Goals: The objective of this course is to provide a foundation for a range of students both in and outside of Statistics who seek to do research involving spatial and spatio-temporal statistics. For Statistics students, the goals will be to learn some of the underlying theory for Gaussian processes as it relates to estimating covariance functions and interpolation of irregularly observed spatial and spatio-temporal data, as well as to understand some of the practical problems with applying methods from spatial statistics to real data. For students outside of Statistics, the goals will be to gain an understanding of the properties of a range of models and methods for analyzing spatial and spatio-temporal data and when these models and methods may be appropriately used to address scientific problems. All students are expected to gain a facility for and appreciation of interacting with researchers from disciplines outside of their own. In addition to the formal assignments and project, interactions between students in and outside of lectures is encouraged and will be an important part of the educational process.

Expected background: The main audience for this course is Ph.D. students in Statistics. Those students will be expected to have a previous solid background in time series analysis at the level of 16:960:665, Advanced Time Series Analysis. Students who have this background will necessarily have the appropriate background in mathematics and statistics to take the course. The course will be structured to also be suitable for doctoral students in other disciplines with a solid statistical background and a strong interest in spatial statistics as part of their doctoral research. The required coursework will have sufficient flexibility between theory, numerical computations, simulations and data analysis to allow such students to benefit from the class. Students must have a working knowledge of the statistical package R. Advanced Masters students both in and out of Statistics may be allowed to take the class based on the strengths of their backgrounds and the relevance of the course content to their research interests.

Web page: All handouts (including this one) and homeworks will be posted on the course website.
**Homeworks:** There will be approximately six homework assignments during the semester. These will cover a range of theory, methodology and applications. The more theoretical parts of problems will be optional for students outside of Statistics. The first assignment will be posted before the first class meeting and will be due on January 31.

**Project:** In addition to homework assignments, there will be a modest final project on a topic to be chosen by each student in consultation with the instructor. Students outside of Statistics would normally do a project using data relevant to their research interests. Projects by groups of two students with one in Statistics and one outside of Statistics are possible. Draft project write-ups will be due a few weeks before the end of the semester to give time for students to receive feedback and revise their work. Oral presentations will be given at the end of the semester.

**Lectures:** Lectures will be fairly freewheeling with, hopefully, lots of discussion.

**Grading:**

- Homework, 60%
- Written final project, 30%
- Oral presentation(s) on final project, 10%

**Text:** You do not need to purchase a text for the class. I am presently writing a book on spatial statistics that will serve as a text for part of the course. I will make draft chapters of the text freely available to registered students in the class. *Circulation of any of this material to anyone outside the class is strictly forbidden.* For space-time statistics, for which I have not yet written any material, some of you may find it helpful to consult *Spatio-Temporal Statistics with R* by Wikle, Zammit-Mangion and Cressie, for which a pdf file is available for free at [https://spacetimewithr.org](https://spacetimewithr.org). In addition to covering some statistical concepts for spatio-temporal data, it also describes an R package for analyzing spatio-temporal data.

**Office hours:** I will have an office hour on Wednesdays at 3:30 and can make arrangements to meet virtually with students at other times.

**Academic Integrity:** All students are responsible for locating, reading, and abiding by the University Policy on Academic Integrity for Graduate Students. The policy is available on-line at [http://academicintegrity.rutgers.edu/](http://academicintegrity.rutgers.edu/).
Specifically,

a) You must properly acknowledge and cite all use of the ideas, results, or words of others.
b) You are welcome to discuss homework problems, assignments and projects with others unless stated otherwise, but every write-up and code you submit must be your own and produced without the aid of unsanctioned materials or unsanctioned collaboration. In particular, you may not copy and paste someone else’s computer code or output. If you run any simulations, use your own personal values of \texttt{set.seed} to ensure that your simulation results are not identical to those of another student.
c) You should properly acknowledge all contributors to a given piece of work.
d) You must treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress (reproduced from http://academicintegrity.rutgers.edu/academic-integrity-at-rutgers/).