Fall 2013 Advising Newsletter
Department of Mathematics and Statistics

Dear Majors and Minors in the Department of Mathematics and Statistics,

Registration for Fall 2013 classes will take place April 3-12 and advising will begin shortly. We cannot emphasize enough the importance of meeting with your advisor to discuss your academic plans, progress, and career goals. To encourage you meeting with your advisor, every non-graduating student (so graduating seniors aren't eligible, sorry!) who meets with their advisor will be entered to win a $25 gift card from the bookstore. To enter, when you meet with you advisor, please pick up a blue entry form. Fill out the information and drop off the form in the department office. We'll draw and announce the winner once registration is over. Your advisors should be contacting you to arrange a time to meet, but you can also reach out to your advisor to schedule an appointment. Good luck in the drawing!

Here are a number of general department announcements that you should be aware of:

1. *Student Advisory Board and Suggestion Box.* The Student Advisory Board is composed of the six majors: Kayla Coleman, Vianna Fagel, Erica Hernandez, Virginia Hixson, Alana Huszar, and Ryan Manheimer. These students represent all of the department's majors and specializations and meet with the co-chairs twice a semester to discuss issues of concern. Suggestions can be sent to the Student Advisory Boards at mathsab@tcnj.edu. The department also has a suggestion box in the department office (a green box labeled "Suggestion Box") where you can also make suggestions.

2. *Waiting Lists.* This spring, the Department will again have a waiting list for all closed classes. Once your registration time opens up, if a class is closed, you should fill out the Google form -- found at the link on our web site, or at http://tinyurl.com/TCNJWaitList -- to be placed on the wait list. As students change courses, and spots open up in closed classes, the Department will fill the spots with students from the wait-list. The wait list should be used only when there is a closed section that you need to enroll in and there is no open section that fits your schedule.

3. *Differential Equations.* All students in the Applied Mathematics specialization, and all students considering switching to the Applied Mathematics specialization should take the course MAT 326: Differential Equations as early as possible in their college career. It should be taken no later than the end of their sophomore year. To ensure this, the department will pre-enroll all students in the Applied Mathematics specialization or those considering switching to the specialization. To be pre-enrolled in MAT 326, please email the department at mathstat@tcnj.edu with your id number and the section of the Differential Equation you would like to be registered for.

4. *Capstone Courses.* All senior Mathematics and Statistics majors are required to complete a capstone course (MAT/STA 498). These courses are only offered in the Spring semester. When planning your fall schedule, you should ensure that your schedule will allow you to take the capstone course in the spring. Also, students who expect to graduate in Fall 2014 will need to

take the capstone course in the Spring 2014 semester. Please make sure that you have completed the necessary prerequisites for the capstone. Remember also that one of the prerequisites for the capstone is to attend four seminar/colloquium presentations in your junior and senior years prior to taking the capstone course.

5. *Departmental Honors.* We would like to encourage more of our majors to consider earning departmental honors. Departmental honors are awarded by our department at graduation and appear on one's transcript. They are independent of the College's Honors Program, and the Latin honors (*summa cum laude*, …) awarded at graduation. To earn departmental honors, students must have a 3.5 GPA in mathematics and statistics courses and complete the following:
   - A student must engage in independent research during their junior or senior year. The student should successfully complete an Independent Research 493 course during a semester they spend on-campus, and prepare a paper which will be due the middle of their last (graduating) term. A presentation (which we envision being a 40 minute talk, perhaps during a lunch period) will be given in the two week period following the submission of the paper. The members of the student's Honors Committee will be present, and be given ample opportunity to ask the students questions about their research to gauge their level of understanding.

6. *Applied Mathematics Options and 400-level requirement.* The Applied Math Options for the 2013-14 academic year are indicated by an asterisk below. Applied Mathematics majors should also remember that they must take a 400-level Applied Math Option course and at this time, these courses are only offered in the spring semester.

7. *Sections of Courses.* The following list shows the currently anticipated number of sections to be offered for the upper level courses in the major. The list of all regular offerings is at http://mathstat.pages.tcnj.edu/files/2011/06/CourseOfferingsS12revision.xls.

   The courses listed in bold are courses that were not offered during the current 2012-13 year. Please take advantage of the opportunity to take them! Descriptions can be found at the end of this newsletter.

Fall 2013 Semester (# of sections)	*Spring 2014 Semester (# of sections)*
MAT 301: Number Theory (1)	MAT 301: Number Theory (2)
MAT 305: Abstract Algebra (2)	MAT 305: Abstract Algebra (1)
MAT 310: Real Analysis (1)	**MAT 317: Linear Programming* (1)**
MAT 316: Probability* (2)	MAT 316: Probability* (2)
MAT 326: Differential Equations (2)	MAT 320: Complex Analysis (1)
MAT 331: Numerical Methods* (1)	MAT 326: Differential Equations (2)
MAT 351: Geometry (1)	MAT 351: Geometry (1)
MAT 370: Topics in Mathematics (Graph Theory) (1)	**MAT 453: Seminar in Real Analysis (1)**
MAT 452: Seminar in Geometry/Topology (1)	**MAT 454: Seminar in Applied Mathematics (Partial Differential Equations)* (2)**
	MAT 498: Capstone (2)

MTT 380: Methods of Teaching Mathematics I (2)	MTT 390: Methods of Teaching Mathematics II (1)
MTT 490: Student Teaching (2)	MTT 490: Student Teaching (4)
STA 305: Regression Analysis (2)	**STA 303: Design of Experiments (1)**
STA 306: Applied Multivariate Analysis (1)	**STA 307: Data Mining and Predictive Modeling (1)**
STA 410/ MAT 318 : Mathematical Statistics (1)	STA 498: Capstone (1)

We wish you a successful registration session. Please write or see us if you have any questions!

