

# Syllabus

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## Description

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This [module](#) is also available as a concatenated page, suitable for printing or saving as a PDF for offline viewing.

### **MET CS555**

#### **Data Analysis and Visualization**

This course provides an overview of the statistical tools most commonly used to process, analyze, and visualize data. Topics include describing data, statistical inference, 1 and 2 sample tests of means and proportions, simple linear regression, multiple regression, logistic regression, analysis of variance, and regression diagnostics. These topics are explored using the statistical package *R*, with a focus on understanding how to use and interpret output from this software as well as how to visualize results. In each topic area, the methodology, including underlying assumptions and the mechanics of how it all works along with appropriate interpretation of the results, are discussed. Concepts are presented in context of real world examples.

## Prerequisites

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CS546 (Quantitative Methods for Information Systems) and CS544 (Foundations of Analytics) or equivalent background.

### **Technical Notes**

The table of contents expands and contracts (+/- sign) and may conceal some pages. To avoid missing content pages, you are advised to use the next/previous page icons in the top right corner of the learning modules.

This course requires you to access files such as word documents, PDFs, and/or media files. These files may open in your browser or be downloaded as files, depending on the settings of your browser.

## Learning Objectives

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By successfully completing this course, you will be able to do the following:

- Appreciate the science of statistics and the scope of its potential applications.
- Summarize and present data in meaningful ways.
- Select the appropriate statistical analysis depending on the research question at hand.
- Form testable hypotheses that can be evaluated using common statistical analyses.
- Verify the underlying assumptions of a particular analysis.
- Communicate results from analyses performed to others effectively and clearly.
- Conduct, present, and interpret common statistical analyses using R.

## Instructor

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### **Kia Teymourian**

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Metropolitan College  
Boston University  
1010 Commonwealth Avenue  
Boston, MA 02215

**Office Hours:** By Appointment Only

**Email:** [kiat@bu.edu](mailto:kiat@bu.edu)

Dr. Kia Teymourian is an Assistant Professor of Computer Science at Boston University's Metropolitan College. Dr. Teymourian holds a PhD from Freie Universität Berlin as well as a MS and BS from Berlin University of Technology (TU-Berlin). His computer science expertise lies in data stream processing and complex event processing, big data programming, semantic technologies, and knowledge representation, as well as web technologies and natural language processing. He has made important contributions to multiple large and international research projects, including several funded by the European Commission, the German Federal Ministry of Education and Research (BMBF), and the DARPA Pliny Project at Rice University. He is a senior member of Institute of Electrical and

Electronics Engineers (IEEE), and a member of the Association for Computing Machinery (ACM). At Metropolitan College, Dr. Teymourian teaches data analysis and visualization, as well as software design patterns.

Additional information can be found on [Dr. Teymourian's Academic Website](#)

## Materials

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The modules themselves will provide you with the necessary information for the theory, concepts, and examples that you will need to complete your quizzes and understand the methodologies that you will apply to the problems presented in the homework assignments. There will be no reading assignments from the following recommended books. These are excellent supplemental texts that you may want to review as we go through the course and also keep as reference text as you continue to use *R* in the future. Both of these books can be purchased from [Barnes and Noble at Boston University](#).

