

UNIVERSITY OF MASSACHUSETTS
Department of Biostatistics and Epidemiology

BIOSTATS 540 - Introductory Biostatistics
Fall 2015

<http://people.umass.edu/~biep540w>

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There is NO Required Text:

Instead, we will be utilizing two open learning resource websites.

1. **University of Florida Health
Biostatistics Open Learning Textbook**
<http://bolt.mph.ufl.edu>

2. **Carnegie Mellon University Open Learning Initiative
Course, Statistical Reasoning (Open & Free)**
<https://oli.cmu.edu/jcourse/webui/guest/join.do?section=statreasoning>

Text Resources for Those Wishing Them (but NOT required)

(1) *This is the textbook I've used in past years. Some like it. Some don't. Others never used it.*

Rosner, B
Fundamentals of Biostatistics, *Seventh Edition*
Brooks/Cole Cengage Learning
2011
ISBN-13: 978-0-538-73349-6

(2) *A very reader friendly resource, very basic, for those of you dreading this course*

Triola MM and Triola MF
Biostatistics for the Biological and Health Sciences
Pearson Addison Wesley
2006
ISBN 0-321-19436-5

(3) *A wonderful introductory book that emphasizes understanding and literacy and with minimal use of equations and mathematical notation*

Motulsky H

Intuitive Biostatistics

Oxford University Press

1995

ISBN 0-19-508607-4 (Soft cover)

Statistical Software:

Use of a statistical software package is not required and will **not be needed for any of the exams**. Often, however, there is a lot of interest in this.

I am currently using Stata version 14 in my teaching and will provide illustrations of its use in this class. If you have already obtained an earlier version, please be in touch before you upgrade. Most likely, it will not be necessary.

How to Obtain Stata version 14 (OPTIONAL):

Stata Corp. offers student discounts on the purchase of Stata. The cost varies, depending on the size of Stata you want (maximum number of variables, lease versus perpetual license).

Step 1: Compare features of the various options, at <http://www.stata.com/products/which-stata-is-right-for-me/>.

Compare features

Package	Max. no. of variables	Max. no. of right-hand variables	Max. no. of observations	64-bit version available?	Fastest: designed for parallel processing?	Platforms
Stata/MP	32,767	10,998	20 billion*	Yes	Yes	Windows, Mac, or Unix
Stata/SE	32,767	10,998	2.14 billion	Yes	No	Windows, Mac, or Unix
Stata/IC	2,047	798	2.14 billion	Yes	No	Windows, Mac, or Unix
Small Stata	99	98	1,200	Yes	No	Windows, Mac, or Unix

*The maximum number of observations is limited by the amount of available RAM on your system. Stata/MP can theoretically analyze up to 281 trillion observations, but current hardware memory limitations don't yet allow that many.

Requirements

Package	Memory	Disk space
Stata/MP	2 GB	900 MB
Stata/SE	1 GB	900 MB
Stata/IC	512 MB	900 MB
Small Stata	512 MB	900 MB



Comparison:


Stata/MP - **Not recommended:** *it's expensive and far more than you will ever need*

Stata/SE - *Good choice if you anticipate working with very large data sets.*

Stata/IC - *My first choice for class work.*

Small Stata - *This is okay and has the advantage of being the least expensive.*

Step 2: Compare prices at <https://www.stata.com/order/new/edu/gradplans/student-pricing/>



New purchases ALL PRICES IN USD



Student pricing

Students currently enrolled at degree-granting institutions may purchase Stata at the prices listed below. Proof of student status (i.e., copy of your university ID card) is required.

