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Study Guide

Mathematical Background  
for Biostatistics (MBB)

Semester 1, 2018

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## ACADEMIC COORDINATORS

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## OTHER CONTACTS

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## WELCOME LETTER

Dear Student,

Welcome to Mathematical Background for Biostatistics (MBB). In this unit, we will develop the basic mathematical background needed to understand the proofs and mathematical reasoning used in the detailed treatment of biostatistical methods in subsequent units. Completion of this unit will allow you to concentrate on the statistical concepts presented in the later units without being distracted by the detail of the mathematical techniques.

In the light of the preparatory nature of the material, the primary sources are two mathematics textbooks. There is little requirement for reading beyond those works.

One topic worthy of mention is the role of computer algebra systems (CAS) in relation to this unit. These are computer programs capable of solving abstract mathematical problems and are accessible on a number of platforms including CAS calculators, specialised packages such as Maple and Mathematica and on websites such as <http://www.wolframalpha.com>. Such packages are able to solve many of the problems given in the textbook with little effort or understanding on the part of the user. It is therefore important to understand that the purpose of setting exercises is to help you develop skills in mathematical reasoning through practicing the calculations rather than just to get a correct answer by any means available. It is, of course, convenient and useful to use a CAS package to check your calculations but you should not allow this to become the focus.

Please don't hesitate to contact us if you are having problems with the unit material.

Gary Glonek and Mel Humphries  
February 2018

## UNIT BACKGROUND

This unit of study is offered throughout Australia through the Biostatistics Collaboration of Australia (BCA). It is available in distance learning mode only, to students enrolled in postgraduate degrees in biostatistics coordinated by the BCA.

The purpose of MBB is to prepare students with little training in mathematics to study statistics at an advanced level. Students who have studied mathematics or statistics at undergraduate level, or who have equivalent work experience, are exempted from this unit.

On completion of this unit you should be able to follow the mathematical demonstrations and proofs used in biostatistics at Masters degree level, and to understand the mathematics behind the statistical methods introduced. This will allow you to concentrate on statistical concepts in subsequent units of your BCA program, with confidence in your mathematics.

The use of eLearning (sometimes referred to as Blackboard) is very important in this unit and provides a guide to the unit material. This is the forum used to generate discussion of the unit content, to answer questions and to ensure that students have a solid comprehension of the necessary concepts.

## UNIT OBJECTIVES

On completion of this unit, students should be able to:

- (1) Manipulate general mathematical expressions and inequalities.
- (2) Understand the notion of a limit and calculate simple limits.
- (3) Understand the notion of the derivative and its applications, and calculate simple derivatives.
- (4) Understand the notion of the integral and its applications, and calculate simple integrals.
- (5) Manipulate and evaluate simple matrix expressions.
- (6) Understand matrix concepts such as determinant, inverse, rank, orthogonal matrix, eigenvalues and eigenvectors.
- (7) Appreciate the nature and importance of mathematical arguments.



## UNIT CONTENT

The subject will consist of three modules. These will cover the topics of:

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Module 1	Numbers, Functions and Limits
Module 2	Calculus
Module 3	Matrices

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Module 1 will require approximately 2 weeks of study, Module 2 will require approximately 4 weeks of study and Module 3 will require approximately 5 weeks of study, with a week free after each module for the associated assignment. The work for each week consists of readings and exercises. The exercises are not assessed, but the assignment questions will be similar so the exercises will be useful practice. Material will be accessed through the textbooks, which are required reading. Additional material will be provided as required. Notes for each module will be provided on Blackboard and will include the relevant text references, notes and exercises. Written material will be supplemented by discussion on eLearning.

## SOFTWARE

The computing in this unit does not require a statistical software package. However, graphs are an important tool for understanding mathematics, and we assume you have access to either Wolfram Alpha, Microsoft Excel or Stata and can use it for calculations and for graphing functions. The “student resources” page on the BCA web site provides self-teaching materials for Excel and Stata. Wolfram Alpha is free and can be accessed at <http://www.wolframalpha.com>.

## TEXTBOOKS

You WILL NEED a copy of both of the following textbooks, making sure you have the exact edition mentioned:

Anton H, Bivens I and Davis S  
Calculus: Early Transcendentals, 11th Edition (Wiley, 2015)  
ISBN 9781118883822

- It can be found on the companion website: [www.wiley.com/college/anton](http://www.wiley.com/college/anton)
- Wiley Direct:  
<http://www.wileydirect.com.au/buy/calculus-early-transcendentals-11th-edition/>
- It is also available from university bookshops or online from [fishpond.com.au](http://fishpond.com.au) or [amazon.com](http://amazon.com) or via [www.addall.com](http://www.addall.com).
- Be sure you have the correct version: **not** “late transcendentals” and **not** “brief edition”. The ISBN identifies the right one.

