

12-15-2014

## Mathematics and Statistics Academic Program Review, 2014

Wright State University College of Science and Mathematics

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College: College of Science and Mathematics

Department: Department of Mathematics and Statistics

Academic Programs Reviewed:

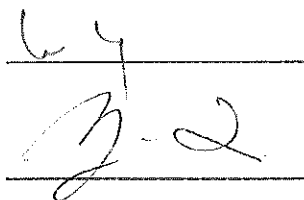
1. MS – Applied Mathematics
2. MS – Mathematics
3. MS – Applied Statistics
4. BA/BS – Mathematics
5. BS – Statistics
6. Minor – Mathematics
7. Minor – Statistics

Program Review Committee:

- Joanne Dombrowski (Chair)
- Harry Khamis
- Kimberly Kinatader
- Phan Loi

Submitted: December 15, 2014

Department Chair: Welfu Fang

Handwritten signature of Welfu Fang, consisting of a stylized 'W' and 'F' followed by a horizontal line.

Dea: Yi Li

## Program 1. MS – Applied Mathematics

### Enrollment and Graduate History

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	4	5	5	1	5
Graduates	3				

### Program description

The Applied Mathematics Graduate Program provides students with a thorough introduction to application-oriented mathematics. The program is designed to develop the student's ability to analyze and solve a variety of problems, and to increase the student's understanding of specific problems encountered in other fields. Students typically select courses in numerical analysis, methods of applied mathematics, mathematical modeling, optimization techniques, discrete mathematics and probability and statistics, within specific guidelines. Students also have the option to complete a modeling project as part of their program. The program requires 30 semester hours of approved graduate level course work. Comprehensive exams are given at the completion of the program.

### Alignment with university mission, strategic plan

This program provides students with the mathematical knowledge, and advanced problem solving skills, needed for employment in a rapidly changing world. The program is accessible to students from a variety of disciplines with a solid mathematical background. There are career opportunities in the area, including Wright Patterson Air Force Base.

### Program distinctiveness

This program is designed for students with a bachelor's degree in mathematics, or a related technical discipline. Required courses are offered in the late afternoon to accommodate part time students. Two year planning schedules allow students to create a program of study that full time students can complete in 2 years. The high faculty student ratio encourages faculty and student interaction. Students have the opportunity to undertake a modeling project as part of their program. A relatively new option allows students to complete both the BS and MS degrees in Applied Mathematics in five years.

### Recognitions of quality of the program

A recent graduate of the program is currently in the Ph.D. program at Oakland University, while working for the Chrysler Corporation. Several recent graduates have been employed at Wright Patterson Air Force Base. The goals of the program seem compatible with regional employment opportunities.

### Program learning outcomes

Graduates of this program should be able to communicate effectively, demonstrate mathematical literacy and evaluate arguments and evidence critically.

### **Description of learning outcomes assessment program**

Comprehensive exams are administered at the end of the program to assess student achievement. Three exams cover three areas of study from the program of study. Passing these exams requires an understanding of basic mathematical concepts, problem solving skills, and an ability to write correct mathematical arguments. A student who chooses to do a project as part of the degree program may substitute the oral presentation of the project for one of the comprehensive exams.

### **Summary of assessment findings for past five years**

Graduates of this program acquire a solid foundation in applied mathematics. Students have been successful in passing the comprehensive exams over three areas of study. In recent years, however, the program has not attracted many students. Several students who started in this program changed to and eventually completed the Applied Statistics Program. There has been a significant increase in enrollment in the Applied Mathematics Program for Fall, 2014. This program should be an appropriate starting point for students interested in the interdisciplinary Ph.D. program currently under consideration.

### **Major curricular changes since last review (or past five years)**

All graduate courses and program requirements were reviewed, updated, and restructured where needed, during the conversion from the quarter system to the semester system.

The five year BS/MS program was introduced to allow students to begin graduate work while completing their undergraduate degrees. The interdisciplinary Ph.D. program, which is currently in the approval process, should have a significant impact on the applied mathematics graduate program.

### **Graduate placement data, employer satisfaction**

Complete information is not available.

Several recent graduates have been employed at Wright Patterson Air Force Base. One recent graduate is in the Ph.D. program at Oakland University while working for the Chrysler Corporation.