Small Stata For small datasets.	Stata/IC For the price conscious.	Stata/SE For general-purpose users.	Stata/MP ⁱ For power users. <small>Select cores</small>
PERPETUAL LICENSE (not available)	PERPETUAL LICENSE Buy \$198	PERPETUAL LICENSE Buy \$395	
ANNUAL LICENSE (Students only) Buy \$54	ANNUAL LICENSE Buy \$125	ANNUAL LICENSE Buy \$235	
SIX-MONTH LICENSE (Students only) Buy \$38	SIX-MONTH LICENSE (Students only) Buy \$75	SIX-MONTH LICENSE (Not available)	

Product features	Small Stata	Stata/IC	Stata/SE	Stata/MP
Maximum number of variables ⁱ	99	2,047	32,767	32,767
Maximum number of observations ⁱ	1,200	2.14 billion	2.14 billion	Up to 20 billion
Maximum number of right-hand-side variables ⁱ	98	798	10,998	10,998

Step 3: Please make your purchase online at
[\(http://www.stata.com/order/new/edu/gradplans/course-pricing/\)](http://www.stata.com/order/new/edu/gradplans/course-pricing/).

Small Stata For students.	Stata/IC For the price conscious.	Stata/SE For general-purpose users.	Stata/MP  For power users. <div>Select cores </div>
PERPETUAL LICENSE (not available)	PERPETUAL LICENSE <div>Buy \$198</div>	PERPETUAL LICENSE <div>Buy \$395</div>	
ANNUAL LICENSE (Students only) <div>Buy \$54</div>	ANNUAL LICENSE <div>Buy \$125</div>	ANNUAL LICENSE <div>Buy \$235</div>	
SIX-MONTH LICENSE (Students only) <div>Buy \$38</div>	SIX-MONTH LICENSE (Students only) <div>Buy \$75</div>	SIX-MONTH LICENSE (Not available)	

Course Description

This course is the first of a two semester sequence of biostatistics: BIOSTATS 540 – *Introductory Biostatistics* and BIOSTATS 640 – *Intermediate Biostatistics*. Minimal mathematical background (algebra) is required and logarithms and exponents will be reviewed, if necessary. The goal of BIOSTATS 540 is basic statistical literacy. It begins with a discussion of the ideas of variability in nature and the tools we use for its description. The distinctions between systematic versus chance variability are detailed. Concepts in simple random sampling and sampling distributions are introduced. Within this framework, you will learn selected methods of data summarization, estimation, and hypothesis testing.

Topics include: graphical and numerical description, random sampling and selected probability models (the Bernoulli, binomial, and normal), sampling distributions, confidence interval estimation, and the basics of statistical hypothesis testing. If time permits, there will also be an introduction to simple linear regression and correlation.

Course Objectives and Outcome Competencies

Course Objectives: By the end of this course, you should be able to perform, interpret, and communicate the findings of selected simple statistical analyses of biological and health data, including description, confidence interval estimation and hypothesis testing.

Outcome Competencies:

The specific outcome competencies include, but are not limited to, the following:

1. Describe the roles biostatistics serves in the discipline of public health;
2. Distinguish among the different measurement scales and the implications for selection of statistical methods to be used based on these distinctions;
3. Apply descriptive techniques commonly used to summarize public health data;
4. Describe basic concepts of probability, random variation and commonly used statistical probability distributions;
5. Apply common statistical methods for inference;
6. Describe preferred methodological alternatives to commonly used statistical methods when assumptions are violated;
7. Select and perform the appropriate descriptive and inferential statistical methods for selected basic study design settings;
8. Interpret the results of statistical analyses found in selected, basic, public health studies; and
9. Apply basic informatics techniques with vital statistics and public health records in the description of public health characteristics.

Office Hours:

Online Section: I or Minming (our teaching assistant) will respond to a posting within 24 hours. Phone appointments are possible, too. Email your request to me directly at cbigelow@schoolph.umass.edu

Worcester, In-Class, Section: 4:00-5:00 Mondays, in the UMass/Worcester Medical hospital cafeteria, or, by appointment.

