Week 1: Course Introduction, Outcomes, Events, and Probabilities

Gracia Dong

STA 237

Fall 2024

Overview

- Welcome to STA237!
- Overview of course policies and the syllabus
- Outcomes, events and probability

Who am I?

- Instructor: Dr. Gracia Dong
- Assistant Professor, Teaching Stream, Human Biology Program and Statistical Sciences
- Office: Stewart Building (149 College Street), Room 410B
- I did all my degrees at the University of Waterloo, and then did a postdoc joint between the University of Toronto and the University of Victoria
- My background is in computational statistics, but I've since pivoted to biostatistics

What is STA237 about?

- An introduction to probability
  - We will cover probability from both a simulation and mathematical viewpoint, as well as how it relates to real life scenarios
  - This lays foundation for more advanced courses in statistical sciences
  - We will use R for calculations and to guide the theoretical component through simulations
- If you are interested in a more mathematical approach to probability, you can consider taking STA257 instead
  - You will want to take STA257 if you are in actuarial science and are planning on writing the P exam soon
- There are a lot of concepts in this course, and it may feel disjointed at first, but things will come together by the end!

Who are you?

- I expect you to know basic calculus, set theory, and logic
- We will review any necessary formulas!
- No prior knowledge of statistics is assumed
- No prior experience with R is assumed

Course Policies

Class Times

LEC0201 Tuesday 9-11am R 10-11am	TUT0201- TUT0204 Thursday 9-10am
LEC0301 Tuesday 1-3pm Thursday 1-2pm	TUT0301-TUT0304 Thursday 2-3pm

My Office Hours:

- Tuesday 11am – 12:30pm
- Tuesday 3 – 4pm
- Thursday 11am – 12:30pm

Room 410B, Stewart Building

- You MUST attend your registered tutorial section
- You can attend either of my lecture sections AS LONG AS there are empty seats
- Typically, we will use Tuesdays to go through concepts and Thursdays to go through examples

Communication with the Teaching Team

- Questions about course content → Post on Quercus Discussion Board. Our Quercus site is https://q.utoronto.ca/courses/354355
  - Questions about quizzes, reflections, lecture/tutorial content, exams,…
- Personal questions and questions related to course administration → Email sta237@course.utoronto.ca
  - Questions about your specific assessment, accessibility accommodations, info about office hours,…
- Instructor-specific questions → Email gracia.dong@utoronto.ca
  - Requests for reference letters,…
- We will aim to reply to all inquiries within 2 business days

Quercus Page

2024 Fall

- Home
- Announcements
- Discussions
- Modules
- Grades
- Library Resources

Recent Announcements

STA237H1 F (ALL SECTIONS) 20249:Probability, Statistics and Data Analysis I

SYLLABUS	MEET THE FALL 2024 STA237H1 INSTRUCTORS

Week 1 - Sept 3-8 (Intro)	Week 2 (TBA)	Week 3 (TBA)
Week 4 (TBA)	Week 5 (TBA)	Week 6 (TBA)
Week 7 (TBA)	Week 8 (TBA)	Week 9 (TBA)
Week 10 (TBA)	Week 11 (TBA)	Week 12 (TBA)

COURSE HELP & SUPPORT	ASSESSMENTS

Mark Breakdown

- Weekly Reflections – 10% (1% each up to a maximum of 10%)
  - Due every Sunday night at 11:59pm
- Tutorial Quizzes – 3 x 10% each
  - Can work in groups of up to 3
  - Must be written in your own tutorial section
  - Sept 25/26, Nov 6/7, Nov 20/21
- Term Test – 20%
  - Friday, October 18, 5-6:30pm
  - Makeup available if you have a conflict – see syllabus for details
- Final Exam – 40%
  - 2 hours, To be scheduled by the faculty between Dec 6-21

Missed Assessments

- Fill out the missed assessment form on Quercus within 1 week of the tutorial quiz or term test, with attached documentation
  - Absence declaration via ACORN
  - U of T Verification of Illness or Injury Form (VOI)
  - College Registrar's letter
  - Letter of Academic Accommodation from Accessibility Services
  - Proof of Course Conflict (for the term test only)
- Tutorial quiz 1 will be shifted to the term test
- Tutorial quiz 2, 3, and term test will be shifted to the final
- Full details are on the syllabus