**If program has professional accreditation, attach most recent review findings and recommendations**

## Program 2. MS – Mathematics

### Enrollment and Graduate History

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	10	13	14	19	18
Graduates	1	4	1	2	3

10%

31%

7%

15%

11%

17%

### Program description

The Master of Science Program in Mathematics offers advanced mathematical training in the traditional areas of mathematics, yet is flexible enough to provide opportunities for students to pursue their interests in specific areas of mathematics. Students may select courses in modern algebra, analysis, combinatorics and geometry, as well as differential equations, graph theory, numerical analysis and statistical theory. Individual interests and future goals determine the actual program of study within specific guidelines. The program requires 30 semester hours of graduate level coursework. Students may choose to write a thesis. Comprehensive exams are given at the end of the program.

### Alignment with university mission, strategic plan

This program provides a solid foundation for student success in further graduate work, for a career in teaching, and for employment in any field requiring advanced problem solving skills and a strong mathematical background. The close interaction of students and faculty at the graduate level enhances the academic climate of the Department. There are ample opportunities for students to engage in research.

### Program distinctiveness

This program attracts some of the best and brightest students in the area, who wish to continue the study of mathematics in preparation for a career in teaching or industry, or who wish to prepare for further graduate work at the Ph.D. level. Required courses are offered in the late afternoon or evening to allow for part-time study. Two year planning schedules assist students in designing a program that full-time students can complete in two years. The faculty student ratio encourages faculty and student interaction. Students have opportunities to engage in research with the faculty. A relatively new program allows the very best students to complete both the BS and MS degrees in Mathematics in five years.

### **Recognitions of quality of the program**

Graduates of this program seem to be successful in their future endeavors. One excellent graduate completed a Ph.D. at AFIT and is currently employed at Proctor and Gamble. Two recent graduates have been accepted into Ph.D. programs, at the Air Force Institute of Technology and the University of Colorado at Boulder. Several graduates hold teaching positions at Sinclair Community College and Wilberforce. One recent student returned to teaching high school after completing the MS degree, and another is working as an actuary in Nashville.

Students engaged in research during their degree programs, working closely with their faculty mentors, have published results in *Cryptography and Communications*; the *Journal of Combinatorics, Information and System Sciences*; the *Journal of Statistical Planning and Inference*; the *Bulletin of the Kerala Mathematical Association*; the *Australasian Journal of Combinatorics*; *Fractals*; *Complex Analysis and Operator Theory*; *Communications in Mathematical Analysis*.

Program faculty are active researchers and scholars. Student course evaluations, and the exit surveys used in assessing the program, indicate a high level of satisfaction with the quality of the instruction.

### **Program learning outcomes**

Graduates of this program should be able to communicate effectively, demonstrate mathematical literacy and evaluate arguments and evidence critically.

### **Description of learning outcomes assessment program**

Comprehensive exams, administered at the end of the program, have always been used to assess student achievement. For the non-thesis option, there are three exams covering three areas of mathematics from the program of study. To pass these exams students must demonstrate their understanding of mathematical concepts, and their ability to write correct mathematical arguments. In the thesis option, the oral presentation of the thesis results replaces one of the comprehensive exams. Exit surveys are also used to assess the program.

### **Summary of assessment findings for past five years**

Students have been successful in passing the comprehensive exams given at the end of the program of study. Exit surveys have indicated a high level of satisfaction with the overall program and the quality of instruction. Offering a wider variety of courses, often specific to student interests, has been a recurrent suggestion for program improvement. While this is difficult to implement with current enrollment, the thesis option has provided opportunities for students to pursue additional interests. As indicated above, students have been successful in publishing thesis results in a variety of appropriate journals.

Overall, the program does seem to meet the needs of the students enrolled. Graduates have successfully entered Ph.D. programs, or have obtained positions in teaching or industry.

**Major curricular changes since last review (or past five years)**

All graduate courses and program requirements were reviewed, updated, and restructured where needed, during the conversion from the quarter system to the semester system.

The five year BS/MS program was introduced to allow strong students to begin graduate work while completing their undergraduate degrees. An interdisciplinary Ph.D. program is currently in the approval process, which should have a positive impact on the mathematics graduate program. Several recent graduates have expressed an interest in this Ph.D. program.

**Graduate placement data, employer satisfaction**

Complete information is not available.

