues to grow under the leadership of Anuj Srivastava. Three new faculty members, Adrian Barbu, Wei Wu, and Jinfeng Zhang joined the group. The group is very productive in the terms of publications and external grant support as shown in faculty's research and creative activity summarized in Question 14.
As a continuation of previous research, Victor Patrangenaru, a new senior faculty member joined the department in 2006, with his students and jointly with Xiuwen Liu from Computer Science, successfully developed his own machine vision research on 3D projective shape analysis from bilateral views.

In the next five to ten years, the department plans to continue and enhance our Statistical Shape Analysis and Modeling Group so that it becomes an established national center attracting both permanent and visiting faculty and creates additional research interests for our faculty, as well as our undergraduate and graduate students.

4) *Research and education are increasingly becoming interdisciplinary. Future success in academia demands teamwork. From federal grants to international awards, the focus is shifting from individual labor, a hallmark of past eras, to team efforts. The nature of research and education in statistics makes it ideal for groups with wide expertise, from areas such as data collection, mathematical formulation, computational solution, and eventual application. We will strongly encourage collaborations within in the department, and with colleagues across the campus. Successes of current collaborations involving XuFeng Niu (with meteorology), Ian McKeague (with oceanography), Dan McGee with Social Sciences and the Medical Center, KaiSheng Song (with criminology), Doug Zahn (with psychology), and Anuj Srivastava (with mathematics, computer science, and CSIT) serve as motivations for new faculty to invest in such team efforts and inter-disciplinary research. In addition to strengthening existing teams (LCV, biostatistics group, and the consulting center, we expect to form new groups that cater to interdisciplinary collaboration and focused research.*

As summarized in Question 28, the department continues to strengthen its interdisciplinary activities in the last five years. There is extensive collaboration of the statistics faculty on research projects with faculty in other departments, including Eric Chicken with the FSU Geophysical Fluid Dynamics Institute, Dan McGee, Deb Sinha, and Elizabeth Slate with medical school, XuFeng Niu with Biology, Finance, and Meteorology, Victor Patrangenaru with Computer Science, Anuj Srivastava with Computer Science and Mathematics, Wei Wu with Phycology, and Jinfeng Zhang with Biology. In the last five year, seven PhD students wrote their dissertations in the interdisciplinary option. Two students are currently pursuing the interdisciplinary option in Finance.

In the next five to ten years, the department plans to continue and enhance its thrust into interdisciplinary research with other fields and departments including oceanography,

meteorology, biology, psychology, computer science, mathematics, and the Medical School. For example, In August of 2012 Jinfeng Zhang had a meeting with a few faculty members from other FSU units (including biology, medical school, and computer science). They are working together to formalize an interdisciplinary research initiative that facilitates collaboration (e.g., grant writing or publication) across different departments. The Department of Statistics will strongly support this kind of activities.

5) *Another challenge is to build up the Statistical Consulting Center's resources in order to*
    a. *enhance the quality of research done by faculty and graduate students in other departments throughout the university,*
    b. *teach our graduate students to be first-rate consultants, and*
    c. *enhance the quality of research done in state government.*

The Statistical Consulting Center is directed by our Research Associate Steve Ramsier. In the academic years 2007-2008 and 2008-2009 the Center was run by two graduate students with one being the lead and the other in an apprentice role. To accommodate the walk-in hours for the 2009-2010 years, the number of consultants was increased to four graduate students and has fluctuated between four and five in subsequent years. With four or five consultants there is generally a lead consultant responsible largely for scheduling and facilitating several appointments, a second experienced consultant who takes the lead in several other appointments, and the remaining consultants responsible mostly for walk-ins but also serve in an apprentice role at many of the appointments.

Consultants had an average of slightly more than three appointments each week, for an annual Center average of about 90 appointments. The demand was relatively consistent across the months, with slight increases at the beginning and end of the semester, and close to important dates such as submission deadlines for research proposals or dissertations.

The task of holding walk-in hours was split up between several of the consultants. There was no appointment required. Clients were allowed to drop in whenever they wanted. Often, based on client needs, walk-in consultants would suggest that a client make an appointment when sessions required a more in-depth approach. Again, the walk-in activity would experience a spike in demand close to important dates such as submission deadlines for research proposals or dissertations.