Academic Integrity

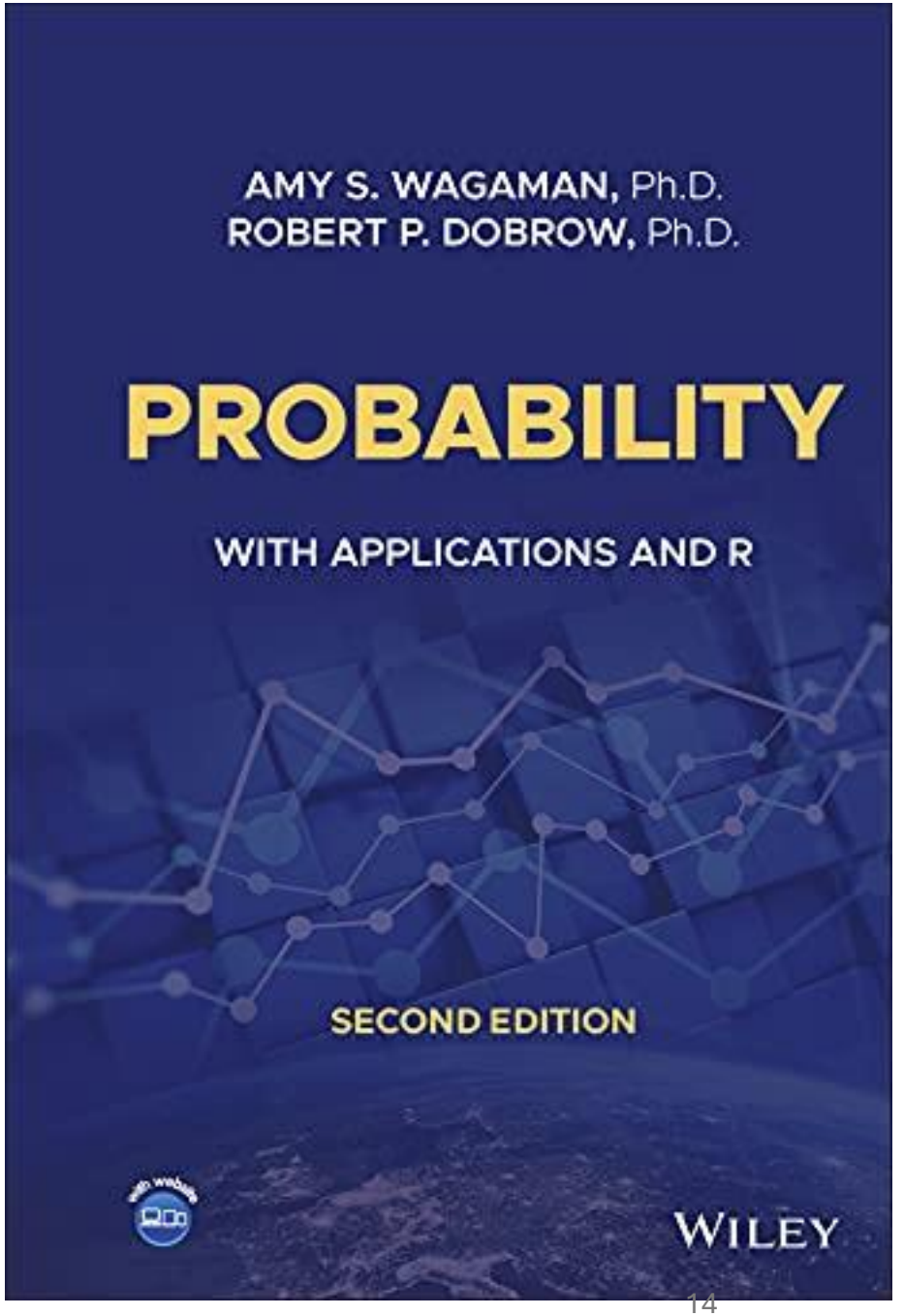
- The use of generative AI, e.g. Copilot is not allowed in this course for any assessments
- Collaboration (except within your group for tutorial quizzes) is not allowed
- Consulting unauthorized aids (e.g. your phone, internet, programmable calculators, notes, etc.) during exams and quizzes is considered an academic integrity violation

Intellectual Property

- All course materials (including assessments) have been created by the University of Toronto Department of Statistical Sciences STA237H1F teaching team for your own personal use in this course to support your learning
- Do your part to respect the intellectual property rights of the teaching team!
- No sharing, posting, or distributing any course material with anyone not officially enrolled in STA237H1F this term
- No (audio or video) recording course meetings without prior **written** (email) permission from the instructor
  - You may take photos of slides/any board work/screens in my sections as long as there is no one in the photos

Textbook

- Wagaman, A. S., and Dobrow, R. P. (2021) *Probability: With Applications and R*. 2nd Edition. Wiley.
- A FREE electronic version is available from UofT Libraries
  - https://books.scholarsportal.info/en/read?id=/ebooks/ebooks6/wiley6/2021-06-14/1/9781119692430
- Very good resource for learning R and for extra practice problems
- Optional: Dekking, F.M., Kraaikamp, C., Lopuha, H.P., and Meester, L.E (2005) *A Modern Introduction to Probability and Statistics: Understanding Why and How*. Springer.