Anton H  
Elementary Linear Algebra, 11th Edition (Wiley, 2014)  
ISBN 9781118473504 (Hardcover); 9781118864180 (Paperback)

*or*

Anton H and Rorres C  
Elementary Linear Algebra: *Applications Version* 11th Edition (Wiley, 2014)  
ISBN 9781118878767 (Wiley E-Text); 9781118434413 (Hardcover)

- Note that the two versions listed above are exactly the same for the purposes of this course. The exercises set, the required readings and the page numbers have all been checked to be identical between the two versions.
- It can be found on the companion website: [www.wiley.com/college/anton](http://www.wiley.com/college/anton).
- Wiley Direct:  
[www.wileydirect.com.au/buy/elementary-linear-algebra-applications-version-11th-edition/](http://www.wileydirect.com.au/buy/elementary-linear-algebra-applications-version-11th-edition/)
- It is also available from university bookshops or online from [fishpond.com.au](http://fishpond.com.au) or [amazon.com](http://amazon.com) or via [www.addall.com](http://www.addall.com).

**Please note:** WileyPLUS is **not** an accessible resource (or required) for students in this course. There is no need to purchase these textbooks with WileyPLUS should it be offered.

## **METHOD OF DELIVERY**

Students will be provided with three modules, as outlined in the previous section. These modules will also be made available on eLearning. The unit assessments will be available on eLearning and will not be provided to students on an individual basis. Important announcements will also be placed on eLearning, so students should regularly monitor eLearning.

Communication should generally be via eLearning (unless of a personal/ confidential nature) as responses to questions and discussion of issues is of benefit to all students. eLearning is an integral component of the MBB unit as it hopefully reduces the isolation which can occur in distance learning. Students can post questions, ideas, suggestions and discussion on eLearning. The tutors will monitor and respond to all communication, however students are also encouraged to respond and take part in these communications.

## **STAFF ROLES**

There are three staff involved in delivering the unit. The academic co-ordinators (Gary Glonek and Mel Humphries) will be responsible for the unit and will contribute to the discussion on eLearning and respond to content-related questions.

## CONTACTING STAFF

A 'MBB Query Page' has been set up for this course to ensure student queries are directed to the relevant staff member for timely responses. The location of the query page is: <http://maths.adelaide.edu.au/mbb/form.html>.

In the unlikely event the query page is down, please email the general MBB email address: [BCA\\_MBB@adelaide.edu.au](mailto:BCA_MBB@adelaide.edu.au). Please include one of the following in the subject line of your email:

- Assignment <*number*> deadline
- Assignment <*number*> submission
- Assignment <*number*> content question
- Module <*number*> question
- Textbook question
- Administrative question

## ASSESSMENT

The assessment for this unit will involve three written assignments.

- Assignment 1 will cover Module 1 and will be worth 20%.
- Assignment 2 will cover Module 2 and will be worth 40%.
- Assignment 3 will cover Module 3 and will be worth 40%.

All assignments will be posted on eLearning two (module 1) or three (modules 2 and 3) weeks prior to the submission date. Model solutions/guides will be posted on eLearning after the submission date.

Individual feedback on assignments will be provided to each student. Students will also be provided with summary statistics on the results for the entire class so that they can judge their relative performance for each assignment.

Students are expected to monitor eLearning for the posting of assignments, solutions and feedback. Email notifications and other channels of communication will not be used.

Examples and exercises are contained in each module to enable students to ascertain their level of understanding of various topics. These will not form part of the assessment for this unit.

The Unit Timetable below shows the due dates for the assignments and a guide to the pace at which students should progress through the unit material.

## UNIT TIMETABLE

Semester 1, 2018 will commence on Monday 26<sup>th</sup> February.

Study Week	Week Commencing	Topic	Assessment
1	26 Feb	Module 1: Numbers and Functions	
2	5 March	Module 1: Limits	
	12 March		<b>Assignment 1 Due: Monday 19 March</b>
3	19 March	Module 2: Calculus 1	
4	26 March	Module 2: Calculus 2	
5	2 April	Module 2: Calculus 3	
	9 April	<b>Mid Semester Break 1 week only</b>	
6	23 April	Module 2: Calculus 4	
	30 April		<b>Assignment 2 Due: Monday 7 May</b>
7	7 May	Module 3: Matrices and Determinants	
8	14 May	Module 3: Vector Spaces I	
9	21 May	Module 3: Vector Spaces II	
10	28 May	Module 3: Least Squares	
11	4 June	Module 3: Eigenvalues, Eigenvectors and Diagonalization	
	11 June		<b>Assignment 3 Due: Monday 18 June</b>

## **EXTENSIONS**

Requests for extension of the due date for an assignment must be made in advance of the due date for that assignment. These requests must be made using the query portal (<http://maths.adelaide.edu.au/mbb/form.html>) and include supporting documentation. You will then receive a reply by email with the decision as to whether an extension has been granted and the new due date (if applicable).

