

Teaching Committee report to the Faculty Board

Examinations for Parts IA, IB and II of the Tripos, 2004

0.1 Introduction

The Committee met three times to consider the Examiners' reports on the 2004 Undergraduate Tripos examinations. We also looked at the examination statistics, the analysis of the lecture questionnaires, the e-mail questionnaires and the examination papers. At the time of writing (8th November), we still have not received one of the Part II External Examiners' reports (Professor Kropholler).¹

We noted with pleasure that as usual the External Examiners, without exception, commented favourably both on the examination process and also on the performance of the candidates. The five External Examiners' reports that we considered include comments such as:

The standards achieved by the undergraduates are of the highest. The examiners marked the large number of scripts very carefully and achieved a high level of consistency and accuracy. (Part IA)

Overall, the standard of the candidates was high. The borderlines were appropriately placed, and the large proportion of first and upper second class results was fully justified. The candidates and the Faculty should be congratulated for this outcome. (Part IB)

I have been impressed by the attention lavished on each examination question and the care and accuracy of the marking process. The general level of attainment seemed very good with particularly strong performances at the top end. (Part IB)

The top end of the class is very strong, with the best being outstanding. The large number of 1st class degrees is a fair reflection of this strength, with the 1st/2.1 and 2.1/2.2 borderlines being consistent with those at comparable institutions. (Part II)

I am pleased to report that I am confident that the examination and assessment procedures are fair and thorough, that they are administered efficiently, and that they contribute in an effective way to the impressive and challenging Part II of the Mathematical Tripos. The work of the top candidates was astounding, and my impression is that 2.1 and above candidates are producing a lot of high quality work. (Part II)

There follows a summary of the points raised in the Examiners' reports which the Committee believe need the attention of the Faculty Board. We have not generally highlighted points of a purely administrative nature: that is for the Chairs of this year's examiners to pick up rather than the Faculty Board.

¹No report had been received from Professor Kropholler by the time of the Faculty Board meeting.

0.2 General Matters

0.2.1 Errors

This year a total of five errors, some insignificant, were reported, in a total of about 280 questions: one error in Part IA; one minor error in Part IB; three errors in Part II, one very minor. In most cases, the errors were spotted early in the examination (or beforehand). It does not appear that any of these errors caused significant difficulty. We would have liked to have seen an account in the examiners' reports of how or at what stage errors arose; this would help eliminate errors in future.

A problem arose when a college requested corrections to be telephoned, as well as faxed, and this message was not passed on to the duty examiner. The candidates who were taking the examination in college did not receive the correction. We **recommend** that deviations from the normal procedure should not be agreed to.

0.2.2 Personal circumstances of candidates

One of the External Examiners (Dr Scott, Part IA) is very much in favour of the system whereby personal circumstances are not considered at the final examiners' meeting but are considered later by a separate body.

However, Professor Strickland (External Examiner, Part IB) believes that current arrangements are not satisfactory, because assessment might require input from the examiners as well as information normally available to the Applications Committee. ('It could easily happen that no one person knew all the facts.') It was not clear to us exactly what situation Professor Strickland has in mind: for example, if the candidate is ill for a small part of the examination, the examiners are indeed asked to take this into consideration; and if the candidate has convincing medical or other grounds, affecting a large part of the examination, for claiming that his or her class is not appropriate, he or she is withdrawn completely from the class list and declared to have deserved Honours (and no input from examiners is required).

Dr Kerswell (External Examiner, Part IB) is 'surprised to see that no consideration is currently given to candidates who have illness letters providing that they make the honours list'. This seems to be based on a misunderstanding (see above); though it is true that examiners do not take into account personal circumstances of classed candidates at the final meeting.

Professor Laws (External Examiner, Part II) makes a similar point, again perhaps based on a misunderstanding. The External Examiners are unlikely to be involved in any reclassification or removal of candidates from the class list since it happens later on in the summer, and so may not be aware that it occurs. In any case, the Mathematics Faculty has no part to play in this matter, and the examiners are required to conform to University policy.