Computing

- We will use R and RStudio within this course
- You will be expected to write, modify, and interpret R code and output in this course
- Access RStudio here: https://r.datatools.utoronto.ca/
- If you want to download R:
  - R is here: http://cran.r-project.org
  - RStudio is here: https://posit.co/downloads/

How to Succeed

- Time commitment of 10 hours/week including lecture time
- You can go to ANY instructor or TA's office hours
- Statistics Aid Center at Sidney Smith and New College
  - https://www.statistics.utoronto.ca/undergraduate-student-resources/statistics-aid-centres
- Ask and answer questions! Monitor/post on Quercus Discussions!
- Check each week's Quercus page for learning objectives, slides, and any other relevant information
- Join a Recognized Study Group (RSG)

Outcomes, events, and probability

Corresponding Textbook Chapters: 1.1-1.2

Learning Objectives

By the end of this week, you should …

- Describe randomness and give examples of real-life phenomena that may be perceived this way.
- Define the random experiment, sample space and events for a given activity or process.

Randomness

- Randomness is why we need to talk about probability
- We never know definitively what will happen in a random experiment
- Individual outcomes are uncertain, but there is structure to how often outcomes occur in very large numbers of repetitions

Random Experiments

- The result of rolling a 6-sided die
- How many people will benefit from a new drug
- The time that a bus arrives at the bus stop
- The height of the next person who walks into the room
- The sex of the next baby born in a hospital
- The maternal mortality rate in Canada next year

Events and Outcomes

- When we run a random experiment, we may be interested in individual outcomes of the experiment
- We use ω (“omega”) to denote a single outcome
- More often, we are interested in some subset of the outcomes in an experiment = an Event
- We use capital letters to refer to an event we are interested in

Sample Space

- A set of possible outcomes of a random experiment.
  - Notation is Ω (“Omega”)
- Subsets of the sample space are events.
- For rolling a die, $\Omega = \{1,2,3,4,5,6\}$

Example

- Random Experiment: Flipping two coins
- Sample Space: $\Omega = \{HH, HT, TH, TT\}$
- Outcome: $\omega = HH$
- Event: A = {Getting at least one head in two coin flips} = $\{TH, HH, HT\}$

Sample Space

- What if we roll a die, and then flip a coin. What is our sample space?

- How do we tell how big our sample space is?
  - We can use the multiplication principal (covered next week, Ch. 1.6)
- The sample space and event can have infinite outcomes!
  - You flip a coin until you get a heads. You are interested in the event you need at least 3 flips. (Textbook Example 1.4)

What is Probability?

- Probability is what we use to talk about the chances of some outcome of an experiment happening
- Notation: $P(A)$ = “The probability of event A occurring”

Relative Frequency

- Relative Frequency interpretation of probability: The probability of an event is equal to its relative frequency in a large (infinite) number of trials
- Example: P(Getting a tails) = $\lim_{n \to \infty} \frac{\#\ tails}{n}$, where n is the total number of coin flips
- As we flip a fair coin a very large number of times, we expect the proportion of tails to be approximately 50%

Summary

- Random experiment: an activity or process in which the outcome is uncertain.
- Sample space Ω: the collection of all possible outcomes of a random experiment
- Outcome: element of a sample space; result of a random experiment
- Event: A subset of the sample space; a collection of outcomes

Next Week

- We will finish Chapter 1 of the textbook
- We will talk about probability, probability functions, and counting
- We will use R for simulation experiments

Your tasks this week

- Reflection 1: Due Sunday at 11:59pm
- Textbook Readings: Ch. 1.1, 1.2 (p. 1-4)
- Textbook Practice Problems: Q. 1.1-1.5 (p. 36)
  - Most odd number solutions are at the end of the textbook
- Carefully review the Syllabus and make note of the course schedule and deadlines
- Explore the Quercus site and make sure you can access the discussion board
- Enroll in a TUT section if one is not showing up on ACORN