



Study Guide

Mathematical Background for
Biostatistics (MBB)

Semester 2, 2018



MACQUARIE
University

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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 me if you are having problems with the unit material.

Maurizio Manuguerra
July 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 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:

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

Module 1 will require approximately 2 weeks of study, Modules 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 text books, which are required reading. Additional material such as explanatory videos will be provided as required. Notes for each module will be provided on eLearning, the Learning Management System of the unit, and will include the relevant text references, notes and exercises. Written material will be supplemented by discussion on eLearning.

SOFTWARE AND TEXT BOOKS

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, R 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>.

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

Anton H, Bivens I and Davis S
Calculus: Early Transcendentals, 11th edition
(Wiley, 2012) ISBN 9781118883822 (Hardcover); 9781118884126 (E-Text)

It can be found on the companion website:

www.wiley.com/en-au

It is available from university bookshops or online from fishpond.com.au or amazon.com or via www.addall.com. Be sure you have the correct version: the ISBN identifies the right one.

Anton H
Elementary Linear Algebra, 11th edition (Wiley, 2014)

Possible ISBNs: 9781118878767 (E-Text); 9781118473504 (Hardcover) or 9781118434413 (Applications Version).

There are two versions of this textbook, the standard one and the “Application version”. We will use the former and will **not** need the latter,

but you can buy the one you prefer. The only difference is that the “Applications Version” has additional material at the end that we do not use. The first part is common to both versions, so the paragraph and the exercise numbers are the same. As a further note, the eText referenced above is only available as “Application version”.

Australian distributor:

<http://www.wiley.com//legacy/products/worldwide/jacaranda/>

It is also available from university bookshops, from Jacaranda Wiley Ltd (1800 777 474) or online from fishpond.com.au or amazon.com or via www.addall.com.

If you want the cheapest price, be sure you buy the correct version, **not** “Applications Version”. The ISBN identifies the right ones.

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 lecturers will monitor and respond to all communications, however students are also encouraged to respond and take part in these communications.

STAFF ROLES

There are two staff involved in delivering the unit. The academic co-ordinator Maurizio Manuguerra will be responsible for the unit, while both Maurizio and Hassan Doosti will contribute to the discussion on eLearning and respond to content-related questions.

CONTACTING STAFF

You can contact Maurizio Manuguerra and Hassan Doosti directly in relation to requests related to personal matters. Email is the preferred method of contact for this kind of requests (email address is stated earlier in this Study Guide).

To facilitate timely responses to your enquiries, please include BCA – MBB and the module in question, or general enquiry, in the subject field of all emails. For example, you may send an email with one of the following subject lines: ‘BCA – MBB Module 1 enquiry’ or ‘BCA – MBB general enquiry’.

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 weeks prior to the submission date. Model solutions/guides will be posted on eLearning after the post date (ie when the results are released). This is usually one week after the due 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 2, 2018 will commence on Monday July 30.

Study Week	Week Commencing	Topic	Assessment
1	30 July	Module 1: Numbers and Functions	
2	6 August	Module 1: Limits	
	13 August		Assignment #1 Due Monday August 20
3	20 August	Module 2: Calculus 1	
4	27 August	Module 2: Calculus 2	
5	3 September	Module 2: Calculus 3	
6	10 September	Module 2: Calculus 4	
	17 September		Assignment #2 Due Monday September 24
	24 September	Mid Semester Break 1 week only	
7	2 October	Module 3: Matrices and Determinants	
8	8 October	Module 3: Vector Spaces I	
9	15 October	Module 3: Vector Spaces II	
10	22 October	Module 3: Least Squares	
11	29 October	Module 3: Eigenvalues, Eigenvectors and Diagonalization	
	5 November		Assignment #3 Due Monday November 12

EXTENSIONS

WITH AN APPROVED SPECIAL CONSIDERATION APPLICATION

Requests for extension of the due date for an assignment must be made submitting a special consideration application at the student's home university and letting the program coordinator and the unit convenor know by email.

Note that due to prerequisites, late results may preclude students from studying subsequent units of study. As such, students that require extensions for Assignment 3 should check with the program coordinator of the university in which they are enrolled that this will not impact on subsequent enrolments.

WITHOUT AN APPROVED SPECIAL CONSIDERATION APPLICATION

If no extension has been given, 5% of the earned mark for an assignment will be deducted for each day that an assignment is late, up to a maximum of 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. 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
Please note: If you have queries about the subject matter for MBB, you should contact the academic coordinator, Maurizio Manuguerra.

If you are experiencing difficulties getting help, please contact the BCA coordinating office on 02 9562 5076, or email erica@ctc.usyd.edu.au.

ASSIGNMENT SUBMISSION

Assignments must be word-processed and submitted in PDF format.

Instructions on how to create a pdf file will be provided.

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).

In the Course Content folder of the MBB site, clicking on the links for assignments will take you to the relevant assignment page. On this page, you can download your assignment and, once completed, submit it on the same page.

Further instruction about how to submit assignments online can be found here: [Assessment Guide](#)

All submissions should be labelled with MBB assignment and number, and your initials (e.g. MBB_assignment1_ABC).

BCA ASSESSMENT GUIDE - MBB

You should read through the BCA Assessment Guide in the Student resources page on the BCA website

<http://www.bca.edu.au/currentstudents.html#assessmentguide>

for further information on the following topics:

- 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 site