Professor Perkins (External Examiner, Part II) is 'surprised that there is no mechanism for considering extenuating circumstances for students who are classified at 3rd of above'. Again, this seems to be based on an incomplete understanding of the system.

0.2.3 Cover sheets

This year, for the first time and after much discussion and persuasion, special cover sheets appropriate to the Mathematical Tripos were used. No comments, adverse or favourable, were made.

0.2.4 Mark processing programs

The antiquity and non-transparency of the mark processing program has been commented on in previous years. The Teaching Committee was pleased to learn that Mr Harris is currently implementing new programs using a standard spreadsheet.

0.2.5 Marking Schemes

Several of the External Examiners complained that even though they received solutions to all the proposed examination questions, some omitted essential working, some were without marking schemes, and some omitted to indicate (right hand column of the standard template) whether the material is (for example) bookwork, or standard calculation, or similar to an examples sheet question, or completely unseen. Professor Strickland makes the point that this information is important in allowing External Examiners and other Examiners to judge the level of questions (especially short questions).

The Committee **recommend** that the Chair of the Faculty Board's letter to Chairmen of Examiners emphasises the importance of complete solutions.

0.2.6 Quality Marks

Following discussions last year, and recommendations from External Examiners, a new system of quality marks is in place for the 2005 examinations (a single alpha or beta is available for 'long' questions, and a single beta is available for 'short' questions, throughout the undergraduate Tripos). This scheme is recommended by Dr Kerswell (External Examiner, Part IB), who also floats the idea that, to be consistent, the Computational Projects should also only carry beta quality marks. However, under the agreed scheme, the Computational Projects will in fact carry four quality marks, either alphas or betas.

Dr Scott (External Examiner, Part IA) raises the related matter of merit marks. We are comfortable with the Faculty Board's decision that merit marks should be used merely as a convenience, should be decided by the examiners and should not be published. We noted that an effective merit mark would have a different formula for each borderline.

Dr Scott suggests that consideration should be given to the idea of awarding 'short' question betas for 7/10 instead of 8/10, because the latter mark is rather a high hurdle for a weaker candidate. We thought that this idea has merit, but we also thought that this increased the mark disparity between a 'long' question beta (10/20) and a 'short' question beta. It was also argued that a bookwork question *should* be mainly correct. We **recommend** that the Faculty Board consider this suggestion.

0.2.7 'Short' questions

The agreed and advertised description for 'short' questions is:

Short questions should be accessible to any student who has studied the material conscientiously. They should not contain any significant 'problem' element.

We looked through the examination statistics and felt that this guideline was more closely adhered to than in previous years. This improvement may have resulted from the innovation of putting the the descriptor for short questions on the lecturers' comment form and asking lecturers specifically if the relevant questions adhere to the criteria.

However, there is no room for complacency. For example, one Complex Methods question had 85 attempts, and average marks of 1.3 and a total of 9 alphas. The examiner's comment: 'Paper 2 Q2 [it was actually Q5] This question required a modicum of lateral thinking ...' seems immediately to rule it out as a 'short' question.

Dr Scott finds it difficult to accept the above guideline, because 'a fairly straightforward problem tests knowledge and understanding just as well as bookwork'. We thought that the wording of the guideline ('no *significant* problem element') allows exactly for the sort of question Dr Scott has in mind.

0.2.8 Continuity of examiners

Last year, we pointed out that the two Part IB External Examiners will both be new and we recommended that steps be taken to try to ensure that the next appointments of Externals are staggered.

This year the new External Examiners for Part IB comment that, despite all arrangements being admirably efficient, they struggled to do everything they needed to do in the time available. They believe that this was in part due to the fact that neither of them had previously acted as external examiners. They suggest that one or the other should serve only two years instead of the usual three. We **recommend** this.

0.2.9 Examining breadth of curriculum

Professor Laws (External Examiner, Part II) amplifies the comment he made last year to the effect that some weaker students manage to pass by answering questions on a very narrow range of courses. We responded last year by noting that our aims and objectives for Part IB and Part II do not specify that students should study a wide (or even non-narrow) range of courses, and allow the possibility of excellence in one area to be compared equally favourably with competence across a broad range of courses. (Part IA is semi-modular, two courses being examined on each of the four papers, so some breadth of knowledge is required.)