The majority of appointment clients in our Statistical Consulting Center were Doctoral students seeking assistance for the quantitative aspect of their dissertations. We also met with several Masters students working on their thesis or research project. On occasion, faculty members were provided statistical advice for their research work. Over the five academic years from Fall 2007 to Spring 2012 the Center was able to provide statistical services for clients from a variety of departments from the University community. Lists of clients of our consulting center in the last five years and some typical consulting cases are given in **Appendix-N** (Statistical Consulting Center Report for QER).

In the last five years, faculty member in the department provided excellent consulting service to different departments of Florida State. For example, Eric Chicken worked on the project

"Evaluation of the Impacts of Storm Surge Flooding on the Water Quality of the Nearshore Environment and on Coastal Aquifers in Sewered and Un-sewered Communities" supported by Florida Department of Environmental Protection and another project "Using the Woodville Karst Plain as a pilot for establishing a hydrological observatory and a water data center based in Tallahassee" funded by Florida Geological Survey. Xu-Feng Niu has been working on several research projects for the State of Florida funded by the Department of Transportation (FDOT), the Florida Agency for Persons with Disabilities (FADP), and the Florida Department of Environmental Protection (FDEP). His research and consulting projects include statistical analysis of Florida highway fatality and injury data, statistical assessment of environmental laboratory testing data, evaluation of the water quality and biological communities in the Everglades protection area, and developing statistical procedures for identifying impaired waters in Florida. Twenty-three technical reports have been produced in the period of 2007 to 2011, and many of Xu-Feng's results in these reports have become environmental regulations for the State of Florida.

In the next five to ten years, the department plans to develop and enhance our Statistical Consulting Center with additional faculty to support interdisciplinary research and garner more outside research support.

6) *One final challenge for the department over the next five years is to improve the quality of its service courses at all levels. We have created large lecture courses to serve the large enrollments in STA 1013, 2023, and 2122 and staffed them with Assistants in Statistics and recitation instructors. Our challenge is to keep the momentum going on the success we have had here, and at the same time keep these positions and their duties attractive to the people who hold them. Another challenge here is to help the recitation instructors grow into their tasks and continue to improve in them. Doing this will involve a continued investment of faculty time in educating these individuals about what it means to be a statistics educator and in observing them and coaching them as they do their jobs. The goal is to get people in the future who excel in both research and teaching -- they are not separate streams.*

In the last five years, Radha Bose and Steve Ramsier taught the large lecture courses of STA 1013, 2023, and 2122 very successfully and have made major contributions to the undergraduate teaching in our department. Both received outstanding Teacher Awards from the University. They are clearly very effective in planning, organizing, and managing the teaching of three large lectures with more than 20 recitation sections and directing the efforts of 6-9 teaching assistants each semester. In the classes, they have developed group work activities in each recitation section that provide students with a more hands-on approach to learning. The two instructors are very enthusiastic about teaching and treat their students with respect at all times. This enthusiasm is reflected in the high marks they have received on their student evaluations.

Radha and Steve spent tremendous time supervising and training the recitation instructors, guiding them in how to best perform their duties as teaching assistants. Their efforts have greatly improved undergraduate teaching in the department and are highly appreciated by students and faculty of this department.

38. Report the findings and recommendations from the previous discipline-specific accreditation. Indicate whether the program is currently undergoing accreditation, or when the next one is scheduled.

The program was reviewed by the SUS Program Review of Mathematics and Statistics Departments in 1997-98.

The recommendations of the 1997-98 SUS Review are as follows:

1). There must be an increase in the size of the faculty and the number of graduate assistants.

This continues to be an issue for the department as we seek to replace retired senior faculty and faculty members who left our program, and add more faculty in order to expend our program. As we have indicated elsewhere in this document, the size of our faculty makes it exceedingly difficulty to outperform our peer institutions and thus rise in the NRC rankings. Our faculty is in some cases one-third to one-half the size of the faculties of our peer and aspirational institutions.

With the establishment of the Biostatistics Master program in 2006 and Biostatistics Ph.D. program in 2007, the department has experienced a fast growing period in the last five years, with the number of graduate students increased from less than 40 in 2005 to about 70 in 2010 and 2011. The department plans to continue its growth in the next five to ten years.

2). The salaries of the faculty and graduate assistants need to be improved to attract outstanding persons.