This course has 9 units

1. Summarizing Data
 2. Introduction to Probability
 3. Populations and Samples
 4. The Bernoulli and Binomial Distributions
 5. The Normal Distribution
 6. Estimation
 7. Hypothesis Testing
 8. Chi Square Tests
 9. Regression and Correlation
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For each unit, the following are provided

- Lecture Notes
 - Homework(s)
 - Computer Illustration(s)
 - Additional Resources
 - Readings
 - Other Links of Interest
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Grading Policy:

Homeworks: **10 of 14 are required for full credit.** I post solutions with the homework questions! Your homework grade is thus based on a timely submission of your attempt of these questions.

Exams: **All 4 exams are required.** These are one week or two week “take home” exams, open book. You are allowed to use whatever resources you like. **But you are NOT allowed to consult with any person except me.**

Your course grade will be based on the timely submission of **10 of 14 homeworks** and your scores on **4 exams**, as described below.

	Percent of Course Grade	Posted	Due
Homeworks (submit 10 of 14)	20%	<i>See page 9</i>	<i>See page 9</i>
Examination I (Unit 1)	20%	September 21, 2015	October 5, 2015
Examination II (Units 2 & 3)	20%	October 12, 2015	October 19, 2015
Examination III (Units 4 & 5)	20%	November 2, 2015	November 9, 2015
Examination IV (Units 6 & 7)	20%	November 30, 2015	December 11, 2015

Policy on Due Dates

Life happens. Sometimes things come up and it is not possible to meet a class deadline. To accommodate this, I will accept late submissions up to one week. Please be aware, however, that in consideration of your classmates, a late submission carries a 20 point penalty. Thus, if you know you cannot make a due date, your best bet is to use the full week grace time!

	Credit Policy
On Time	Full Credit for points Scored
1-7 Days Late	Points Scored – 20 points
8+ Days Late	0 points (no credit)

Policy on Dates of Postings

*I am sorry but I do **not** post lecture notes or exams ahead of schedule.*

Letter Grade Determination:

A	95 and over
A-	90 - 94
B+	87 - 89
B	83 – 86
B-	80 - 82
C+	77 – 79
C	70 – 76
F	Below 70

For PHP Online Students - Policy on GPA and Course Repeat:

All students must maintain a 3.0 GPA during their time as students in the program. In addition, all students must receive a final grade of “B –” or better in each of the following courses:

- BIOSTATS 540 – Introductory Biostatistics
- EHS 565 – Environmental Health Practices
- COM-HLTH 601 – Applications of Social and Behavioral Theory
- HPP 620 – Introduction to the US Health Care System
- EPI 630 – Principles of Epidemiology
- HPP 624 – Research Methods

If a student fails to receive a B- or better in these courses, they will have to repeat the course.

If a student’s overall GPA falls below the 3.0 level, the student will be subject to academic measures pursuant to Section I.4 of the Graduate Student Handbook, including academic probation and/or academic dismissal.

Important Dates to Remember

Note: See page 9 for detailed course schedule..

First Week of Class	Monday-Friday September 7-11, 2015
First Worcester Section Face-to-Face Class	Monday September 14, 2015
Last Day to Drop with no Record	Monday September 21, 2015
Columbus Day Observance (<i>In-Class section</i>)	Monday October 12, 2015 – NO CLASS
Make up of Columbus Day Class (<i>In-Class section</i>)	Tuesday October 13, 2015
Last Day to Drop with “DR”	Tuesday October 19, 2015
Last Week of Class	Monday-Friday December 7-11, 2015
Last Worcester Section Face-to-Face Class	Monday December 7, 2015
Examination IV (FINAL) Due	Friday December 11, 2015

ADA Accommodation Policy

Any student who, because of a disability, may require special arrangements in order to meet course requirements should contact me as soon as possible to make necessary arrangements.