Professor Laws raises the issue that emerging national benchmarks for undergraduate degrees may expect students to have taken a sufficiently non-narrow range of courses. In fact, the current benchmark for Mathematics Statistics and Operational Research is not at all prescriptive in this respect; nor could it be, given the wide variety of programs to which it applies.

Nevertheless, we **recommend** that the Faculty Board considers the current examination arrangements, which allow students to graduate with knowledge of only a narrow range of mathematics beyond the level of Part IA.

0.2.10 Verbal Classification Criteria

Professor Laws (External Examiner, Part II) draws attention to the fact that our classification criteria (published in the Schedules booklet) make no distinction between a fail and an allowance towards an Ordinary degree. Of course, for most practical purposes, there is no real distinction between the two, as far as the fate of the candidate is concerned. He also points out that the criteria for an allowance towards an Ordinary Degree is phrased in terms of what the candidates cannot do, rather than what they can do. We **recommend** that the Faculty Board reconsiders these criteria as a matter of urgency.

0.2.11 Examinations sat in college

It was noted that one candidate sitting an examination in college, and requiring extra time, was allowed to start the examination 90 minutes **early**. There is an obvious danger to such a candidate in respect of errors (suspected or actual) on the papers (much greater danger than to a candidate finishing 90 minutes late) and we **recommend** that the Faculty Board write to the Board of Examinations expressing concern about this early start.

0.2.12 Style guide

It was suggested that much time at the examiners' meeting could be saved if there were a style guide available to examiners (relating to punctuation, labelling of question parts, fonts for hints, etc). This could be created by Chairs of Examiners noting the points that arose at their meetings and circulating the results to the other Chairs. We **recommend** this practice.

We also **recommend** that a tex template be made available so that examiners who typeset their own questions can see how the question will appear on the paper.

0.2.13 Availability of mark spreadsheets

One set of examiners suggested that it might be useful to allow examiners to enter marks on their own laptops. This is in fact currently possible: Mr Harris will provide a copy of the spreadsheet on request.

0.2.14 Consistent classification

Professor Laws (External Examiner, Part II) noted that, although he was happy with the placing of the borderlines this year, at each meeting much time is spent in deciding what relative weight to place on marks and quality marks at the different borderlines. He wonders whether a different group of examiners would have made the same decisions. He asks whether the Faculty Board could provide more guidance on the issue.

We note that the wording given in the Schedules booklet relating to this point has this year been made more explicit. However, we **recommend** that the possibility of further definition be considered (bearing in mind the limited influence Faculty Boards can have over examiners.²)

We further **recommend** that, to assist the examiners in drawing the lowest borderlines, the last page of the mark list for the past five years be made available at the final meetings.

0.2.15 Rubric violations

The Part IA examiners attribute an increase in the number of candidates handing in extra questions to the rubric ‘adopted by the examiners for this year’ that placed no restriction on the number of questions attempted, only on the number that would be taken into account.

However, the rubric was identical to last year’s, so any change was either just a statistical fluctuation or due the rubric becoming somehow more widely appreciated.

We noted that the rubric relating to this matter is different for each Part of the Tripos. We **recommend** that the same rubric be used in each Part of the Tripos; and we commend the Part IB rubric: *You should attempt at most **four** questions from Section I and at most **six** questions from Section II.* The policy of marking all the answers submitted and assessing on the basis of the best answers consistent with the rubric should be adumbrated in the Schedules booklet.

0.2.16 Faculty Secretary

All the Examiners’ reports remarked on the excellent support given by Ms Katheryn Ayres.

0.2.17 Computer Officer

As usual, Examiners comment on the indispensability (or words to that effect) of Mr David Harris. As usual, the Committee **recommend** that the Faculty Board investigate whether he is indeed indispensable, and takes steps to provide back up if that proves to be the case.

²Grace 4 of 24 July 2002 (Reporter, 2001-2, p. 1277) entitles Faculty Boards to issue to Examiners details of the conventions and criteria to be applied in determining class-lists. Stats and Ords 2003, page 216.