This continues to be an issue. The average salaries of the faculty and average stipend level for graduate assistants are much lower than the national averages. In 2011, we lost two senior faculty members, Marten Wegkamp and Flori Bunea to Cornell due to salary differences and deteriorating financial conditions in the Florida public university system. This problems needs to be addressed as soon as possible.

3). While there have been excellent individual research and teaching efforts, there should be more "community" in the Department.

There is a continuing effort to blend new faculty and graduate students into the department through mentoring programs, conversations with advisors, informal conversations in small classes, senior faculty including junior faculty in their research programs, and a series of social events spanning the year.

4). The Department should continue to search for ways to improve the service courses and communication with the departments being serviced.

We have received feedback from both students taking courses and instructors teaching them that students would prefer a more unified presentation of the course contend with less variation among the sections. We have addressed this by putting Research Associate Steve Ramsier in

charge of the three major service courses, STA 1013 Statistics By Example, STA 2023 Introduction to Business Statistics, and STA 2122 Introduction to Applied Statistics. In addition, we have instituted large lectures in each of the courses with recitation sections. We have also instituted a pre-fall semester program to prepare our teaching assistants for teaching these sections. We observe our recitation instructors during the semester and help them to improve the effectiveness and efficiency of their sections.

5). From the nature of the discipline, statisticians should be involved in much more interdisciplinary research and must reach out to other fields.

The problem has been addressed in the last ten years. The department's extensive activities in interdisciplinary areas have been discussed in several places in this self-study document.

6). The Statistics Department at FSU should get involved in SPAIG.

So far the department has not chosen to get involved in Statistical Partnerships among Academe, Industry, and Government (**SPAIG**), in part because of a lack of local industry that is participating in SPAIG. Students wanting industrial experience during their degree programs at FSU usually engage in a summer internship to achieve this goal. In the last five years, more than 10 Ph.D. students did one or more summer internships after they were awarded their MS degree. For example, Yang Liu, graduated in 2010, did her internships at Merck & Co. Inc. at Rahway, NJ in the summers of 2007 and 2008, and Haiyan Zhao, graduated in 2011, did her internship at the Eisai Medical Research Inc. in Ridgefield, New Jersey in the summer of 2009.

39. What process does the program use to formulate student learning outcomes and assess student learning? How are the key concepts and other knowledge the faculty want the students to learn explicitly mapped into the curriculum?

In the department, student learning outcomes are formulated and assessed by degree level:

B.S.

Goals	**Measures**
Students completing the B.S. program have the ability to use modern statistical techniques and theory including statistical software.	Homework and examinations used to test knowledge of students. Instructors will examine homework, exam or project results to identify weaknesses that will be strengthened in subsequent offerings of the course.
Students completing the B.S. program have the ability to communicate statistical results in writing and orally to both technical and non-technical people.	Written projects and oral presentations in courses will be evaluated to test the knowledge of advanced students. Instructors will assess the projects and presentations and identify weaknesses that will be strengthened in subsequent offerings of the course.
Students completing the B.S. program have the ability to obtain employment in which they can utilize their statistical education.	Graduating students will receive a modified exit survey.

M.S.

Goals	Measures
Students completing the M.S. program have the ability to use modern graduate level statistical methods and theory, including software and writing code in various computer languages.	Homework and examinations, including the M.S. Comprehensive exam, were used to test the knowledge of M.S. students.
Students completing the M.S. program have the ability to communicate statistical results in writing and orally to both technical and non-technical people one-on-one and in groups.	Written projects and evaluations are used to test the communication skills of M.S. students. Instructors will assess the projects and presentations and identify weaknesses that will be strengthened in subsequent offerings of the course.
Students completing the M.S. program have the ability to enter a challenging career in government, business, industry, or education.	Graduating students will receive a modified exit survey. Assess employment positions of recent M.S. graduates.

Ph.D.

Goals	Measures
Students completing the Ph.D. program have the ability to use modern graduate level statistical methods and theory, including software and writing code in various computer languages.	Instructors will examine homework, exam or project results to test statistical knowledge of Ph.D. students.
Students completing the Ph.D. program have the ability to communicate statistical results in writing and orally to both technical and non-technical people one-to-one and in groups.	Instructors will use written projects and oral presentations to test the communication skills of Ph.D. students.
Students completing the Ph.D. program have the ability to enter a challenging career in government, business, industry, or education.	The department will send out a modified exit survey and Instructors will assess the current employment positions of Ph.D. graduates.