One recent graduate completed a Ph.D. at AFIT and is currently employed at Proctor and Gamble. Two others have been accepted into Ph.D. programs, at the Air Force Institute of Technology and the University of Colorado at Boulder. Several recent graduates hold teaching positions at Sinclair Community College and Wilberforce. One recent student completed the MS degree and returned to teaching high school, and another is working as an actuary in Nashville.

**If program has professional accreditation, attach most recent review findings and recommendations**

## Program 3. MS – Applied Statistics

### Enrollment and Graduate History

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	24	22	23	30	30
Graduates	6	6	6	4	9

### Program description

This Program prepares students for employment as professional statistical scientists and provides a solid foundation for doctoral studies in statistics. A core of required courses provides a strong grounding in the statistical theory and methodology needed for the design of experiments, the collection and analysis of data, and the interpretation of statistical results. Elective courses introduce students to advanced topics and lend flexibility to the Program.

Specifically, students take 16 credit hours in statistical theory and methods and a two-credit hour course where they work in the Statistical Consulting Center honing their statistical skills working with real clients and real data. Students take 12 credit hours in elective courses gaining deeper knowledge of specialized topics. A comprehensive exam is given in the second year of the Program.

### Alignment with university mission, strategic plan

Through a modern, high-quality, innovative Program, a solid foundation for student success and empowerment is created. In addition to acquiring the knowledge base needed to become a statistical scientist through coursework, students have the opportunity through the Statistical Consulting Center to engage in community service activities and to work with researchers from across the University thereby engaging in problem solving skills and acquiring first-hand consulting experience.

### Program distinctiveness

- High faculty-to-student ratio
- Faculty have active research programs and take teaching very seriously
- All classes are offered in the late afternoon or evening
- A new BS-MS degree program enables strong students to complete their B.S. and M.S. degrees in five years
- A new track in the program provides students with a statistics M.S. degree with a specialization in biostatistics
- Location near Wright-Patterson Air Force Base and in a region of expanding technology and research offers huge opportunities for internships and employment
- Unique opportunity for students to work with real research problems and fellow scientists through the Statistical Consulting Center



- Unique opportunity for students to engage in community service activities
- Upon successfully completing their comprehensive exams, every student receives free membership in the American Statistical Association

#### Recognitions of quality of the program

- In 1989 the Statistics Program received an “Academic Challenge Grant” (\$480,000) and was designated a “Center of Excellence” by the State of Ohio
- In 2011 the Statistical Consulting Center was awarded the President’s Award for Excellence as “Outstanding Unit”
- Articles about the Statistical Consulting Center have appeared in publications worldwide (*The American Statistician*, *Biostatistics: A Foundation for the Health Sciences* by Wayne Daniel, *The Statistical Consultant*, Volume 167 of the *Quantitative Applications in the Social Sciences*)
- The Program includes two American Statistical Association Fellows on its faculty
- The 2013 COSM Outstanding Alumnus Award recipient was a graduate of the Statistics MS program.

#### Program learning outcomes

Students in the Graduate Statistics Program will be able to:

- communicate effectively both orally and in writing
- demonstrate mathematical and statistical literacy
- evaluate arguments and evidence critically
- correctly apply statistical principles to research involving data

#### Description of learning outcomes assessment program

Assessment of student learning outcomes is based on:

- performance on the comprehensive exam
- student portfolios, which are collected in the Statistical Consulting Course (STT 7910), a core course in the program
- exit questionnaire
- periodic surveys of graduates

#### Summary of assessment findings for past five years

- Between Fall 2009 and Fall 2013, 45 students took the comprehensive exam and all passed (14 had to retake one or more parts of the exam at least once to pass).
- Generally, comments in the STT 7910 portfolios and from informal interviews indicate that students value the Program and are happy with their experience in the Program; specific comments can be found in the Assessment reports for the Statistics Program.

- Findings from a major survey of all alumni of the Statistics Graduate Program (132 students) conducted in 2007 indicate that the Program is strong and highly valued by alumni. Details of the survey results can be found in the Assessment report for 2007-08.

#### **Major curricular changes since last review (or past five years)**

- Conversion from quarter system to semester system during which major restructuring of the curriculum was accomplished; this included elimination of out-of-date courses, development of new courses reflecting the advances in the statistical sciences, combining courses for a more efficient, modern curriculum.
- Introduction of a new BS-MS five-year degree program; the first graduate of this program will graduate in Spring 2015.
- Introduction of a new track in biostatistics in consideration of the strong need for statisticians in the pharmaceutical industry and medical sciences.