## Recommended Books

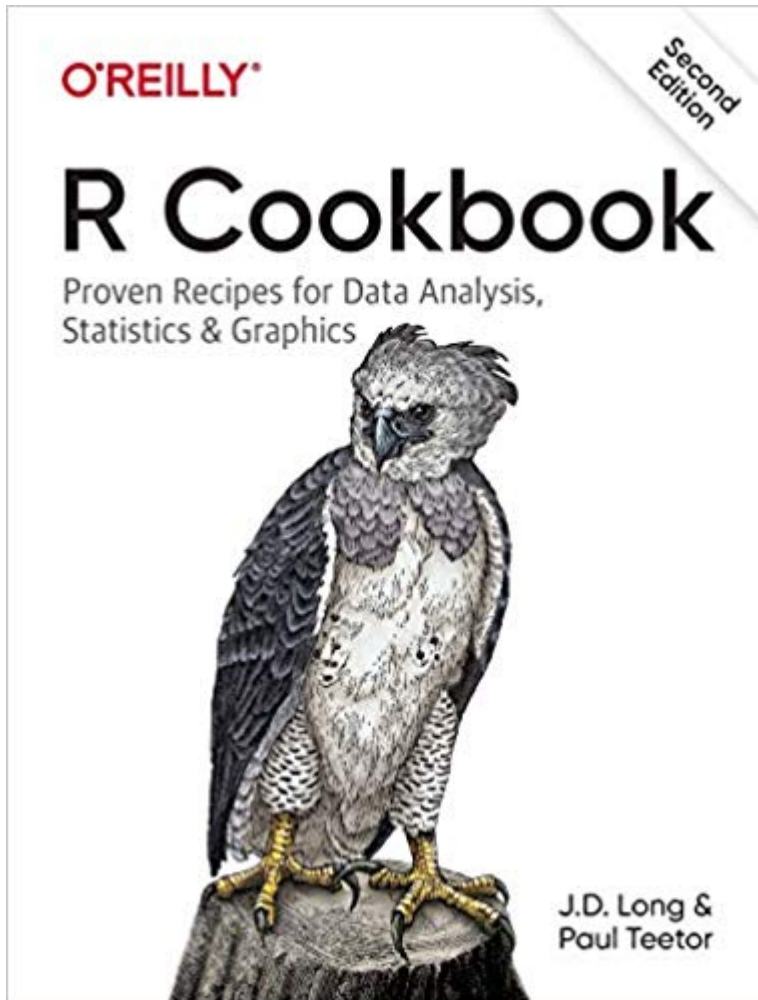
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Long, J. D. & Teetor, P. (2019). *R Cookbook: Proven Recipes for Data Analysis, Statistics, and Graphics*, 2nd edition.

O'Reilly Media

ISBN: 978-1492040682.

You can access [the free eBook](#).

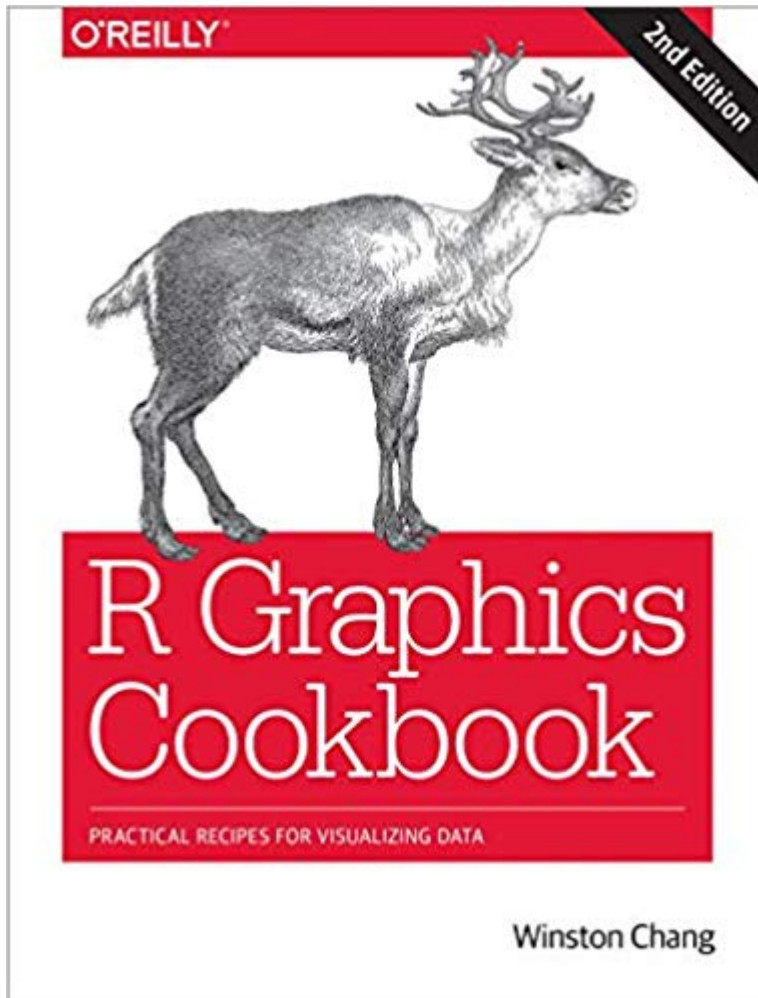


Chang, W. (2018). *R Graphics Cookbook: Practical Recipes for Visualizing Data*, 2nd edition.