Appendix-F presents the Student Learning Outcomes Assessment results in the period of 2010-2011. Below are some examples of how the key concepts and other knowledge the faculty want the students to learn are explicitly mapped into the curriculum:

1). Performing comprehensive data analysis

Start Date: 08-25-10
End Date: 08-06-11

Outcome Type: Content/Discipline Knowledge & Skills

Define Outcome:
Upon completion of core undergraduate courses, the student will be able to perform a comprehensive data analysis consisting of multiple investigations and interpretations of a data set. This will be assessed upon completion of assignments within core undergraduate courses.

Assessment and Evaluation Process:
There will be a faculty-reviewed assessment for projects in STA 3024, a required core course for statistics majors. The assessment will be used to evaluate students' ability to select appropriate statistical tools as well as create and organize a complete statistical analysis. At least 75% of the students must score at or above 80% on this component. Method(s): Class Performance or Presentation.

Results:
Of the twenty-six statistics majors enrolled in our two offerings of STA 3024, twenty-three of them (88.5%) were able to satisfactorily complete the elements of a comprehensive data analysis in their course project. The average score was 89% for statistics majors. This was considerably higher than the non-majors taking the class. One student was unable to complete the project due to extenuating circumstances and the other two students receiving fewer than 80% for this category missed opportunities to apply more appropriate techniques to their data.

Improvements Made or Action Plan Based on Analysis of Results:
The grading rubric modifications better identified whether the expectations for a comprehensive data analysis were being met. The vast majority of students were able to apply techniques that they learned in the course to their projects; however, a few students still missed opportunities to do better. The action plan involves improving the planning of the final project. Students will now be asked to submit a project proposal which will have them list the data anticipated to be used and the techniques to be applied to the data. The instructor will them provide feedback as to whether the student is on track. It is anticipated that this will allow for better communication of expectations by the instructor.

2). Writing statistical analyses of problems

Start Date: 08-25-10
End Date: 08-06-11

Outcome Type: Communication Skills

Define Outcome:

Upon completion of core undergraduate courses, the student will be able to produce a written explanation of a complex problem from a discipline outside of statistics in a manner that explains the essence of the problem in a non-technical way. This will be assessed upon completion of core undergraduate courses.

Assessment and Evaluation Process:
There will be a faculty-reviewed assessment for projects in STA 3024, a required core course for statistics majors. The assessment will be used to evaluate students' ability using written communications to break down discipline-specific issues in a conceptual way. At least 75% of the students must score at or above 80% on this component. Method(s): Project Evaluation and Written Report or Essay.

Results:
Twenty-five out of twenty-six (96.2%) students successfully produced a non-technical written description of their project problems and goals. The average score of 89% was pulled down by one student if the fall who did not attempt any of the project. That same student enrolled again in the spring and performed at a high level. We found the model project write-ups presented to the students were effective and increased the number of students exceeding the requirement compared to last year. We believe that the reason for this being one of the highest objective success rates is due to the fact the assignments given throughout the semester provided ample practice on this activity.

Improvements Made or Action Plan Based on Analysis of Results:
We will continue to show more examples of non-technical problem descriptions so that students will be gather a better idea of what is expected with the written documents. One way to improve here is to use examples which emphasize concise explanations. Some students, although arriving at a written result accurately, could do so in a more efficient manner. A grade element will be added to the project grading rubric to directly evaluate conciseness.

3). Statistical methods and software

Start Date: 08-25-10
End Date: 08-06-11

Outcome Type: Content/Discipline Knowledge & Skills

Define Outcome:
Upon completion of the course of instruction, the student will be able to employ modern statistical techniques and software effectively to solve problems and analyze data.

Assessment and Evaluation Process:
Projects and course embedded assignments within the required courses STA 5166 and STA 5167 (Statistics in Applications I and II) will be used to test students' knowledge of modern statistical techniques and their ability to use statistical software to work with data and solve problems. These courses are required of all MS Statistics students. Our goal is 90% of students receive a score of 76% or better in these courses. Method(s): Project Evaluation and Course Embedded Assignment (Often in tandem with exam question bank).

Results:
In the fall of 2010, 84% of the students in STA 5166 received a score of 76% or better. In the following spring, 100% of the students in STA 5167 earned scores of 76% or better. For the year-long sequence, we had 92% at or above a score of 76%.

