Study Guide

Mathematical Background for Biostatistics (MBB)

Semester 1, 2016
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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 \url{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.

Trent Mattner, Jono Tuke and Ty Stanford
February 2016
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:

<table>
<thead>
<tr>
<th>Module 1</th>
<th>Numbers, Functions and Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 2</td>
<td>Calculus</td>
</tr>
<tr>
<td>Module 3</td>
<td>Matrices</td>
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</tbody>
</table>

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
ISBN 9780470647691

- It can be found on the companion website: www.wiley.com/college/anton
- It is also 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: not “late transcendentals” and not “brief edition”. The ISBN identifies the right one.

Anton H
ISBN 9781118473504 (Hardcover); 9781118864180 (Paperback)

Or

Anton H and Rorres C
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.
- It is also available from university bookshops or online from fishpond.com.au or amazon.com or via 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 four staff involved in delivering the unit. The academic co-ordinators (Trent Mattner, Jono Tuke and Ty Stanford) will be responsible for the unit and will contribute to the discussion on eLearning and respond to content-related questions. Stephen Crotty will be active on eLearning, posting material and helping when required.
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. 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.
Semester 1, 2016 will commence on Monday February 29.

<table>
<thead>
<tr>
<th>Study Week</th>
<th>Week Commencing</th>
<th>Topic</th>
<th>Assessment</th>
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<tbody>
<tr>
<td>1</td>
<td>29 February</td>
<td>Module 1: Numbers and Functions</td>
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<tr>
<td>2</td>
<td>7 March</td>
<td>Module 1: Limits</td>
<td>Assignment #1 Due: Monday 21 March</td>
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<td></td>
<td>14 March</td>
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<tr>
<td>3</td>
<td>21 March</td>
<td>Module 2: Calculus 1</td>
<td></td>
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<tr>
<td>4</td>
<td>28 March</td>
<td>Module 2: Calculus 2</td>
<td></td>
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<tr>
<td>5</td>
<td>4 April</td>
<td>Module 2: Calculus 3</td>
<td></td>
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<tr>
<td>6</td>
<td>11 April</td>
<td>Module 2: Calculus 4</td>
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<td></td>
<td>18 April</td>
<td><strong>Mid Semester Break</strong></td>
<td>Assignment #2 Due: Monday 2 May</td>
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<td></td>
<td>1 week only</td>
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<td></td>
<td>25 April</td>
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<tr>
<td>7</td>
<td>2 May</td>
<td>Module 3: Matrices and Determinants</td>
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<tr>
<td>8</td>
<td>9 May</td>
<td>Module 3: Vector Spaces I</td>
<td></td>
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<tr>
<td>9</td>
<td>16 May</td>
<td>Module 3: Vector Spaces II</td>
<td></td>
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<tr>
<td>10</td>
<td>23 May</td>
<td>Module 3: Least Squares</td>
<td></td>
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<tr>
<td>11</td>
<td>30 May</td>
<td>Module 3: Eigenvalues, Eigenvectors and Diagonalization</td>
<td>Assignment #3 Due: Monday 13 June</td>
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<tr>
<td></td>
<td>6 June</td>
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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**


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](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.
ASSIGNMENT SUBMISSION

You will need to submit assignments using the Assignment tool in 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.¹

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).

¹A 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 exception.
Submitting Via eLearning

Instructions for Blackboard: 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.

In the Assignment Information section at the top of the page, you will find a link to the assessment document for downloading to your computer. In the Assignment Materials and Submit sections, you can upload and submit your completed assessment item. Note that you can add a short comment in the Comments box (under the Attach file line).

Further instruction about how to submit assignments online can be found at: http://sydney.edu.au/elearning/student/help/assignments.shtml All submissions via eLearning should be labelled with MBB assignment and number, and your initials (e.g. MBB_assignment1_ABC).

Assignment Cover Sheet

Where assignment work is submitted online using the Assignment tool in eLearning, you will be able to indicate your compliance with the plagiarism guidelines and policy by electronic means. In this case, you do not need to complete the MBB 2016 Assignment Cover Sheet.

If an alternative submission process has been previously arranged (say, by email), then you do need to complete the MBB 2016 Assignment Cover Sheet, in which you will be asked to certify that the submission is your own work and that you have read the policy of the university at which you are enrolled (see Appendix). The cover sheet can also be downloaded from eLearning. The signed and scanned cover sheet needs to be submitted with your assignment.
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
APPENDIX: MBB 2016 ASSIGNMENT COVER SHEET
Online submission is the preferred method, however, in the event of a system breakdown, students can send assessment items to coordinators by email.

Where assessment items have NOT been submitted via your eLearning site, you must print and complete this form and submit it to the unit coordinator with your assignment or exam, by attaching your assessment document/s to the submission email.

Note: a cover sheet is generally not required for assessable exercises.

See the BCA Assessment Guide for a complete list of submission guidelines and BCA assessment policies and procedures. The guide contains a list of home university websites outlining university policies, procedures and advice regarding plagiarism, own work and citing sources. www.bca.edu.au/currentstudents.html#assessmentguide

MBB 1-2016 assignment no.

Coordinator email: BCA_MBB@adelaide.edu.au

I certify that:

1. I have read the policy on plagiarism associated with the University in which I am enrolled;
2. I understand that failure to comply with the student plagiarism policy and procedures of the University in which I am enrolled may lead to the University commencing proceedings against me for student misconduct, in accordance with the By-Laws of the University;
3. this Work is substantially my own work, and to the extent that any part of this Work is not my own, I have indicated that it is not by acknowledging the source of that part or those parts of the Work;
4. this Work or substantial parts of it have not previously been submitted for academic credit in any formal course of study; and
5. the Work is not the result of collaboration with others.

And, I agree that:

1. the assessor of this Work may, for the purpose of assessing this Work, reproduce this Work and provide a copy of this Work to another BCA unit coordinator or member of the BCA Board of Assessment.

NAME ______________________________

SIGNED ______________________________

DATE ______________________________