O'Reilly Media

ISBN: 978-1491978603

You can access [the free eBook](#).



## Course R Code Resources on Github

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Our course R code examples are available on [Github](#).

- You don't need to register the Github account to access the course R code resources.
- You can download them all as a single zip file.

## Video Tutorials

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Video tutorials are available at the end of each module.

## Summary Table of Statistical Techniques

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Check out a “short” [summary table of statistical techniques](#).

## MathJax

Variables, formulae, and equations in this course are rendered using [MathJax](#).

### Adding Fractions

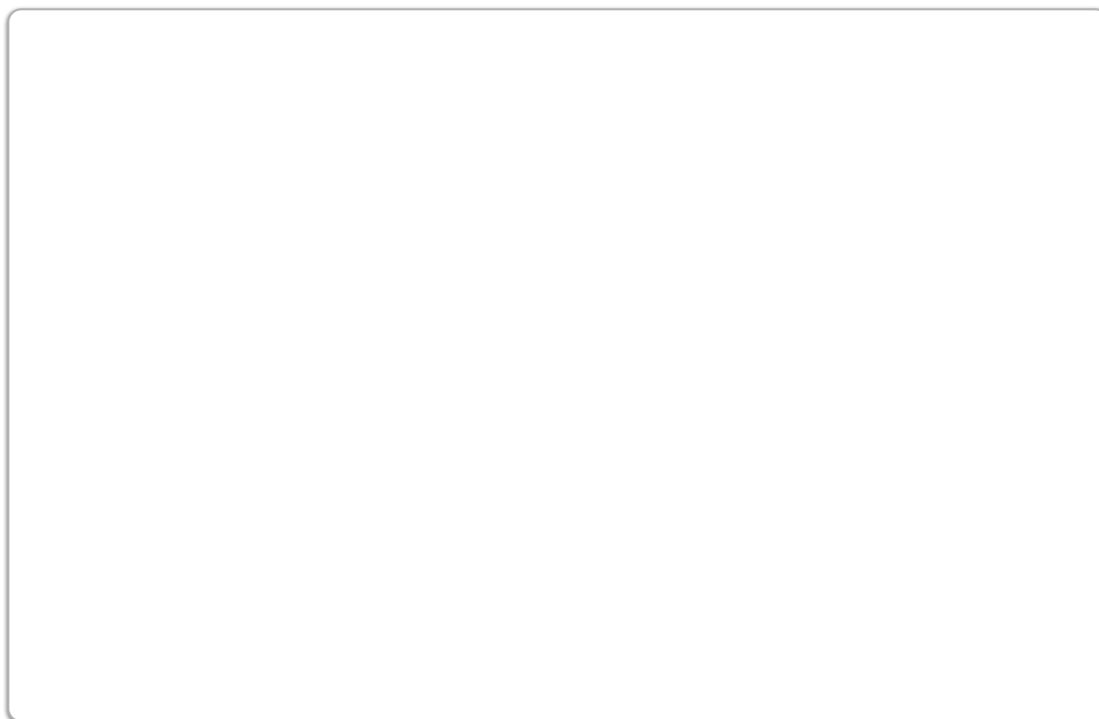
Adding fractions:  $\frac{a}{b} \pm \frac{c}{d} = \frac{ad \pm cb}{bd}$ , often this is easy to remember.  $a, b, c, d$  do not have to be the following:

To enable its features in your browser, right-click (or ctrl-click on a single-mouse-button Mac) on a variable or equation to see your MathJax settings.

MathJax can be used with the [MathPlayer](#) plugin for Internet Explorer, which converts math to speech and highlights the math as it is spoken.

## Boston University Library Information

Boston University has created a set of videos to help orient you to the online resources at your disposal. An introduction to the series is below:



All of the videos in the series are available on the [Online Library Resources](#) page, which is also accessible from the Campus Bookmarks section of your Online Campus Dashboard. Please feel free to make use of them.

As Boston University students, you have full access to the BU Library. From any computer, you can gain access to anything at the library that is electronically formatted. To connect to the library, use the link <http://www.bu.edu/library>. You may use the library's content whether you are connected through your online course or not, by confirming your status as a BU community member using your Kerberos password.