Improvements Made or Action Plan Based on Analysis of Results:
Our department is pleased with the level of achievement of our graduate students with respect to this student learning outcome. We expect our students to continue to display this high performance level in the future.

Since this learning outcome was first proposed, our department has created a four-course professional graduate certificate in statistical computer analysis. In the future, we will use completion rates of our graduate students in this certificate program as our measure of a student's ability to use software with modern statistical techniques analyze data and solve problems.

4). **Ability to communicate statistical analyses**

Start Date: 08-25-10
End Date: 08-06-11

Outcome Type: Communication Skills

Define Outcome:
Upon completion of the course of instruction, the student will be able to express statistical results and inferences in writing and orally to both technical and non-technical audiences.

Assessment and Evaluation Process:
Communication skills are analyzed through written and oral work required of all students in the statistics MS program. Each student must give a 30 minute presentation on a relevant statistical topic. A written project to accompany this presentation is also required. We use the course STA 5167, a required course for statistics MS students, to measure this. Our goal is that 90% of the students receive a score of 76% or more. Method(s): Project Evaluation and Class Performance or Presentation.

Results:
In spring 2011, 100% of the STA 5167 students received a score 76% or better.

Improvements Made or Action Plan Based on Analysis of Results:
We are pleased that our students meet our basic requirement for this learning outcome. We intend to make two changes to our measure of success for it. First, in the future we desire that 90% of our graduate students will successfully complete this requirement with a score of 85% or

better, the previous score being 76% or better. Second, we will require that the students analyze and present their projects using real world data, rather than textbook sets. In particular, we will begin using data brought to our department's statistical consulting center. This will ensure that the analyses and presentations made by these students are timely and relevant.

40. What specific changes has the program made in response to assessment of student performance on learning outcomes?

In response to assessment of student performance on learning outcome, each instructor who is teaching the course for the specific purpose will assess the projects and presentations and identify weaknesses that will be strengthened in subsequent offerings of the course.

For example, in STA5107 and STA5167, following changes are made after assessing the projects and presentations:

We will continue the assessment procedure and require students to demonstrate their communication skills and to interpret statistical results and concepts effectively. To ensure our continued success we have established a process and require students to follow and improves their communication skills at each step:

- Each student is required to prepare an outline of his/her course project and discuss it with the instructor four weeks ahead the oral presentation.
- During a student's presentation, other students ask questions. This question/answer interaction improves the students' communication skills. The instructor provides comments and suggestions to each student on how to improve his/her course project.
- Students make final modifications in their projects after their oral presentations and submit their written projects to the instructor.

41. How do the program's curricula compare to the best efforts nationally? How often are the curricula reviewed and by whom? When was the most recent comprehensive review of the degrees, majors, and certificates offered by the program? Describe any changes that were made based on this review and discuss their implementation. How is the program monitoring the effects of curricular changes? What new degree programs, at what levels, does the unit plan to propose in the next five years?

Considering the number of faculty, our department's graduate course offerings are very respectable compared to our peer and aspirational universities. In some cases, departments with three times as many faculty members offer only 50% more courses. Even with our department's resources, we are able to provide excellent coverage of modern statistical methods and theory, coverage that is comparable to our peer and aspirational institutions. The additional offerings of other statistics departments appear mostly to be service courses, sequel courses, introductory biostatistics, and various theory courses. It appears that the departments with a larger faculty offer a slightly more breadth but in most cases no or little more depth in contemporary course

offerings. A comparison of graduate course offerings with two peer [Texas A&M University (TAMU), University of Minnesota (UMN)] and two aspirational [NC State University (NCSU),University of North Carolina (UNC)] universities is given below:

Graduate Course Offerings

FSU	TAMU	NCSU	UMN	UNC
Comp. Stat. 1	X	X	X	X
Comp. Stat. 2	X		X	
Intro (service course)	X	X	X	
Stat. Apps. 1	X	X	X	X
Stat. Apps. 2	X	X	X	X
Stat. Apps. 3	X	X	X	X
Adv. App. Stat.		X		
Stat. In Epidem.				
App. Survival			X	X
ANOVA/Exp. Dsgn.	X	X	X	X
Regression	X	X	X	
Lin. Stat. Models	X	X	X	
Clinical Trials		X		X
Sample Surveys	X	X	X	X
Appl. Logistic Reg.				
Long Data Anal		X	X	
Math. Stat.	X	X	X	X
Distribution Theory	X	X	X	X
Stat. Inference	X	X	X	X
Limit Theory	X		X	X
Intro. Prob.				
Prob. and Measure		X	X	X
Probability Theory		X		X
Nonparametric	X	X	X	X
Quality Control		X	X	
Reliability	X	X		
App. Multivariate	X	X	X	X
Multivariate Theory	X	X	X	X
SAS Data Manag			X	
Stochastic Proc.	X	X	X	X
Time series	X	X	X	X
Medical Consulting			X	X
Intro. Consulting		X	X	X

