Module MA3484, Hilary Term 2015
Preparing for Examination

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Structure of the MA3484 Paper at the Annual Examination 2015

There are 4 questions on the paper. Credit is awarded for the best 3 questions. All questions have equal weight.

Three of the four questions are concerned with the Transportation Problem (Section 3) and/or the Simplex Method (Section 5). Two of those questions will require you to solve particular numerical optimization problems. (These problems can be solved using the methods discussed in lectures and exemplified in material available from the module website.) The remaining question on the Transportation Problem and/or Simplex Method will require you to give a proof of a theoretical result.

The fourth question is concerned with the material presented in Section 5 concerning general linear programming problems, duality and complementary slackness. The details as to examinable and non-examinable material presented below should be consulted as a guide in preparing for examination with regard to this question.

Material presented on the Website

The set of Notes available from the Module Website at

`http://www.maths.tcd.ie/~dwilkins/Courses/MA3484/Notes_2015/`

is intended to be the definitive set of notes for the course, superceding the contents of the Lectures, and superceding handouts previously available.

However the Lectures and the Solutions to the circulated Problems contain within themselves the material required in order to be able to complete the examination fully. (The specification of examinable and non-examinable

material given below should respect the principle that any material in the Notes that has not been presented in a similar form in the lectures for the module is non-examinable.)

In addition to the main Notes, a problem set, with worked solutions as discussed in lectures, is available from the website. Also other worked solutions to particular problems are available from the website.

1. Introduction to Linear Programming

You will not be examined on the contents of this section.

2. Bases of Finite-Dimensional Vector Spaces

You will not be examined on the contents of this section.

This section contains statements and proofs of results in linear algebra that are occasionally cited in later sections of the module.

3. The Transportation Problem

This material is examinable, with the exception of specific results declared here to non-examinable.

Of course the details of particular numerical examples are not examinable themselves as bookwork, though you should be familiar with the methods presented, so as to be able to apply them to other specific problems of the same type.

Subsection 3.1 is non-examinable.

Subsections 3.2, 3.3 and 3.4 are examinable. In particular Proposition 3.1 and Lemmas 3.2 and 3.3 are examinable.

Subsection 3.5 is examinable with the exception of the statement and proof of Proposition 3.4.

The statement and proof of Proposition 3.4 are non-examinable. (This result has recently been added to the main notes, and the proof has not been presented in lectures.)

Lemma 3.5 is examinable.

Subsection 3.6 is examinable. In particular, Proposition 3.6 is examinable.

Subsections 3.7 and 3.8 present numerical examples. You need to understand these so as to be able to apply such methods to other problems of the same type.

The material in Subsections 3.9, 3.10 and 3.11 is not examinable as bookwork. In particular the statement and proof of Proposition 3.7 are non-examinable.

(Subsections 3.9, 3.10 and 3.11 have recently been added to the notes, to complete the treatment, and are only relevant for examination purposes to the extent that they explain results and methods presented elsewhere in this Section, by giving formal descriptions of methods such as the Minimum Cost Method for finding an initial basic feasible solution of an instance of the Transportation Problem, and demonstrating that such methods do indeed result in a basic feasible solution.)

In Subsection 3.12, Proposition 3.8 and Corollary 3.9 are examinable. The proof of Proposition 3.10 is not examinable. However you should be familiar with basic result stated in Proposition 3.10.

You should be familiar with the basic steps involved in finding a basic optimal solution to a (non-degenerate) instance of the Transportation Problem. The method is outlined in Subsection 3.12, and exemplified in the example presented in Subsection 3.8 and in other material available from the module website (in the solutions to problems and in a separate document giving worked solutions to instances of the Transportation Problem).

4. The Simplex Method

This material is examinable. No material is specifically excluded.

Of course the details of particular numerical examples are not examinable themselves as bookwork, though you should be familiar with the methods presented, so as to be able to apply them to other specific problems of the same type.

5. General Linear Programming Problems, Duality and Complementary Slackness

This material is examinable, with the exception of specific results declared here to non-examinable.

The results, concepts and methods presented in Subsections 5.1 and 5.2 are examinable.

The material of Subsections 5.3, 5.4 and 5.5 is non-examinable. (This material is based on results and concepts of real analysis that should have been taught and assessed in the Freshman years, but that have not been reviewed in detail in MA3484 itself.)

The proofs of Proposition 5.13 and Lemma 5.14 (Farkas's Lemma) are not examinable as bookwork. You should be familiar with the statements of those results (so as to be able to apply them in particular contexts), and you should be familiar with the rest of the material of Subsection 5.6.

The proof of the Strong Duality Theorem 5.20 is not examinable as book-work. You should be familiar with the rest of the ideas and methods presented in Subsection 5.7