#### **Graduate placement data, employer satisfaction**

No formal data is available. Anecdotal evidence indicates that all graduates of the program seeking employment are able to find good jobs. Based on the 2007 survey of alumni, 71% of respondents were employed full-time with median income \$72,500; 15% obtained a Ph.D. in statistics or a related field; 43% worked in an academic environment, 40% in private enterprise, and 5% in government. Among graduates since 2010 for whom employment information is known, employers include: Clark State Community College, Sinclair Community College, Elsevier Science, U.S. Saudi Cultural Mission, Lexis-Nexis, Cincinnati Children's Hospital, CareSource Dayton, Wright-Patterson Air Force Base, and Air Force Institute of Technology.

## Program 4. BS/BA – Mathematics

### Enrollment and Graduate History

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	98	105	130	103	95
Graduates	15	13	31	17	25

### Program description

- 1) The BA in Mathematics provides a broad introduction to the subject. The requirements feature flexibility while providing an opportunity to explore one or more areas in greater depth or to co-major in other disciplines.
- 2) The BS in Mathematics is a more rigorous program of study designed to teach the theories and applications of classic and modern mathematics. A set of core courses, which include the year long real analysis and algebra sequences, provide a broad base of mathematical knowledge, reasoning and problem-solving skills, while a variety of elective courses introduce students to more advanced topics to prepare them for a career in teaching or employment in industry, as well as graduate or professional school.

### Alignment with university mission, strategic plan

This program provides students with a solid foundation for success and empowerment in further graduate study, for a career in teaching and for employment in any field that requires advanced problem solving skills with a mathematical background.

### Program distinctiveness

- High faculty-to-student ratio.
- Faculty focus on both research and teaching—not just research.
- Opportunities for student internships and employment at the nearby Wright-Patterson Air Force Base.
- Emphasis on rigorous content
- State of the art computing facilities.
- Pedagogical preparation for students interested in high school teaching

### **Recognitions of quality of the program**

Four of the 2014 graduates were named Woodrow Wilson Ohio STEM Teaching Fellows, and one Woodrow Wilson Indiana STEM Teaching Fellow.

### **Program learning outcomes**

- 1) Advanced ability to reason logically.
- 2) Ability to communicate mathematics effectively both in written and oral forms.
- 3) Ability to read junior/senior mathematical texts and papers.
- 4) Ability to understand the mathematical concepts and theories covered in the coursework.

### **Description of learning outcomes assessment program**

The assessment is based on annual surveys sent to faculty instructors of advanced mathematics classes such as Real Variables (MTH 4310, 4320), Modern Algebra (MTH 4510, 4520), and Senior Seminar (MTH 4920).

### **Summary of assessment findings for past five years**

General comments in the courses listed above indicate that students value the program and are happy with their experience in the program.

Recent assessment findings indicate that slightly higher than 80% of the students surveyed were judged to have met the four learning outcomes described above "very well" or "fairly well", and the rest "not well".

### **Major curricular changes since last review (or past five years)**

- 1) Conversion from quarter system to semester led to changes in the curriculum with the elimination of some old courses and the consolidation of others into new ones.
- 2) Addition of a new BS-MS five-year degree program.

### **Graduate placement data, employer satisfaction**

Recent graduates in the BS program have been employed by government agencies (NSA, Wright-Patterson Research Lab), and by companies in information technology (Reynolds and Reynolds), finance (Morningstar), institutions of secondary education (Sinclair Community College), while many have pursued graduate degrees at various universities (Air Force Institute of Technology, Duke University, SUNY-Binghamton, University of Northern Colorado, Hawaii Pacific University). Several of the graduates in the Math Education concentration are teaching in area high schools: Dayton Business Technology HS, Springfield HS, Centerville HS, Lakewood HS, Ketterling Fairmont HS, Bellbrook HS, Springboro HS, Piqua HS, Northwest HS, Allen County Educational Service Center, Dayton Christian HS, and Stivers School for the Arts.

## Program 5. BS – Statistics

### Enrollment and Graduate History

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	7	4	6	6	11
Graduates	1		3		2

### Program description

This Program prepares students for employment in the many corporations and government agencies for which statisticians design experiments, conduct surveys, and analyze data. Also, the Bachelor of Science in Statistics prepares students for graduate study in statistics (or in a science in which statistics plays a decisive role), after which one has even greater employment possibilities. A core of required courses provides a strong grounding in the statistical theory and methodology needed for the design of experiments, the collection and analysis of data, and the interpretation of statistical results. Elective courses introduce students to advanced topics and lend flexibility to the Program.

