7010A Block III-1, Spring 2019

Quantitative Skills for the Biomedical Researcher I
http://quantitativeskills.org

Instructors (Office hours by appointment)
Ryung S. Kim, PhD. (ryung.kim@einstein.yu.edu) Block 316, (718) 430-3378
Jee-Young Moon, PhD. (jee-young.moon@einstein.yu.edu) Belfer 1312B, (718) 430-3558

Teaching Assistant (Office hours by appointment)
Josh Axelrod (jaxelrod@mail.einstein.yu.edu)

Lectures: Mon., Wed. @ 1:20–2:40, Friday @1:20-3:10 3rd Floor Lecture Hall, Forchheimer
On March 25th and April 1st, the lecture will be at 5th Floor Lecture Hall.

Main Source of Information: Class notes will be posted on the course webpage.

Recommended Textbook: These books are not necessary for the course but they may be helpful resources for your research.
Marcello Pagano and Kimberlee Gauvreau, *Principles of Biostatistics, 2nd Edition*
Bernard Rosner, *Fundamentals of Biostatistics 8th Edition*

Reading Assignments (choose one of the followings)

1. Three articles:
   Ioannidis J. *Contradicted and initially stronger effects in highly cited clinical research.* JAMA, 2005:294:218-28
   Ioannidis J. *Why Most Published Research Findings Are False.* PLoS Med, 2005:2(8):e124
   Fanelli D, Ioannidis J. *US studies may overestimate effect sizes in softer research*. PNAS USA, 2013:110(37):15031-36.

2. Daniel Kahneman. *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux, 2011 (Introduction, parts II and III)

3. Geoffrey Kabat. *Getting Risk Right: Understanding the Science of Elusive Health Risks*, NY: Columbia Univ. Press, 2017

This 3-week course aims to acquaint students with the fundamental concepts of biostatistics, applications of basic methods, and their interpretation. Topics covered will include introduction to probability, discrete and continuous probability models, sampling distributions, the central limit theorem, confidence intervals, hypothesis testing, and statistical theory of research reproducibility. Students will gain familiarity with the statistical programming language R. All students are expected to have basic computer skills and college mathematics.

Topics	**Pagano and Gauvreau Chapters**
Hypothesis Testing (Part I)	1
Probability and Distribution	6,7
Sampling Distribution	8
Hypothesis Testing (Part II)	10
Confidence Interval	9
Inference on Two Means	11
Inference on Proportions	14
Reproducibility in Medical Research	N/A

Homework: There are weekly homework assignments posted on the course webpage. They must be submitted before the class on the due date. On the due date, your assignment will be graded automatically and you will receive some feedback.

Exam: There will be one take-home exam for the topics. You must work alone. Makeup exam will not be given unless advance arrangements have been made, and then only in extreme circumstances.

Reading Response Paper: Write a well-organized, grammatically sound, and rational 2 page (double-spaced, 12-point font, 1" margins) response. If you are reading Ioannidis papers, write persuasive arguments and evidence about the current lack of reproducibility in research and/or the reason behind it. You do not need to report all the numbers in the papers, but rather report what you deem as the most persuasive evidence. If you are writing book responses, write about how the author challenged your understanding of statistical intuition or research reproducibility. In addition to answering this general question, engage one argument the author makes.

You may propose novel ideas for various parties (investigator, funding agency, institutional review board, institutional committees on appointments and promotions) to promote reproducibility in research. Note these suggestions are not meant to structure your paper; they are meant to spark your thinking about the books. Your paper may be structured in any way you see fit. You are

encouraged to discuss this assignment with your classmates. But you should write up the response yourself. The paper must not be longer than two pages. Submit it by email.

Grades will be based on **homework (20%), reading response paper (20%) and an exam (60%).**

Statistical Software: You will use the statistical software R. The core learning outcomes of the course are conceptual and are *not* related to the software. You are not going to need the software for the exam.

Course schedule

Date	Lectures	Assignments due
11 March (M)	Units 1.1 & 1.2	
13 March (W)	Units 1.2 & 1.3	
15 March (F)	Conference	Homework 1
18 March (M)	*Julius Marmur Symposium*	
20 March (W)	Units 1.3-1.4	
22 March (F)	Unit 1.5-1.6	
25 March (M)	Conference	Homework 2
27 March (W)	Units 1.7-1.8	
29 March (F)	Units 1.8-1.9	Reading Response Paper due
1 April (M)	Conference	Homework 3
3 April (W)		Take-home Exam due

Attendance at conferences is mandatory. Conference sessions are for working through problems and learning how to use statistical software. **Lectures will be focused on the explanation of statistical concepts, whereas problem solving will be taught during the conferences.** During the conferences, the instructor will go over a few (not all) problems in the conference material. Please bring your own laptop with the latest version of R installed on it.

Exercise problems: For students who want additional practice problems, we have chosen several problems from each chapter to help you self-study. This is not homework so do not submit your work.

Chapter 2 exercises 3,7,8,14,16,18,19
Chapter 3 exercises 7,8,11
Chapter 6 exercises 8,11,13
Chapter 7 exercises 8, 10, 15, 18, 19
Chapter 8 exercises 2,5,10,13,15
Chapter 9 exercises 1,3,4,8,10
Chapter 10 exercises 3,4,11(b,c),14
Chapter 11 exercises 1,5,10(a-c),14
Chapter 14 exercises 5,7,10
Chapter 15 exercises 16

Course accommodations: Students with a disability that may require some modification of seating, testing or other class requirements should contact the instructor at the beginning of the semester.

Collaboration and academic honesty: You are encouraged to discuss homework with your classmates. However, outright copying is unacceptable. It is fine to discuss how to do a problem, but you should do the actual work and write up the answers yourself. For the take-home examination, each student must work alone and without any assistance from other students or sources. In the event of suspected cheating and plagiarism, the instructor must immediately provide the Associate Dean of Graduate Education with a complete written report of the incident and evidence of cheating or plagiarism for review by the Academic Affairs Committee.