Once in the library system, you can use the links under "Resources" and "Collections" to find databases, eJournals, and eBooks, as well as search the library by subject. Some other useful links follow:

Go to [Collections](#) to access eBooks and eJournals directly.

If you have questions about library resources, go to [Ask a Librarian: Help & FAQs](#) to email the library or use the live-chat feature.

To locate course eReserves, go to [Reserves](#).

Please note that you are not to post attachments of the required or other readings in the water cooler or other areas of the course, as it is an infringement on copyright laws and department policy. All students have access to the library system and will need to develop research skills that include how to find articles through library systems and databases.

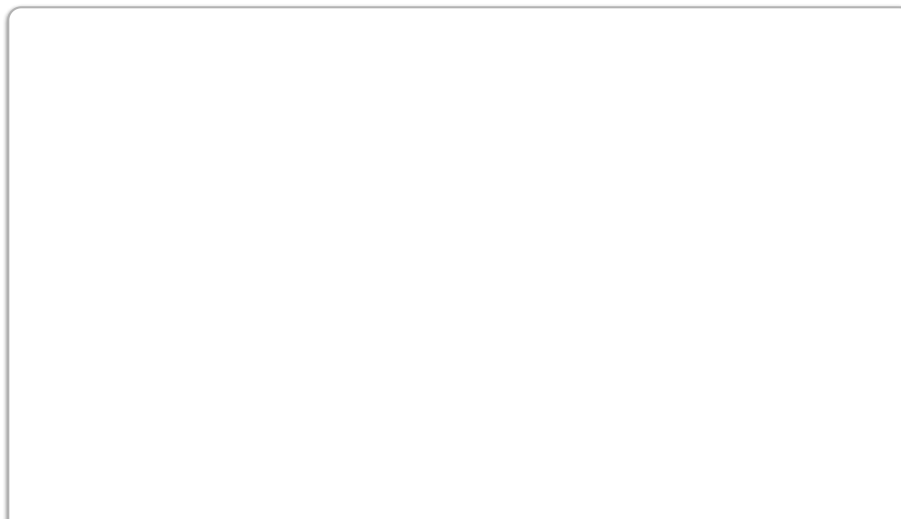
## Free Tutoring Service

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Free online tutoring with Smarthinking is available to BU online students for the duration of their courses. The tutors do not rewrite assignments, but instead teach students how to improve their skills in the following areas: writing, math, sciences, business, ESL, and Word/Excel/PowerPoint.

You can log in directly to Smarthinking from Online Campus by using the link in the left-hand navigation menu of your course.





[YouTube](#)

### Please Note

Smarthinking may be used only for current Boston University online courses and career services. Use of this service for purposes other than current coursework or career services may result in deactivation of your Smarthinking account.

## Study Guide

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### Module 1 Study Guide and Deliverables

Required      Module 1 online content

Reading:

- Optional      • Teetor, Sections 2.6, 2.13, 3.1, 3.6, 3.9, 8.9, 8.10, 8.11, 9.1, 9.2, 9.5, 10.9, 10.11,  
Reading:      10.16, and 10.18
- Chang, Sections 1.3, 1.4, 2.3, 2.4, 2.5, 3.1, 6.1, 6.6, 13.16

- Assignments:      • Self-Introduction due Thursday, July 8 at 11:59 PM ET (Not graded. Access at "My  
Groups" on the left-hand course menu).
- Assignment 1 due Tuesday, July 13 at 6:00 AM ET

Assessments: Quiz 1 due Tuesday, July 13 at 6:00 AM ET



- Live
- Wednesday, July 7, 6:00 – 8:15 PM ET
- Classroom:
- Facilitator live office hour: TBD

## Module 2 Study Guide and Deliverables

Required Reading: Module 2 online content

Optional Reading: Teetor, Sections 8.9, 8.10, 9.8, 9.9, 9.15, 10.9, 10.10, and 10.17

Assignments: Assignment 2 due Tuesday, July 20 at 6:00 AM ET

Assessments: Quiz 2 due Tuesday, July 20 at 6:00 AM ET

- Live Classroom:
- Wednesday, July 14, 6:00 – 8:15 PM ET
  - Facilitator live office hour: TBD