### Alignment with university mission, strategic plan

Through a high-quality, innovative Program, a solid foundation for student success and empowerment is created. In addition to acquiring the knowledge base needed to become a statistical scientist through coursework, students take several courses in a discipline in which statistics can be applied, such as biology, engineering, management, finance, and psychology, thereby positioning themselves to enter a variety of career fields.

### Program distinctiveness

- High faculty-to-student ratio
- Upper level classes are offered in the late afternoon or evening
- Faculty focused on both teaching and active research programs
- Unique location near Wright-Patterson Air Force Base and in a region that is a growing hotbed of technology and research, Wright State's prime location offers students opportunities for internships and employment
- Students who wish to pursue both an undergraduate and graduate degree in statistics can choose to complete a combined Bachelor of Science and Master of Science degree in five years
- Dual major option, most suitable for students in engineering, computer science, or physics
- Proximity to Wright State's on-campus Boonshoft School of Medicine

### Recognitions of quality of the program

- In 1989 the Statistics Program received an "Academic Challenge Grant" (\$480,000) and was designated a "Center of Excellence" by the State of Ohio

- In 2011 the Statistical Consulting Center was awarded the President's Award for Excellence as "Outstanding Unit"
- Articles about the Statistical Consulting Center have appeared in publications worldwide (*The American Statistician*, *Biostatistics: A Foundation for the Health Sciences* by Wayne Daniel, *The Statistical Consultant*, Volume 167 of the *Quantitative Applications in the Social Sciences*)
- The Program includes two American Statistical Association Fellows on its faculty

### **Program learning outcomes**

Students in the BS Statistics Program will be able to:

- demonstrate mathematical and statistical literacy
- understand statistics in the broader context of its scientific applications
- apply appropriate statistical methods to quantitative analysis required of a wide variety of scientific and sociological fields
- use a statistical computing software package

### **Description of learning outcomes assessment program**

Assessment of student learning outcomes is based on :

- In MTH/STT 4920, students were assessed based on their work in reading, understanding, and presenting (in 15 minutes) a selected topic/paper of mathematics that was approved by the instructor.
- periodic surveys of graduates

### **Summary of assessment findings for past five years**

- Generally, comments in STT 4920 and from informal interviews indicate that students value the Program and are happy with their experience in the Program.
- From a sample of MTH/STT 4920 projects over several years, it was found that
  - a) 83% were judged to have met the learning outcome [Advanced ability to reason logically] "very well" or "fairly well", and the rest "not well".
  - b) 87% were judged to have met the learning outcome [Ability to communicate effectively the mathematics that the students have learned in both written and oral form] "very well" or "fairly well", and the rest "not well".
  - c) 82% were judged to have met the learning outcome [Ability to read junior level mathematical of statistical texts and papers] "very well" or "fairly well", and the rest "not well".
  - d) 91% were judged to have met the learning outcome [understanding the principles governing the mathematics or statistics that they have encountered] "very well" or "fairly well", and the rest "not well".

### **Major curricular changes since last review (or past five years)**

- Conversion from quarter system to semester system during which major restructuring of the curriculum was accomplished; this included elimination of out-of-date courses, development of new courses reflecting the advances in the statistical sciences, combining courses for a more efficient, modern curriculum.
- Introduction of a new BS-MS five-year degree program; the first graduate of this program will graduate in Spring 2014.
- Actuarial concentration, in consideration of the need for statisticians in the insurance industry and associated marketability.

### **Graduate placement data, employer satisfaction**

Our graduates have found success in industry and graduate school, in places such as Elsevier Science, University of Cincinnati, and the Air Force Research Institute.

## Program 6. Minor – Mathematics

### Enrollment and Graduate History

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	7	6	13	12	27
Graduates	5	2	8	6	10

### Program description

Candidates complete at least 20 semester hours of mathematics: 12 hours (3 courses) of calculus and differential equations, 3 hours (1 course) of matrix algebra, 3 hours (1 course) of basic logic and logical reasoning and writing, and 3 hours (1 course) of approved elective material above the 3000 level.