Adv. Meth. Epidem.				
Adv. Stat. Inf.	X	X		X
Adv. Prob.				X
Nonpar. Curve Est.	X			X
Spatial Statistics		X		

Offerings Not at FSU	Intro BioStat	Sampl. Animals Pop.	Bayesian Dec.	Design and Robust.
	Sampling Thy.	Stat Behavior Sci.	Finite Samp.	Bayesian & Lin. Mod.
	Adv. Exp. Design	Exp. for Biology	Dist. Thy. 2	Adv. Dsgn. Exp.
	Stat. For Chem.	Exp. for Sc. Sci.	Pred. Infer.	Sequential Anl.
	Dec. Thy.	Exp. for Eng. 1&2	Stat. Dec. Thy.	Nonparam. Infer.
	Resp. Surf. Meth.	Stat for Mgt.	Sequential Anl.	Stochastic Proc. 2
	Stoch. For Sci.	Plant Sci. Stat.	Nonlin. Reg.	Time Series 2
	Stat For Ecology	Off-Line Qual. Cntrl	Reg. Graphics	Extreme Val. Thy.
	Research 1&2	Ecomometrics	Thy. Cat. Var.	Stoch. Analysis
	Quant. Literacy	Stoch. Modeling	Bio Stat 1&2	Information Thy.
	Data Modeling 1&2	Nonlin. Prog.		Error Correct. Codes
	Time Series 2	Genetic	Latent Var.	Adv. Multivariate
	Internship	Decision Modeling	Correl. Data	Nonparam. Multivar
			Adv. Surv.	Thy of Survival Anl.
		Bayesian Inf.		Genetics 1&2
		Stochastic Proc. 2		
		Stoch. Diff. Eqs.		
		Econometrics		
		Adv. ANOVA		
		Comp. Mole. Evolut.		
		Nonlin Resp. Model		
		Stat in Genetics		
		Time Series 2		

The curricula in the department is reviewed and improved annually by the Academic Affair Committee of department. Every five or six years, the department's program, including the degrees, majors, and certificates, is reviewed by the Quality Enhancement Review and University Graduate Policy Committee (GPC) Review. The last extensive review of the department's program was done in 2003-2004. Changes based on the review were discussed in Part V (Curriculum) and in Question 37.

As we discussed in Question 11, curriculum, the department offers very diverse degree programs. In the next five to ten years, the department will focus on enhancing its newly established

programs in Biostatistics. At this juncture, we do not envision any new degree programs will be proposed by the department in the next five years.

VIII. List of Appendices

Appendix A. QER Vitae (build the CVs through the Faculty Expertise and Advancement System available through the Faculty Development and Advancement Office website and include hard copies in the binder).

Appendix B. Budgeted and actual faculty FTE for the last 5 years.

Appendix C. Teaching Evaluations (for faculty, teaching assistants, and adjuncts); be sure to provide an explanation regarding the scale used on the SUSSAI (see sample form).

Appendix D. Organizational Chart.

Appendix E. Enrollment and Completion Tables (GPC Question 13).

Appendix F. Student Learning/Program Outcomes, Assessments, Actions, and Results from IE Portal (most current full year available).

Appendix G. URL/Weblink to Student Handbooks.

Appendix H1. Surveys of current students, graduates, alumni.

Appendix H2. Statistics-Undergrad-Exit-Survey-Results

Appendix I. Undergraduate and graduate placements.

Appendix J. Statistics-Booklet-2012

Appendix K. Statistics_Dual_Degrees_Awarded.

Appendix M. Statistics Graduate Courses offered 2007-2012

Appendix N. Statistical Consulting Center Report for QER

Appendix O. Proposal#-AmountAwarded-2007-2012