0.3 Part IA

0.3.1 E-mail to students

This year, at the suggestion of last year's Part IA Examiners, the Teaching Committee provided the text of an e-mail to explain the rubric which was sent to all Part IA students by the Faculty Office. This year's Examiners request that students should be e-mailed again next year, and the Teaching Committee **recommend** that this should be done.

0.3.2 Re-use of past papers

At the request of the Faculty Board, we considered a letter sent to the Chair by two students, complaining about the similarity between this year's questions on Differential Equations and the questions on the 1999 and 2000 papers. There was similar criticism expressed in the responses to the e-mail questionnaire. Although the letter also mentioned probability questions, we could find no evidence of similarity between the 2004 questions and those of the above years.

The extent of the similarity is as follows.

- Q1 is similar to 2000,Q1. But this is a very standard question, which also appears on an examples sheet. The right hand sides are respectively $\frac{x-2y}{2x+y}$, $\frac{2x-y}{x+2y}$, $\frac{x-y}{x+2y}$.
- Q2 is not similar to any 1999 or 2000 question.
- Q5 is identical to 1999,Q7 and relatively standard.
- Q6 is identical to 2000,Q6 and highly non-standard.
- Q7 is identical to 2000,Q7 and standard.
- Q8 is identical to 1999,Q8 and somewhat non-standard.

We recognise that examiners may well base their questions on ideas gleaned from past Tripos papers (or indeed from other sources).

A serious issue is whether using Tripos questions from years as recent as four and five years ago gives an unfair advantage to those students who happened to have revised these papers. Given that a first class requires only 13 or so good answers to 'long' questions, we think that there probably was unfair advantage. We believe that it is not acceptable practice either to re-use questions from recent papers or to copy questions wholesale from the papers of just one or two years (even if not recent). However, the fact that no similar complaints have been voiced in previous years suggests that this is merely commonsense.

0.4 Part IB

0.4.1 Computational Projects

We noted that in the second year of the new format (core projects submitted early, etc) all seems to have run very smoothly.

0.4.2 Distribution of questions

There were two anomalies.

An additional question was set on Paper 3: instead of Electromagnetism and Special Relativity 'sharing' a question, both courses had a full complement of questions. We don't believe that this give a significant advantage to any candidates; and the situation cannot arise again because the new distribution of questions agreed for 2005 eliminates 'shared' questions of this sort.

A few students complained that a question on Quantum Mechanics that should have appeared on Paper 4 appeared on Paper 3. This change, made at the request of Directors of Studies, had been advertised to students and Directors of Studies by e-mail in the Michaelmas term, and had appeared as a Form and Conduct notice in the Reporter. Unfortunately, through an oversight, the Schedules on the Faculty Website had not been updated. The External Examiners were not of the opinion that any candidate could have been significantly affected. The situation was discussed at the October meeting of the Faculty Board and the Faculty Documentation Committee was encouraged to update the web site when appropriate.

0.4.3 Complex methods

We wish to draw the attention of this year's examiners to the poor response this year (and to a certain extent in other recent years) of candidates to the questions on Complex Methods. We believe that the reason for the poor response was that the questions, on balance, were too sophisticated; in some cases, this means too much like Further Analysis questions, and in other cases this means expecting too great an expertise in non-routine techniques. With the new arrangements for examining Complex Analysis and Complex Variable, much vigilance will be required to set appropriate questions.

0.5 Part II

0.5.1 Level of difficulty of questions

We noted that, for some joint courses, the level of difficulty of questions was unsuitable for Part II(A) students — for example, the examiner for Principles of Statistics and Stochastic Financial Models comments that four of his questions were too difficult for Part II(A) students.

We **recommend** that the Faculty Board requests Part II examiners this year to be particularly vigilant in respect of the level of difficulty of the questions: D-course questions should be aimed at the average Part II student (rather than the average first or upper second student, as was the case for Part II(B) questions) and the C-course short questions should be accessible to *any* student who has studied the course diligently.

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