Sincerely,

Professors Hagedorn and Liebars
Co-Chairs of the Department of Mathematics and Statistics

Fall 2013 Semester:

1. *MAT 331: Numerical Methods*. Prof. Gevertz.
   Prerequisites: MAT 128 and MAT 205.
   Description: Numerical Methods is a course which focuses on methods of approximating solutions to problems for which the techniques of the earlier Calculus and Linear Algebra courses fail. A course covering methods of approximation, errors in approximation, and efficiency of algorithms.

2. *MAT 370: Topics in Mathematics (Topic: Graph Theory).* Prof. Alves.
   Prerequisites: MAT 200 and MAT 205.
   Description: A graph is a set of points called vertices and a set of edges (lines/relations) connecting vertices. Part of the appeal of graph theory is that many of its concepts, as illustrated by the definition of a graph, are easy to understand and visualize. Another aspect that is appealing is the variety of fields it can be applied to. Some of the questions we'll address will be:
   a. What is the minimum number or airplanes an airline needs for its fleet to be able to cover a desired set of routes?
   b. Can a salesperson cover their territory visiting each city exactly once on a given trip?
   c. How can we schedule final exams to avoid conflicts?
   d. What is the minimum number of colors needed to color any map, so that no two states (counties/electoral districts/school districts/…) sharing a border are assigned the same color?

   While theory is part of the title, this is not a heavy theoretical course as you can see from the types of questions we'll be addressing. You'll see that graph theory is actually a lot of fun!

3. *MAT 452: Seminar in Geometry and Topology (Topic: Knot Theory).* Prof. Curtis.
   Prerequisites: MAT 229 and MAT 305.
   Description: Knot theory is just what it sounds like: the study of knots in ropes or strings, or more mathematically, in infinitely thin strings. The mathematics of knots has been studied since the late 19th century. The field has applications in topology, biology, chemistry, and statistical mechanics.

   The primary problem in knot theory is to determine when two knots can be *deformed*, or pushed, to look like one another. Questions in knot theory are generally quite simple to state; however solving them can be very challenging. Techniques used to solve problems in knot theory come from linear algebra, group theory, geometry, and combinatorics, so you will be able to use and build upon your knowledge in these areas.

I will run the course as a seminar, inviting (expecting) a lot of participation from the class. MAT305 is a co-requisite, so you should have completed it or be planning to take it in the fall. For more information contact Professor Curtis.

Spring 2014 Semester:

1. *MAT 317: Linear Programming.* Prof. Thayer.
   Prerequisites: MAT 205, and MAT 127 or MAT 125
   Description: Linear Programming deals with the problem of maximizing or minimizing a linear function subject to a set of linear constraints. Areas as diverse as finance, the military and medicine all extensively exploit the mathematical techniques and theory of linear programming. The field is important to many businesses because it allows complex problems to be represented in the form of mathematical models.

   This course is an introduction to the theory and applications of linear programming. Selected topics include: the simplex method for solving a linear program (LP), the geometry of LPs, variants of the simplex method, constructing mathematical models using LPs, duality theory, sensitivity analysis, integer programming, transportation and trans-shipment models, network models, program management models, and solving LPs using modern software packages (Excel, LINDO, LINGO, AMPL or MATLAB). Connections to Linear Algebra will be highlighted where relevant.

2. An introduction to the field of operations research, in particular that portion of the field which deals with deterministic problems. Topics include optimization using linear programming techniques, network problems, and applications to problems of transportation and trans-shipment. Operations research software packages are integral to the course.

3. *STA 303: Design of Experiments.* Prof. Holmes.
   Prerequisites: STA 215.
   Description: An introduction to problems and techniques inherent to the design and analysis of experiments. There are broad applications across numerous disciplines in the sciences and the humanities. Topics include: analysis of variance, blocking, general factorial models, nested designs, confounding and fractional replication. A statistical software package will be used throughout the course (SAS, SPSS or MINITAB).

4. *STA 307: Data Mining and Predictive Modeling.* Prof. Ochs.
   Prerequisites: BIO 352 or ECO 231 or MAT 316 or PSY 303 or (CSC 320 and STA 215).
   Description: An introduction to Data Mining and Predictive Modeling. Topics include decision trees, link functions, logic regression, neural networks, TreeNet, support vector machine, text mining, association rules (market basket analysis), and link analysis.

5. *MAT 453: Seminar in Analysis (Topic: Real Analysis II).* Prof. Kardos.
   Prerequisites: MAT 229 and MAT 310.
   Description: In this course we continue to explore deeper properties of real functions and the real line. We will also continue to work with limit processes by exploring derivatives, sequences and series of functions and the concept of the definite integral.

6. *MAT 454: Seminar in Applied Mathematics (Topic: Partial Differential Equations).* Prof. Harris
   Prerequisites: MAT 229 and MAT 326.
   Description: In this course we will begin by studying series solutions and Laplace Transforms, two topics that may have been covered briefly in MAT 326 - Differential Equations. From there, we will explore Fourier series, series that are used to express functions as sums of trigonometric functions. These series will be used in our analysis of partial differential equations, differential equations that contain partial derivatives of multivariable functions. There will be an in-depth study of three classic partial differential equations – the wave equation, the heat equation, and Laplace's equation. The heat equation describes heat flow through a wire whose ends are kept at a constant temperature. The wave equation describes the motion of a vibrating string. Laplace's equation describes steady state temperature in a region. We will study methods for determining solutions to these fundamental equations. At the end of the course we will consider numerical solutions to partial differential equations and students will be expected to approximate solutions numerically.