

# FLORIDA ATLANTIC UNIVERSITY™

UGPC APPROVAL \_\_\_\_\_  
 UFS APPROVAL \_\_\_\_\_  
 SCNS SUBMITTAL \_\_\_\_\_  
 CONFIRMED \_\_\_\_\_  
 BANNER POSTED \_\_\_\_\_  
 CATALOG \_\_\_\_\_

## Graduate Programs—NEW COURSE PROPOSAL<sup>1</sup>

DEPARTMENT:  
MATHEMATICAL SCIENCES

COLLEGE:  
SCIENCE

**RECOMMENDED COURSE IDENTIFICATION:**

PREFIX STA COURSE NUMBER 6901 LAB CODE (L or C) \_\_\_\_\_

(TO OBTAIN A COURSE NUMBER, CONTACT [RSHIMAN@FAU.EDU](mailto:RSHIMAN@FAU.EDU))

COMPLETE COURSE TITLE: STATISTICAL COMPUTING

**EFFECTIVE DATE**

(first term course will be offered)

**CREDITS:**

3

**TEXTBOOK INFORMATION:**

Statistical Computing with R by Maria L. Rizzo, Chapman & Hall/CRC, ISBN 1-58488-545-9, 2008.

GRADING (SELECT ONLY ONE GRADING OPTION): REGULAR  SATISFACTORY/UNSATISFACTORY \_\_\_\_\_

**COURSE DESCRIPTION, NO MORE THAN THREE LINES:**

Algorithms in statistical computing: random number generation, generating other distributions, random sampling and permutations.  
 Matrix computations in linear models. Non-linear optimization with applications to statistical procedures. Other topics of current interest, such as machine learning, optimization, and data science.

PREREQUISITES\*:  
STA 4443 or equivalent

COREQUISITES\*:  
NONE

REGISTRATION CONTROLS (MAJOR, COLLEGE, LEVEL)\*:

\* PREREQUISITES, COREQUISITES AND REGISTRATION CONTROLS WILL BE ENFORCED FOR ALL COURSE SECTIONS.

**MINIMUM QUALIFICATIONS NEEDED TO TEACH THIS COURSE:**

PH.D. IN MATHEMATICS OR PH.D. IN STATISTICS

Faculty contact, email and complete phone number:  
Lianfen Qian  
lqian@fau.edu  
297-2436

Please consult and list departments that might be affected by the new course and attach comments.<sup>3</sup>  
N/A

**Approved by:**

Department Chair: Lee Klingler  
 College Curriculum Chair: [Signature]  
 College Dean: [Signature]  
 UGPC Chair: [Signature]  
 Graduate College Dean: [Signature]  
 UFS President: \_\_\_\_\_  
 Provost: \_\_\_\_\_

**Date:**

4/9/13  
4/29/13  
4/29/13  
9-11-13  
9-12-13

1. Syllabus must be attached; see guidelines for requirements: [www.fau.edu/provost/files/course\\_syllabus.2011.pdf](http://www.fau.edu/provost/files/course_syllabus.2011.pdf)

2. Review Provost Memorandum: **Definition of a Credit Hour**  
[www.fau.edu/provost/files/Definition\\_Credit\\_Hour\\_Memo\\_2012.pdf](http://www.fau.edu/provost/files/Definition_Credit_Hour_Memo_2012.pdf)

3. Consent from affected departments (attach if necessary)

Email this form and syllabus to [UGPC@fau.edu](mailto:UGPC@fau.edu) one week before the University Graduate Programs Committee meeting so that materials may be viewed on the UGPC website prior to the meeting.

# Syllabus

1. Course Name	Course Number	Credit Hours
Statistical Computing	STA 6901	3

## 2. Course prerequisites

STA 4443 or equivalent

## 3. Instructor

Lianfen Qian, Office SE 244

Phone: (561) 297-2486, fax (561) 297-2436

E-mail address: lqian@fau.edu

## 4. Course description

Algorithms in statistical computing: random number generation, generating other distributions, random sampling and permutations. Matrix computations in linear models. Non-linear optimization with applications to statistical procedures. Other topics of current interest, such as issues of efficiency, and use of graphics.