## Module 3 Study Guide and Deliverables

Required Reading: Module 3 online content

Optional Reading: Teetor, Sections 2.6, 9.17, 10.1, 10.6, 11.1, 11.3, 11.4, and 11.13

Assignments: Assignment 3 due Tuesday, July 27 at 6:00 AM ET

Assessments: Quiz 3 due Tuesday, July 27 at 6:00 AM ET

- Live Classroom:
- Wednesday, July 21, 6:00 – 8:15 PM ET
  - Facilitator live office hour: TBD

## Module 4 Study Guide and Deliverables

Required Reading: Module 4 online content

- Optional Reading:
- Teetor, Sections 11.2, 11.8, 11.10, 11.11, 11.14
  - Chang, Section 5.13

Assignments: Assignment 4 due Tuesday, August 3 at 6:00 AM ET

Assessments: Quiz 4 due Tuesday, August 3 at 6:00 AM ET

- Live Classroom:
- Wednesday, July 28, 6:00 – 8:15 PM ET
  - Facilitator live office hour: TBD

## Module 5 Study Guide and Deliverables

Required Reading: Module 5 online content

Optional Reading: Teetor, Sections 11.20, 11.21, 11.22

Assignments: Assignment 5 due Tuesday, August 10 at 6:00 AM ET

Assessments: Quiz 5 due Tuesday, August 10 at 6:00 AM ET

Live Classroom:

- Wednesday, August 4, 6:00 – 8:15 PM ET
- Facilitator live office hour: TBD

## Module 6 Study Guide and Deliverables

Required Reading: Module 6 online content

Optional Reading: Teetor, Sections 9.11, 9.12, 9.18, and 13.7

Assignments: Assignment 6 due Tuesday, August 17 at 6:00 AM ET

Assessments: Quiz 6 due Tuesday, August 17 at 6:00 AM ET

Final Project: Final project due Thursday, August 19 at 6:00 AM ET

Live Classroom:

- Wednesday, August 11, 6:00 – 8:15 PM ET
- Facilitator live office hour: TBD

## Final Exam Details

The Final Exam is a proctored exam available from **Wednesday, August 18 at 6:00 AM ET to Saturday, August 21 at 11:59 PM ET.**

The Computer Science department requires that all final exams be administered using an online proctoring service called Examity that you will access via your course in Blackboard. In order to take the exam, you are required to have a working webcam and computer that meets Examity's system requirements. A detailed list of those requirements can be found on the How to Schedule page ("Proctored Final Exam Information" module at the course home page). Additional information regarding your proctored exam will be forthcoming from the Assessment Administrator. You will be responsible for scheduling your own appointment within the defined exam window.

The exam is accessible only during the final exam period. You can access it from the Assessments section of the course. Your proctor will enter the password to start the exam.

Final Exam Duration: 3 hours.

Final Exam is open book/open notes. The following materials can be used during the exam:

- Use of the physical and/or ebook textbook is allowed.
- Use of a standard handheld and/or desktop calculator is allowed. Online calculators are not permitted.
- Use of any printed and/or electronic materials (such as PDFs) is allowed.
- Use of the following software is allowed: R or R Studio software.
- Use of three pieces of blank scratch paper is allowed.

## Grading Information

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The course is divided into modules. The course opens on a Tuesday. For each module's due date, follow Study Guide.

## Grading Structure and Distribution

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The grade for the course is determined by the following:

### Overall Grading Percentages

<b>Homework Assignments</b>	30%
<b>Quizzes (Modules 1-6)</b>	30%
<b>Final Project</b>	10%
<b>Final Exam</b>	30%

The conversion to a letter grade is based on the following distribution:

Scores	Letter Grade

100–95.00	A
94.99–90.00	A–
89.99–87.00	B+
86.99–83.00	B
82.99–80.00	B–
79.99–77.00	C+
76.99–73.00	C
72.99–70.00	C–
69.99–60.00	D
Below 60.00	F

## Homework Assignments

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Homework assignments are focused on applying theory learned in the week's module to a set of data and analyzing that data in *R*. Assignment submissions should be a single Microsoft Word or PDF file. The *R* code used to generate your results should be appended to the end of your assignment. Lectures relating to *R* will be held and recordings will be posted after each session. Slides from the session will also be made available to students.