### Alignment with university mission, strategic plan

Since mathematics is a foundational topic in so many other major fields of study (science, engineering, linguistics, operations research, and more), a solid grounding in mathematics is very helpful to students in learning these disciplines; it even looks good on their eventual resumes. Also, we designed the program to dovetail nicely into our dual-major program in mathematics for those more-gifted students who (surprisingly often) feel the desire to delve even further into mathematics along with their primary major.

### Program distinctiveness

It would seem almost ludicrous to claim that a minor program in mathematics could be distinctive, since almost every comprehensive university offers a minor program in mathematics. However (and unfortunately) most of them do not specifically include a course in basic logical reasoning and writing. We feel that this is a disservice to students and thus include such a course in our program.

### Recognitions of quality of the program

Note the rather dramatic increase in enrollments and graduates of this program in the data above. Since mathematics is a challenging subject, this is the best accolade that we could ever hope for!

### Program learning outcomes

Students should obtain a good foundation in basic calculus, differential equations, and matrix algebra. Students should begin to appreciate logical reasoning and concise writing. Students



also have the opportunity to take an elective that could possibly count towards their major field of study. Thus the minor program helps students to communicate effectively, demonstrate mathematical literacy and evaluate arguments and evidence critically.

**Description of description of learning outcomes assessment program**

No formal assessment was made.

**Summary of assessment findings for past five years**

**Major curricular changes since last review (or past five years)**

- Switch from a quarter hour based program to a semester hour based program
- Inclusion of a course on basic logic and logical writing

**Graduate placement data, employer satisfaction**

**If program has professional accreditation, attach most recent review findings and recommendations**

## Program 7: Minor – Applied Statistics

### Enrollment and Graduate History

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment			1		
Graduates				1	1

### Program description

This Program supports students' for employment in the many fields in which statistics plays a supporting role due to the presence of experimental data or surveys. Also, the Minor in Applied Statistics strengthens preparation for graduate study in statistics (or in a science in which statistics plays a decisive role), after which one has even greater employment possibilities. A core of required courses provides a strong grounding in the statistical theory and methodology needed for the design of experiments, the collection and analysis of data, and the interpretation of statistical results.

### Alignment with university mission, strategic plan

Through a high-quality, Innovative Program, a solid foundation for student success and empowerment is created. In addition to acquiring the knowledge base needed to understand the role of statistics as well as data analysis through coursework, students complete a full academic major in a discipline in which statistics can be applied, such as biology, engineering, management, finance, and psychology, thereby positioning themselves to enter a variety of career fields.

### Program distinctiveness

- High faculty-to-student ratio
- Upper level classes are offered in the late afternoon or evening
- Faculty focused on both teaching and active research programs
- Unique location near Wright-Patterson Air Force Base and in a region that is a growing hotbed of technology and research, Wright State's prime location offers students opportunities for internships and employment

### Recognitions of quality of the program

- In 1989 the Statistics Program received an "Academic Challenge Grant" (\$480,000) and was designated a "Center of Excellence" by the State of Ohio
- In 2011 the Statistical Consulting Center was awarded the President's Award for Excellence as "Outstanding Unit"
- Articles about the Statistical Consulting Center have appeared in publications worldwide (*The American Statistician*, *Biostatistics: A Foundation for the Health Sciences* by Wayne Daniel, *The Statistical Consultant*, Volume 167 of the *Quantitative Applications in the Social Sciences*)
- The Program includes two American Statistical Association Fellows on its faculty

### **Program learning outcomes**

Students in the Minor of Applied Statistics Program will be able to:

- demonstrate mathematical and statistical literacy
- understand statistics in the broader context of its scientific applications
- apply appropriate statistical methods to quantitative analysis required of a wide variety of scientific and sociological fields
- use a statistical computing software package

### **Description of learning outcomes assessment program**

#### **Summary of assessment findings for past five years**

No formal assessment was made.

#### **Major curricular changes since last review (or past five years)**

- Conversion from quarter system to semester system during which major restructuring of the curriculum was accomplished; this included elimination of out-of-date courses, development of new courses reflecting the advances in the statistical sciences, combining courses for a more efficient, modern curriculum.

