BIO STATISTICS COLLABORATION OF AUSTRALIA

Study Guide

Mathematical Background for Biostatistics (MBB)

Semester 2, 2020

Prepared by:

Houying Zhu & Benoit Liquet
Department of Mathematics and Statistics
Faculty of Science and Engineering
Macquarie University, NSW 2109, Australia

MACQUARIE University

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Academic Coordinators

Dr. Houying Zhu

Lecturer in Statistics
Department of Mathematics and Statistics
Faculty of Science and Engineering
Macquarie University, Sydney NSW 2109, Australia

Phone: 02 9850 4749
Email: houying.zhu@mq.edu.au

Prof. Benoit Liquet

Professor of Mathematical and Computational Statistics
Department of Mathematics and Statistics
Faculty of Science and Engineering
Macquarie University NSW 2109, Australia

Phone: 02 9850 8944
Email: benoit.liquet-weiland@mq.edu.au

Other Contacts

If you have trouble contacting the academic coordinator/academic staff, or have any other queries, please contact:

Executive Officer
Biostatistics Collaboration of Australia
NH&MRC Clinical Trials Centre
University of Sydney
NSW 2006

Phone: 02 9562 5076
Fax: 02 9562 5350
Email: bca@ctc.usyd.edu.au

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 these 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.

Houying Zhu & Benoit Liquet
July 2020

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.

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 (also referred to as Canvas) 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 textbooks, 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

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.

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 (Hardcover); 9781118884126 (E-Text)

- It is available via 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 or amazon.com.
- Be sure you have the correct version: **NOT** "single variable", **NOT** "late transcendentals" and **NOT** "brief edition". The ISBN identifies the right one.

Anton H
Elementary Linear Algebra, 12th Edition ISBN 978-1-119-28236-5 (Hardcover), eText: 978-1-119-40672-3

or

Elementary Linear Algebra: Applications Version, 12th Australia and New Zealand Edition Howard Anton, Chris Rorres, Anton Kaul. ISBNs E-Text: 9781119670858, Hard Cover Textbook: 9781119666066

- 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 is available via Wiley Direct:

  https://www.wiley.com/en-us/Elementary+Linear+Algebra%2C+Applications+Version%2C+12th+Edition-p-9781119406723
- It is also available from university book shops or online from fishpond.com.au or amazon.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 lecturers will monitor and respond to all communications; however, students are also encouraged to respond and take part in these communications.

Workload Requirements

The expected workload for this unit is 10-12 hours per week on average, consisting of exercises, discussions posts, independent study and completion of assessment tasks.

Method of Communication with Coordinators

There are two staff involved in delivering the unit. The academic co-ordinators Dr. Houying Zhu and Prof. Benoit Liquet will be responsible for the unit and contribute to the discussion on eLearning and respond to content-related questions.

You can contact Houying Zhu and Benoit Liquet 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 <number> enquiry*
- *BCA – MBB general enquiry*
- *BCA – MBB Assignment <number> submission*
- *BCA-MBB Textbook question*
- *BCA-MBB Administrative question*

We would like to note, that we strongly encourage questions regarding course content to be posted on eLearning to generate and facilitate discussion. For more general enquiries regarding the BCA program, or if you are having trouble contacting the academic coordinators/staff please contact Executive Officer.

Assignment

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

You may submit neatly handwritten work, however, please note that marks will potentially be lost if the solution cannot be understood by the markers due to unclear or illegible writing. This handwritten work should be scanned and collated into **a single pdf file** and submitted via the eLearning site. See the BCA Assessment Guide document for specific guidelines on acceptable standards for assessable work. Once you scan your document please check that the page turnover nicely follows the order and the scanning is not done in reverse order on odd and even pages. The instructors will generally avoid answering questions relating directly to the assessable material until after it has been submitted, but we encourage students to discuss the relevant parts of the notes among themselves, via eLearning.

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 dates about the assignments and a guide to the pace at which students should progress through the unit material.

MBB Timetable 2020 _S2

Semester 2, 2020 will commence on Monday 3rd of August.

Study Week	Week Commencing	Topic	Assessment
1	3 August	Module 1: Numbers and Functions	
2	10 August	Module 1: Limits	
	17 August		Assignment 1 released due in two weeks
3	24 August	Module 2: Calculus 1	
4	31 August	Module 2: Calculus 2	
5	7 September	Module 2: Calculus 3	
6	14 September	Module 2: Calculus 4	
	21 September	Mid-semester Break 1 week only	Assignment 2 released due in two weeks
7	28 September	Module 3: Matrices and Determinants	
8	5 October	Module 3: Vector Spaces I	
9	12 October	Module 3: Vector Spaces II	
10	19 October	Module 3: Least Squares	
11	26 October	Module 3: Eigenvalues, Eigenvectors and Diagonalization	Assignment 3 released due in two weeks

Late Submission of Assessments and Extension Procedure

The standard BCA policy for late penalties for submitted work is a 5% deduction from the earned mark for each day the assessment is late, up to a maximum of 10 days (including weekends and public holidays). Extensions are possible, but these need to be applied for (by email) as early as possible. The Unit Coordinator is not able to approve extensions beyond three days; for extensions beyond three days you need to apply to your home university, using their standard procedures.

Submission of Assessments and Academic Honesty Policy

You should submit all your assessment material via eLearning unless otherwise advised. The use of Turnitin for submitting assessment items has been instigated within unit sites. For more detail please see pages 3-5 the BCA Student Assessment Guide. The BCA pays great attention to academic honesty procedures. Please be sure to familiarise yourself with these procedures and policies at your university of enrolment. Links to these are available in the BCA Student Assessment Guide. When submitting assessments using Turnitin you will need to indicate your compliance with the plagiarism guidelines and policy at your university of enrolment before making the submission.

eLearning

The online learning package used by the BCA is called eLearning (sometimes referred to as Canvas). 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. You will receive any specific instructions on using the eLearning site this semester from the BCA Coordinating Office. There is also a Getting Started document available on the Student Resources page of the BCA website.

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 coordinators.

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

Assignment Submission

You will need to submit assignments using the 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**[1] **as a single file.**

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

- 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 on the BCA Assessment Guide.

[1] 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

Feedback

Our feedback to you:

The types of feedback you can expect to receive in this unit are:

Formal individual feedback on submitted assignments

Responses to questions posted on Blackboard

Your feedback to us:

One of the formal ways students have to provide feedback on teaching and their learning experience is through the BCA student evaluations at the end of each unit. The feedback is anonymous and provides the BCA with evidence of aspects that students are satisfied with and areas for improvement.

Acknowledgements

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