**Due time:** at the end of each module (check the Study Guide for the specific due date).

**Where to submit:** The "Assignments" section in the left-hand course menu.

## Quizzes

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Quizzes will evaluate students understanding of concepts presented in the corresponding module. Students should ensure adequate preparation before starting the quiz. It will not be possible to do well on the quiz without first reviewing the course material in depth and attempting to understand all examples and test yourself questions. It is recommended that you complete the quiz after you feel comfortable with the material and asked any questions that you may have had.

**Due time:** at the end of each module (check the Study Guide for the specific due date).

**Where to complete:** The "Assessments" section in the left-hand course menu.

## Final Project

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In a final project, student will select a real-world data set, analyze it based on the concepts learned in this course and write a brief report about it.

**Due time:** at the end of Module 6 (check the Study Guide for the specific due date).

**Where to submit:** The "Assignments" section in the left-hand course menu.

## Proctored Final Exam

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There will be a proctored Final Exam in this course. Detailed instructions regarding your proctored exam will be forthcoming from the Assessment Administrator. You will be responsible for scheduling your own appointment.

The final exam will be a similar format to the quizzes but longer in length. It is comprehensive and will cover concepts from Modules 1–6.

**Due time:** after Module 6 (check the Study Guide for the specific due date).

**Where to complete:** The "Assessments" section in the left-hand course menu.

## Expectations

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Due dates will be indicated for each assignment in the assignments section of the course and in the Study Guide. If, for any reason, you are unable to meet any assignment deadline, contact your facilitator. All times mentioned in the course (unless otherwise specified) are in Eastern Time. All assignments (and quizzes) must be completed and must be turned in by their due dates and due times. No extensions can be given for quizzes. Extensions may be granted for assignments, though only under mitigating circumstances. No credit can be given for homework assignments submitted after homework solutions are reviewed.

## Academic Conduct Policy

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Please visit Metropolitan College's website for the full text of the department's [Academic Conduct Code](#).

## A Definition of Plagiarism

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“The academic counterpart of the bank embezzler and of the manufacturer who mislabels products is the plagiarist: the student or scholar who leads readers to believe that what they are reading is the original work of the writer when it is not. If it could be assumed that the distinction between plagiarism and honest use of sources is perfectly clear in everyone’s mind, there would be no need for the explanation that follows; merely the warning with which this definition concludes would be enough. But it is apparent that sometimes people of goodwill draw the suspicion of guilt upon themselves (and, indeed, are guilty) simply because they are not aware of the illegitimacy of certain kinds of “borrowing” and of the procedures for correct identification of materials other than those gained through independent research and reflection.”

“The spectrum is a wide one. At one end there is a word-for-word copying of another’s writing without enclosing the copied passage in quotation marks and identifying it in a footnote, both of which are necessary. (This includes, of course, the copying of all or any part of another student’s paper.) It hardly seems possible that anyone of college age or more could do that without clear intent to deceive. At the other end there is the almost casual slipping in of a particularly apt term which one has come across in reading and which so aptly expresses one’s opinion that one is tempted to make it personal property.”

“Between these poles there are degrees and degrees, but they may be roughly placed in two groups. Close to outright and blatant deceit-but more the result, perhaps, of laziness than of bad intent-is the patching together of random jottings made in the course of reading, generally without careful identification of their source, and then woven into the text, so that the result is a mosaic of other people’s ideas and words, the writer’s sole contribution being the cement to hold the pieces together. Indicative of more effort and, for that reason, somewhat closer to honest, though still dishonest, is the paraphrase, and abbreviated (and often skillfully prepared) restatement of someone else’s analysis or conclusion, without acknowledgment that another person’s text has been the basis for the recapitulation.”

The paragraphs above are from H. Martin and R. Ohmann, *The Logic and Rhetoric of Exposition, Revised Edition*. Copyright 1963, Holt, Rinehart and Winston.

## Academic Conduct Code

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### I. Philosophy of Discipline

The objective of Boston University in enforcing academic rules is to promote a community atmosphere in which learning can best take place. Such an atmosphere can be maintained only so long as every student believes that his or her academic competence is being judged fairly and that he or she will not be put at a

disadvantage because of someone else's dishonesty. Penalties should be carefully determined so as to be no more and no less than required to maintain the desired atmosphere. In defining violations of this code, the intent is to protect the integrity of the educational process.

