

WELLESLEY COLLEGE

QUANTITATIVE ANALYSIS INSTITUTE

Summer Program 2014 Information

Overview: The Quantitative Analysis Institute Summer Program is a statistics and data analysis course for Wellesley students that meets three days a week during June and July. Students can earn a Quantitative Analysis Institute Certificate. The course is free and not for course credit.

About the QAI: The QAI was founded in 2013, designed to expand the role of statistics in research, learning, and teaching at Wellesley. In Summer 2013, the QAI piloted a summer course for students participating in the summer research programs. The QAI also includes courses during the semester, workshops for students and faculty, and statistical consulting for research projects. The QAI website is at <http://www.wellesley.edu/lts/qai>.

Summer Program description: The goal of the QAI Summer Program is to introduce advanced statistical skills while supporting students in their current and future research projects. The course is also intended to bring together students from a variety of disciplines whose work involves data. Topics include **statistics fundamentals**, such as study design, statistical inference, and tools for handling common complications like missing data or multiple comparisons; **practical data handling skills**, including data cleaning and the use of complex data sets; and **data communication**, such as best practices for creating graphics and writing about scientific findings. All students will become proficient in the statistical software R, which is free, open-source, and field-neutral, and training in other statistical software packages used in students' summer research, such as Stata and SPSS, will be available as well.

A syllabus will be available later in the spring.

Instructor: Cassandra Pattanayak, Guthman Director of the QAI
Office: Clapp 238
Email: cpattanayak@wellesley.edu

When: The course will meet from June 2 - July 24, Mon/Wed/Thu 9am-noon. The three-hour sessions will include instruction as well as time for students to work on practice assignments.

In addition, the QAI will schedule optional sessions focused on topics of interest to subsets of students, such as field-specific software training or work-in-progress seminars for research assistants.

Quantitative Analysis Institute Certificates: Students who attend class meetings regularly throughout the summer and satisfactorily complete all assignments will earn QAI Certificates.

Who should apply: Students who plan to be on campus during Summer 2014 are welcome to apply. In particular, students participating in the Science or Social Science Summer Research Programs are encouraged to speak to their advisors about building the QAI program into their summer goals. Students working on campus, such as for the Office of Institutional Planning and Assessment or the Wellesley Centers for Women, should also speak to their supervisors about including the QAI program in their responsibilities. Students who will be living on or near campus should also consider applying.

The program is primarily aimed at students who have completed one previous data-focused course, such as a course that meets the QR overlay requirement. If you haven't taken a QR overlay course but believe

you are prepared based on other coursework or experiences, please get in touch with the QAI Director to discuss.

Application instructions: The application form is available here:

<https://www.wellesley.edu/lts/qai/courses/qai-summer-course>

Please download the pdf application, complete the forms, and email it back to cpattanayak@wellesley.edu. Applications will be considered on a rolling basis. Applications received by April 1 will receive first priority. Please discuss your interest in the QAI program with your advisor or supervisor before applying, if applicable.

For more information: Please contact Cassandra Pattanayak at cpattanayak@wellesley.edu.



Quantitative Analysis Institute Summer Course
Summer 2013

Syllabus subject to change – watch website

Instructor: Cassandra Pattanayak, Director, Quantitative Analysis Institute
cpattanayak@wellesley.edu, Clapp 238

Class Meetings: Mon, Wed, Thurs, 9-11 am, June 3-July 25 (*except July 4*), PNE 130

Office Hours: Mon, Wed, Thurs, 11-12:30, beginning in PNE 130 and moving to Clapp 238; and by appointment

Course Website: <https://sites.google.com/a/wellesley.edu/qai-sum-13/>

Description: The QAI summer course is intended to introduce advanced statistical skills and support students in their current and future research projects. Students will gain an understanding of fundamental statistical principles and methods, along with practical computational skills and experience working with data. This is a pilot program.

Prerequisites: This course is primarily aimed at students who have completed the QR overlay. However, we anticipate that a few students who lack the QR overlay will participate, and we're working on how best to provide support.

QAI Certificate: Students are encouraged to attend all class meetings, but you are also welcome to attend sessions according to your interest. Students who participate throughout the summer and complete all assignments will earn a Quantitative Analysis Institute Certificate.

Assignments: Half of each class meeting will be dedicated to practice exercises. If an assignment is not complete by the end of class, students are required to finish the exercise outside of class only if aiming to earn a QAI Certificate.

Software: All students will learn basic R during certain whole-class exercises, and each student will complete practice exercises in her own field's preferred software (such as R, Stata, SPSS, SAS, or JMP), with instructor support.

Structure of class meetings: On a typical week, one class meeting will focus on statistics fundamentals, one will focus on data handling skills, and one will focus on communicating data and results. Software skills will be integrated into all lessons. Approximately the first half of each class will be spent on instruction, and the second half will be spent on practice exercises.

Weekly Structure	Monday	Wednesday	Thursday
Hour 1: Lesson	Statistics fundamentals	Data handling principles	Communicating data and results
Hour 2: Practice	Computational and written exercises	Data handling exercises; Implementing and exploring statistical methods	Computing exercises on visualization, table creation, summary statistics, guidelines for writing about quantitative findings

Course outline, subject to change: Each week, lessons and practice during the three class meetings will focus on a particular motivating data example. However, the statistical lessons will be generalizable to any field. Some data examples will be derived from faculty members' research, and those faculty members will visit the class to introduce and discuss the examples. The topics shown here will be rearranged as needed to correspond to the selected data examples. An up-to-date schedule will be available on the course website throughout the summer.

	Monday	Wednesday	Thursday
	<i>Statistics fundamentals</i>	<i>Data handling</i>	<i>Communicating data and results</i>
Week 1 (June 3)	Introduction; Sampling, randomization, and bias	Reading data from various formats; Basic data exploration; Central Limit Theorem via simulation	Boxplots, scatterplots, histograms; Writing output and saving graphics
Week 2 (June 10)	Hypothesis tests, confidence intervals, and robustness to assumptions; Randomization-based inference	Performing hypothesis tests and calculating confidence intervals	Best practices for summarizing study results, quantitatively and in words
Week 3 (June 17)	Causality and generalizability	Comparing multiple groups; Assessing generalizability and causal scope of a data set	Visualizing multivariate distributions
Week 4 (June 24)	Probability and Bayes' theorem; Bayesian inference	Merging multiple data sets; Databases; Implementing simulation- based inference	Producing clean summary tables; basic LaTeX
Week 5 (July 1)	Multiple comparisons (Bonferroni, etc.)	Reading and writing codebooks; Implementing multiple comparison techniques	<i>No class July 4 (optional practice session on Tuesday, July 2, time TBD)</i>
Week 6 (July 8)	Regression/ANOVA	Implementing regression; Model selection and evaluation; Multicollinearity	Visualizing models; Checking model assumptions graphically
Week 7 (July 15)	Missing data	Imputation of missing values; Data cleaning	Mapping, ArcGIS
Week 8 (July 22)	Survey question design and weights; Measurement bias	Implementing methods that include weights	Wrap-up; Preview of other topics