#### **Graduate placement data, employer satisfaction**

## Departmental Summary

### Faculty demographics

	2008	2009	2010	2011	2012
Full	16.84	16.84	16.84	16.84	16.84
Associate	8.67	9.67	9.67	9.67	9.67
Assistant	5.66	5.66	5.66	5.66	5.23
Inst/Lect	10.00	11.00	11.00	7.33	7.00
Total	41.17	43.17	43.17	38.50	38.74

### Staffing Summary

	2008	2009	2010	2011	2012
Unclassified	3.58	3.58	3.58	3.58	4.90
Classified	4.00	4.00	4.00	4.00	4.00
Total	7.58	7.58	7.58	7.58	8.90

### Student/faculty ratio

	2008	2009	2010	2011	2012
Student FTE/Fac FTE	16.96	16.85	17.67	18.25	18.37

### Average class size

	2010	2011	2012
Lecture	28.77	30.48	34.75
Lab only	NA	NA	NA
Lecture/Lab	28.83	30.23	35.12

**Total of student data for all programs in unit**

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	140	150	190	164	187
Graduates	31	27	44	36	48

**Total credit hours generated for unit**

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Undergraduate	28,671	30,562	31,567	28,970	26,848
Graduate	814	932	888	940	828
Total	29,485	31,494	32,455	29,910	27,676

**Course completions**

	2008	2009	2010	2011	2012
Undergraduate	74.1%	76.0%	74.7%	74.8%	70.8%
Master's	87.2%	89.9%	87.1%	91.5%	90.2%

**Expense per student and revenue to expense ratio**

	2008	2009	2010	2011	2012
Expense per student	\$3,391	\$3,514	\$3,524	\$3,791	\$3,970
Rev/Expense	\$2,031	\$2,066	\$2,164	\$2,171	\$2,207

**Research and External Funding**

	2008	2009	2010	2011	2012
External funding	\$12,000	\$198,633	\$340,623	\$67,500	\$192,968

## Future employment projections for discipline

Program	2015	2017	2019	2021	2023	2025	2027	2029	2031	2033
27.0101 Mathematics, General	15	107	20	\$39.71	Region:	181	405	6.60%	20	
Occupations:					State:	2,358	2,495	5.80%		
Natural Sciences Managers (11-9171)			6		US:	88,016	93,478	6.10%		
Mathematicians (15-2021)			2							
Statisticians (15-2041)			12							
Mathematical Science Occupations, All Other (15-2039)			0							
27.0501 Statistics, General	10	45	18	\$38.64	Region:	331	354	6.80%	18	
Occupations:					State:	2,177	2,300	5.70%		
Natural Sciences Managers (11-9121)			6		US:	81,821	86,752	6.00%		
Statisticians (15-2041)			12							
Department Total and Total Regional Job Openings	25	152	38							

## Description of how unit programs and curricula are "mission critical" to the core Wright State educational experience

By the very nature of the mathematical sciences the unit programs train students to communicate more effectively, demonstrate mathematical literacy, and evaluate arguments and evidence critically. In addition, at both the undergraduate and graduate levels, the programs are focused to prepare students for future careers in teaching or industry, or for further study at the graduate level. The moderate size of the unit programs, and the faculty to student ratio, encourage faculty student interaction, which enhances both quality and success. There are, for example, opportunities for students to engage in research with the faculty and to present their work in appropriate forums. The curriculum is well designed to meet the goals of each program, and is appropriately challenging. The individual program assessments support the fact that graduates of these programs have been successful in a variety of subsequent endeavors.

## Faculty accomplishments and recognitions

- Departmental faculty members are active in five research areas: analysis, applied mathematics, discrete mathematics, mathematics education and probability and statistics. Faculty members regularly publish in peer reviewed journals, with an average of 29 publications per year attributed to the department over the last five years.
- Faculty members are dedicated to teaching as well as research. Most faculty members consistently receive very positive teaching evaluations, particularly in the advanced undergraduate courses and the graduate courses.
- Faculty members work closely with graduate students who choose the thesis option, often leading to publishable results.
- One mathematics faculty member holds the distinguished title of University Professor in recognition of his research contributions, his success in the classroom, as well as his dedication to providing students with research experiences on an individual basis.
- Two of the statistics faculty members have been named American Statistical Association Fellows.

- The Department of Mathematics and Statistics has been very successful in winning both single and multi-year grants from funding organizations such as National Science Foundation, National Institutes of Health, and the US Department of Education.
- Faculty members take responsibility for the departmental programs, serving as advisors at both the undergraduate and graduate levels. The Undergraduate Committee and the Graduate Committee oversee program development.