Carol Bigelow, PhD
tel: 413/545-1319
fax: 413/545-1645
email: cbigelow@schoolph.umass.edu

Policy on Academic Dishonesty

All students are expected to adhere to guidelines of University of Massachusetts regarding academic honesty. A copy of these guidelines is available online at

www.umass.edu/dean_students/code_conduct/acad_honest.htm

The University of Massachusetts/Amherst Senate Document 89-026 defines academic dishonesty as including but not limited to:

- Cheating – intentional deceit, trickery, or breach of confidence, used to gain some unfair or dishonest advantage in one’s academic work.
- Fabrication – intentional falsification or invention of any information or citation in any academic exercise.
- Facilitating dishonesty – knowingly helping or attempting to help someone else commit an act of academic dishonesty.
- Plagiarism – knowingly representing the words or ideas of another as one’s own work in any academic exercise.
- Submitting in whole or in part, without citation, prewritten term papers of another or the research of another (including but not limited to such materials sold or distributed commercially).

BIOSTATS 540 - Introductory Biostatistics Fall 2015

Schedule of Posting of Course Notes

Week	Date	Unit - Lecture	Posting Date
-	September 1-4, 2015	Welcome & Introduction	Tuesday September 1, 2015
1	September 7-11, 2015	1 – Summarizing Data	Monday September 7, 2015
2	September 14-18, 2015	1 – Summarizing Data	-
3	September 21-25, 2015	2 – Introduction to Probability	Monday September 21, 2015
4	September 28 – October 2, 2015	2 – Introduction to Probability	-
5	October 5-9, 2015	3 – Populations and Samples	Monday October 5, 2015
6	October 12-16, 2015	4 – Bernoulli and Binomial	Monday October 12, 2015
7	October 19-23, 2015	5 – Normal Distribution	Monday October 19, 2015
8	October 26-30, 2015	5 – Normal Distribution	-
9	November 2-6, 2015	6 – Estimation	Monday November 2, 2015
10	November 9-13, 2015	6 – Estimation	-
11	November 16-20, 2015	7 – Hypothesis Testing	Monday November 16, 2015
12	November 23-27, 2015	7 – Hypothesis Testing	-
13	November 30 – December 4, 2015	8- Chi Square Tests	Monday November 30, 2015
14	December 7-11, 2015	9 – Regression and Correlation	Monday December 7, 2015

Schedule of Assignments and Exams *(Note – There is **no** exam of Units 8 & 9)*

Assignment/Test	Posting Date	Due Date
HW#1 (Unit 1 – Summarizing Data)	Monday September 7, 2015	Monday September 14, 2015
HW#2 (Unit 1 – Summarizing Data)	Monday September 14, 2015	Monday September 21, 2015
HW#3 (Unit 2 – Probability)	Monday September 21, 2015	Monday September 28, 2015
Exam I (Unit 1)	Monday September 21, 2015	Monday October 5, 2015
HW#4 (Unit 2 – Probability)	Monday September 28, 2015	Monday October 5, 2015
HW#5 (Unit 3 – Populations & Samples)	Monday October 5, 2015	Monday October 12, 2015
HW#6 (Unit 4 – Bernoulli & Binomial)	Monday October 12, 2015	Monday October 19, 2015
Exam II (Units 2 & 3)	Monday October 12, 2015	Monday October 19, 2015
HW#7 (Unit 5 – Normal Distribution)	Monday October 19, 2015	Monday October 26, 2015
HW#8 (Unit 5 – Normal Distribution)	Monday October 26, 2015	Monday November 2, 2015
Exam III (Units 4 & 5)	Monday November 2, 2015	Monday November 9, 2015
HW#9 (Unit 6 – Estimation)	Monday November 2, 2015	Monday November 9, 2015
HW#10 (Unit 6 – Estimation)	Monday November 9, 2015	Monday November 16, 2015
HW#11 (Unit 7 – Hypothesis Testing)	Monday November 16, 2015	Monday November 23, 2015
HW#12 (Unit 7 – Hypothesis Testing)	Monday November 23, 2015	Monday November 30, 2015
HW#13 (Unit 8 – Chi Square Tests)	Monday November 30, 2015	Monday December 7, 2015
HW#14 (Unit 9 – Regression & Correlation)	Monday December 7, 2015	<i>Friday</i> December 11, 2015
Exam IV (Units 6 & 7)	Monday November 30, 2015	<i>Friday</i> December 11, 2015