Where a student is so incapacitated by a medical or other condition that he or she is unable to request an extension in advance, medical or other certification should explicitly note the severity of the disabling condition that precluded the advance request being made.

Note that due to prerequisites, late results may preclude students from studying subsequent units of study. As such, extensions for Assignment 3 will only be considered after assurance is given from the university in which the student is enrolled that this will not impact on subsequent enrolments.

## **PENALTIES FOR LATE SUBMISSION**

Assignments should be submitted no later than midnight EST on the due date. Submissions after this time will be penalised at a rate of 5% of the earned mark per day, up to a maximum of 50%. Submissions after the solutions have been posted on eLearning will not be awarded any marks.

For example, if your mark for an assignment is 40/50 but you submit it two days late, 10% of your mark will be deducted so your final mark will be 36/50.

NOTE: It is not the intention of this late penalty policy to cause a student to fail the unit when otherwise they would have passed. If deductions for late assignments result in the final unit mark for a student being less than 50%, when otherwise it would have been 50% or greater, the student's final mark will be exactly 50%.

## **ELEARNING**

The online learning package used by the BCA is called eLearning (sometimes referred to as Blackboard). The BCA eLearning site will be accessed through the University of Sydney (USyd) server. The BCA online facilities are, however, independent of the policies and procedures of this university. You will have access to online help at the USyd ITS and eLearning Helpdesks. A guide to getting started in eLearning is posted in the Student Resources section on the BCA website.

Online learning will be one of the tools used to provide access to materials and solutions to exercises, and as a communication tool. Students are encouraged to post content-related questions in the Discussion facility in eLearning.

## **ELEARNING HELPDESK**

For further assistance with eLearning, you can contact the eLearning Helpdesk at [http://www.usyd.edu.au/elearning/student/trouble/email\\_us.php](http://www.usyd.edu.au/elearning/student/trouble/email_us.php)

Please note, if you have queries about the subject matter for MBB, you should contact the academic coordinators using:

<http://maths.adelaide.edu.au/mbb/form.html>.

If you are experiencing difficulties getting help, please contact the BCA coordinating office on 02 9562 5076, or email [bca@ctc.usyd.edu.au](mailto:bca@ctc.usyd.edu.au).



## ASSIGNMENT SUBMISSION

You will need to submit assignments using the Turnitin submission links in the Assignments folder on eLearning.

Assignments can either be neatly hand-written or typeset in the word-processor of choice. However, the submitted document must be in *PDF format as a single file*.<sup>1</sup>

If you are using Microsoft Word and wish to convert a .doc or .docx file to PDF (.pdf), choose the relevant set of steps below.

- On Windows (Word 2013 onwards):  
File → Export → Create PDF/XPS → Format: [select PDF] → Publish
- On Windows (prior to Word 2013):  
File → Save as... → Save as type: [select PDF] → Save
- On Mac:  
File → Save as... → Format: [select PDF] → Save

Should the above fail, there are a multitude of online converters available.

Identifying details (MBB assignment and number, and your name) must be inserted in the header or footer box so that they appear on every page. You must also include the page number and the total number of pages on each page of your assignment (e.g. Page 1 of 10).

All submissions should be labelled with MBB assignment and number, and your initials (e.g. **MBB\_assignment1\_ABC**).

To submit your assignment, you first need to complete the relevant assignment declaration in the Assignments folder on eLearning. This will then activate the relevant assignment submission link, which will allow you to upload your assignment.

Further instruction about how to submit assignments online can be found at:  
<http://sydney.edu.au/elearning/student/insideWebsite/TurnitinAssignments.shtml>

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<sup>1</sup>A major reason for this is that Microsoft Word file formats can render differently or not at all on different computers, especially for computers with different add-ons installed. Files that are .pdf format are readable on all systems with rare exceptions.

## BCA ASSESSMENT GUIDE - MBB

You should read through the BCA Assessment Guide in the Student resources page on the BCA website for further information on the following topics (<http://www.bca.edu.au/currentstudents.html#assessmentguide>):

- Guidelines for written work
- Guidelines for submission of assignments and exams
- BCA policies and procedures, including the complaints policy
- “Own Work” guidelines: advice on use of internet sites