## 5. Course objectives

Upon completing this course students can expect to be able to conduct simulation studies using R language for research projects. In details, students will be able to write R language program for optimization problem, EM algorithm, Markov Chain Monte Carlo and Bootstrap methods.

## 6. Lecture Schedule

- Introduction to R (ca. 1 week)
  - Homework: Read intro.pdf and learn to write R sample program for functions
- Random number generation (ca. 1 week)
  - Homework: Using R to generate random samples for given distributions
- Visualization of multivariate data (ca 2 weeks)
  - Homework: Conduct exploratory data analysis using R language for multivariate data
- Monte Carlo integration and variance reduction (ca 2 weeks)
  - Homework: Conduct simulation study and choose efficient methods
- Numerical solution for non-linear optimization problems (ca. 2 weeks)
  - Homework: Write R program to solve non-linear system from maximum likelihood method and analyze real data sets
- Monte Carlo Methods in inference (ca 2 weeks)
  - Homework: Conduct simulation studies for different model settings and begin final project
- EM algorithm (ca. 2 weeks)
  - Homework: Analyze data with missing values using EM algorithm and continue final project

- Markov Chain Monte Carlo methods (ca 2 weeks)
  - Homework: Simulate data using MCMC method, analyze real data and continue final project
- Bootstrap methods (ca 1 week)
  - Homework: Using bootstrap method to obtain bootstrap sampling distribution, make bootstrap inference and complete final project

## 7. Required Text

Statistical Computing with R by Maria L. Rizzo, Chapman & Hall/CRC, ISBN 1-58488-545-9, 2008.

## 8. Supplementary/recommended readings

- Simulation techniques in financial risk management, Ngai Hang Chan and Hoi Ying Wong. Wiley, 2006.
- *Elements of Statistical Computing: Numerical Computation*, Ronald A. Thisted, Chapman & Hall/CRC, 2000.

## 9. Assessment Procedure and Grading

There will be graded homework assignments accounting for 40% of your cumulative performance, a midterm exam, accounting for 30% of your cumulative performance, and a final project that accounts for 30% of your cumulative performance. Your overall grade in the course is derived from your cumulative performance according to the following table.

Cumulative Performance	Grade
> 94%	A
> 90% – 94%	A–
> 87% – 90%	B+
> 83% – 87%	B
> 80% – 83%	B–
> 75% – 80%	C+
> 65% – 75%	C
> 60% – 65%	C–
> 57% – 60%	D+
> 53% – 57%	D
≥ 50% – 53%	D–
<50%	F

## 10. Incomplete Grades

A grade of *I* (incomplete) will only be given under certain conditions and in accordance with the academic policies and regulations put forward in FAU's *University Catalog*. The student has to show exceptional circumstances why requirements cannot be met. A request for an incomplete grade has to be made in writing with supporting documentation, where appropriate.

## 11. Makeup Tests and Extra Credit

If you cannot attend an exam or hand in a homework project in time due to a relevant reason like significant health problems or being involved in a major traffic accident, and you document this, then you can make up the respective assignment.

Extra credit work is not possible.

## **12. Method of Instruction**

The course is conducted in lectures combined with lab sessions. Assignments may require the use of a statistical software package such as Minitab or R language. Unless otherwise specified, for those assignments you can use statistical package of your choice.

## **13. Disability policy statement**

In compliance with the Americans with Disabilities Act (ADA), students who require special accommodations due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) located in Boca Raton - SU 133 (561-297-3880), in Davie - MOD I (954-236-1222), in Jupiter - SR 117 (561-799-8585), or at the Treasure Coast - CO 128 (772-873-3305), and follow all OSD procedures.

## **14. Honor Code policy statement**

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty, including cheating and plagiarism, is considered a serious breach of these ethical standards, because it interferes with the University mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the University community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001 at [http://www.fau.edu/ctl/4.001\\_Code\\_of\\_Academic\\_Integrity.pdf](http://www.fau.edu/ctl/4.001_Code_of_Academic_Integrity.pdf)