#### **Programs and areas of recognized excellence with supporting evidence**

- The Graduate Program in Mathematics has consistently attracted strong students who wish to pursue a career in mathematics. In recent years many of the students have come from the undergraduate mathematics programs here at Wright State. These students are well prepared for the graduate program, often taking the advanced courses in their first year of graduate study. They are then able to pursue the thesis option, leading to publications and presentations in appropriate forums. Graduates have been accepted into Ph.D. programs, or have successfully pursued careers in teaching or industry.
- The Graduate Program in Applied Statistics has recruited students from all over the world. The average number of students in the Program for the last three years (2012 – 2014) represents a 37% increase in the average number of students in the Program over the preceding seven years. Students follow a curriculum that is modern and responsive to the rapidly expanding areas within the statistical sciences. They receive first-hand, real world experience working with fellow scientists in a consulting capacity as part of their program. Graduates are highly successful in securing employment or continuing in a doctoral program. The undergraduate program, though relatively new, has grown (it doubled in 2013 compared to previous years) and many of the students in this program go on to do graduate work in statistics.
- The Department has developed a strong undergraduate program in Mathematics Education. The requirements for the Bachelor of Science degree with a concentration in Mathematics Education far exceed the “short sequence” of mathematics course recommendations made by the Conference Board of the Mathematical Sciences in *The Mathematical Education of Teachers II* (2012) and are within one course of meeting the “long sequence” of mathematics course recommendations. Additionally, Newton et al. (2014) (*Notices of the AMS*, 61(3), 292-295) found few programs meeting the recommendation that future teachers study school mathematics from an advanced perspective. The Wright State mathematics education program exceeds that recommendation.
- The Statistical Consulting Center (SCC) is a research support service for the University providing statistical expertise to researchers working with data. The SCC also works on a limited basis with external clients thereby maintaining valuable connections with the Dayton community. It works on about 128 major projects each year on the average. Statistics M.S. degree students are required to take the Statistical Consulting Course where they gain valuable experience in all phases of the statistical consulting process, working with researchers from around the University on real research projects, all under the supervision of one of the professional SCC consultants. This exposure to the practical application of their science has proven to be invaluable on their resume and in the eyes of employers. The SCC received the Presidential Excellence Award for “Outstanding Unit” in 2011.
- The Department has been successful in establishing international collaborations, hosting visiting scholars mainly from China, but also from Japan, India and Croatia. The visiting

scholars have interacted with the research faculty, presented colloquium talks, and generally enhanced the research climate of the department. Some of the visitors came specifically to observe, compare and discuss teaching methods, and to learn about the preparation of future teachers.

### **Capacity for growth of programs**

- Fall, 2013 enrollment figures for the undergraduate programs compare well with the previous 4 years. The current emphasis on STEM disciplines should lead to further growth. New options such as the concentration in actuarial science should increase enrollment.
- Enrollment at the graduate level has increased. Further growth is anticipated with the new interdisciplinary Ph.D. program approved for Fall, 2015, the biostatistics track in the Applied Statistics Program, the relatively new 5 year BS-MS program, and a possible certificate program for high school teachers which is under consideration.
- A modest increase in the undergraduate enrollment would probably not require additional resources. However, some of the 4000/6000 level courses are currently being offered at near capacity. A significant increase in enrollment would require additional sections of these courses, and hence additional resources to cover these classes.
- The new interdisciplinary Ph.D. program will definitely require additional resources, including GTA support. Some of the advanced graduate courses currently offered in alternate years may need to be offered more frequently.
- The certificate program for high school teachers, which is currently under consideration, will require additional course offerings during the summer to accommodate teachers, and possibly during the Fall and Spring semesters.

### **New program opportunities**

- The new interdisciplinary Ph.D. program has been approved to begin Fall, 2015.
- There is a current need for high school teachers to acquire at least 18 hours of graduate level coursework in mathematics and statistics to prepare for teaching dual credit courses. A certificate program is under consideration to meet this need.

### **Proposals to enhance programs**

- The expected retirement of key faculty members from these programs will require new faculty hires to maintain the quality of the programs.
- The new program in Actuarial Science will require faculty with both expertise and field experience to help students in the program.
- Faculty in applied/computational mathematics are needed to start and support the new interdisciplinary Ph.D. program.