## II. Academic Misconduct

Academic misconduct is conduct by which a student misrepresents his or her academic accomplishments, or impedes other students' opportunities of being judged fairly for their academic work. Knowingly allowing others to represent your work as their own is as serious an offense as submitting another's work as your own.

## III. Violations of this Code

Violations of this code comprise attempts to be dishonest or deceptive in the performance of academic work in or out of the classroom, alterations of academic records, alterations of official data on paper or electronic resumes, or unauthorized collaboration with another student or students. Violations include, but are not limited to:

- A. **Cheating on examination.** Any attempt by a student to alter his or her performance on an examination in violation of that examination's stated or commonly understood ground rules.
- B. **Plagiarism.** Representing the work of another as one's own. Plagiarism includes but is not limited to the following: copying the answers of another student on an examination, copying or restating the work or ideas of another person or persons in any oral or written work (printed or electronic) without citing the appropriate source, and collaborating with someone else in an academic endeavor without acknowledging his or her contribution. Plagiarism can consist of acts of commission-appropriating the words or ideas of another-or omission failing to acknowledge/document/credit the source or creator of words or ideas (see below for a detailed definition of plagiarism). It also includes colluding with someone else in an academic endeavor without acknowledging his or her contribution, using audio or video footage that comes from another source (including work done by another student) without permission and acknowledgement of that source.
- C. **Misrepresentation or falsification of data** presented for surveys, experiments, reports, etc., which includes but is not limited to: citing authors that do not exist; citing interviews that never took place, or field work that was not completed.
- D. **Theft of an examination.** Stealing or otherwise discovering and/or making known to others the contents of an examination that has not yet been administered.
- E. **Unauthorized communication during examinations.** Any unauthorized communication may be considered prima facie evidence of cheating.
- F. **Knowingly allowing another student to represent your work as his or her own.** This includes providing a copy of your paper or laboratory report to another student without the explicit permission of the instructor(s).
- G. **Forgery, alteration, or knowing misuse of graded examinations, quizzes, grade lists, or official records of documents,** including but not limited to transcripts from any institution, letters of recommendation, degree certificates, examinations, quizzes, or other work after submission.
- H. **Theft or destruction of examinations or papers** after submission.
- I. **Submitting the same work in more than one course** without the consent of instructors.

- J. **Altering or destroying another student's work or records**, altering records of any kind, removing materials from libraries or offices without consent, or in any way interfering with the work of others so as to impede their academic performance.
- K. **Violation of the rules governing teamwork**. Unless the instructor of a course otherwise specifically provides instructions to the contrary, the following rules apply to teamwork: 1. No team member shall intentionally restrict or inhibit another team member's access to team meetings, team work-in-progress, or other team activities without the express authorization of the instructor. 2. All team members shall be held responsible for the content of all teamwork submitted for evaluation as if each team member had individually submitted the entire work product of their team as their own work.
- L. **Failure to sit in a specifically assigned seat during examinations**.
- M. **Conduct in a professional field assignment that violates the policies and regulations of the host school or agency**.
- N. **Conduct in violation of public law occurring outside the University that directly affects the academic and professional status of the student, after civil authorities have imposed sanctions**.
- O. **Attempting improperly to influence the award of any credit, grade, or honor**.
- P. **Intentionally making false statements to the Academic Conduct Committee or intentionally presenting false information to the Committee**.
- Q. **Failure to comply with the sanctions imposed under the authority of this code**.

## Important Message on Final Exams

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Dear Boston University Computer Science Online Student,

As part of our ongoing efforts to maintain the high academic standard of all Boston University programs, including our online MSCIS degree program, the Computer Science Department at Boston University's Metropolitan College requires that each of the online courses includes a proctored final examination.

By requiring proctored finals, we are ensuring the excellence and fairness of our program. The final exam is administered online.

Specific information regarding final-exam scheduling will be provided approximately two weeks into the course. This early notification is being given so that you will have enough time to plan for where you will take the final exam.

I know that you recognize the value of your Boston University degree and that you will support the efforts of the University to maintain the highest standards in our online degree program.

Thank you very much for your support with this important issue.

Regards,



Professor Lou Chitkushev, Ph.D.  
Associate Dean for Academic Affairs  
Boston University Metropolitan College

**Boston University** Metropolitan College