

# Teaching Committee report to the Faculty Board

## Examinations for Parts IA, IB and II of the Tripos, 2002

### Introduction

The Committee met three times to consider the Examiners' reports on the 2002 Undergraduate Tripos examinations. We also looked at the examination statistics and the 'General Comments' section of the e-mail questionnaire.

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

*Cambridge can be justly proud of its teaching and examining in mathematics, which are pre-eminent.* (Part IA)

*Cambridge continues to attract the top mathematics students and the solutions of the good first class candidates were virtually perfect and extremely well presented.* (Part IA)

*Overall the standard of candidates was good, and as last year there were some really excellent individual performances by a high number of candidates.* (Part IB)

*I am satisfied that in general the syllabus and teaching of Part IB are working well. The majority of students are demonstrating high levels of attainment. The impressive proportion of students obtaining classes I and II(i) seems justified and highly creditable.* (Part IB)

*The quality and level of the examination and of the majority of scripts continue to endorse the very high standing in which the Cambridge Mathematical Tripos is held. The care and concern for fairness shown by the Chairman and the other examiners are exemplary.* (Part II)

*The design and content of the course are of an excellent standard.* (Part II)

*I was impressed by the overall standard of the scripts that I looked at. There was a large amount of very high quality work. In my opinion, the borderlines were correctly placed, and the levels attained within each class were appropriate for a leading university like Cambridge.* (Part II)

There follows a summary of the points raised in the Examiners' reports which we believe need the attention of the Faculty Board. We have not highlighted the various points of a purely administrative nature that arise (such as a request for the provision of a fax machine in the Mill Lane Lecture rooms, the failure of the Board of Examinations to notify the Part IB Examiners that two of the candidates were not candidates for honours, the possible provision of a second computer on which Examiners can type their examination questions, and the scheduling of any future England-Argentina football matches). We assume that these will be dealt with as appropriate by the Secretary of the Faculty Board in conjunction with the Computer Officer and this year's Chairmen of Examiners.

### General Matters

#### Errors

No errors were reported in Part IA; seven errors were reported in Part IB resulting in formal complaints from College Tutors (four on Examiner D's questions); and nine errors were reported in Part II (three on Examiner D's questions (not the same person as Examiner D in Part IB)). This is a comparatively large number of errors (the total was nine last year) and a cause for concern. In most cases there was no indication in the Examiners' reports of the stage at which the errors arose, despite the explicit request in the letter that the Chairman of the Faculty Board sends to Chairs of Examiners.

It is clear from the reports of Examiners and of the External Examiners that everything that could possibly be done to ensure that no candidates were placed in the wrong class because of these errors was done. Nevertheless, announcing errors in the examination is bound to have an effect on the candidates that is not easily detectable or quantifiable. There may also be a loss of confidence in the examination which persists in future years or is transmitted to other year groups. There is also the problem of candidates' concentration being broken by frequent announcements in the course of the examination (there were complaints about this on the e-mail questionnaires).

It seemed to the Committee that the problems of coping with errors are different in the different parts of the Tripos. In Part IA, where most of the examiners are familiar with the material of most of the questions, one would expect few if any errors. In Part II, the range of questions is so wide that the responsible examiner can expect little help from other examiners. One thing is clear from the pattern this year: if the questions labelled D in both Part IB and Part II had been as rigorously checked (by setters, other examiners or lecturers) as questions with other labels, the number of errors would have been much less of a cause for concern. This seems to suggest that at least part of the problem was a lack of attention of individuals rather than failure of process; or perhaps it was a failure to assign responsibility for correcting errors to specific individuals.

The Committee were of the opinion that individual examiners must take responsibility at all stages for their own questions. In particular, it is not the understanding of the Committee that 'the responsibility for detecting errors rests as much with the checkers and the lecturers as with the examiners' (point 3 of IB Examiners' Report). Lecturers are merely asked to check that the questions are suitable and consistent with the course as given and are not required to check for accuracy.

The Part IB examiners make a number of suggestions for future examiners to consider and we **recommend** that the 2003 examiners in all parts of the Tripos consider these. The Committee were strongly of the view that the questions should appear in printed form at the earliest possible stage and that a TeX template should be used to achieve this. It is essential the limited time available in Examiners' meetings is not largely taken up with typographical issues (some of which could surely be sorted out at secretarial level).

## Rubric

Last year, the Teaching Committee (in response to a comment by one of the External Examiners) recommended a change in the rubric in all parts of the Tripos. This recommendation was accepted almost unanimously by the Faculty Board. The rubric suggested was (for Part IA):

*You will be assessed on, at most, the four questions in Section I and five questions chosen from Section II, with a limit of three questions on each course in Section II.*

*If you submit answers to more than five questions from Section II, or answers to more than three questions on either course in Section II, your lowest scoring attempt(s) will be rejected.*

In the event, the rubric was changed in different ways in Part IA and Part II; it was not changed in Part IB, though the Chairman of Part IB examiners wrote a letter to Directors of Studies explaining the situation and requesting that his message be forwarded to students. The view had been expressed that the proposed change this might lead to an increase in the number of half-hearted attempts, but there was no evidence of this happening.

However, using different rubrics to describe the same situation in different parts of the Tripos is not, in the opinion of the Teaching Committee, very satisfactory. If asked to do so, the Committee would be willing to propose consistent rubrics for the three parts of the Tripos, taking into account the concerns expressed last year by examiners.

## Alternative merit marks

This year, the Examiners were provided with three merit marks: the usual mark, a 'quadratic' merit mark and something else. As usual, there was no agreement at all amongst examiners on

the utility of the alternatives.

There was certainly no enthusiasm for replacing the usual merit mark with one of the alternatives. However, Professor Duck mentions the ‘amplification factor’ in going from 14 to 15 marks in Part IB (saying that it is something of which the examiners should certainly be aware).

Last year, the Teaching Committee spent several meetings discussing merit marks. There was no agreement, though useful points emerged from the discussion. The Committee will report to the Faculty Board later in the year, but for the moment the Committee has no recommendation for change to the current procedures.

## Personal circumstances of candidates

One of the External Examiners mentions the possibility of the examiners taking into consideration the personal circumstances of candidates (those with warning letters, for example). He feels strongly that personal circumstances should be taken into consideration in determining the class of a candidate.

These issues are matters of University policy. They have been discussed recently widely within the University. It is in fact now possible for a candidate’s personal circumstances to be taken into account in this way, though only in very limited situations (where, for example, the candidate is affected for one paper out of four).

## Curriculum

This year, as last year, an External Examiner (Dr Kropholler in Part II this year, Professor Jones in Part IB last year) notes the paucity of abstract algebra in the curriculum. The Committee noted that DPMMS appointed a committee to look at the provision of Algebra in the Tripos and that this committee has met several times over the last year and produced a report. Nevertheless, we **recommend** that these comments are brought to the attention of the Curriculum Committee and the DPMMS staff meeting.

## Computational Projects

There were no adverse comments of the Computational Projects by Examiners in either Part IB or Part II.

## ‘Short’ questions

The agreed and advertised description for short questions (i.e. Section I questions in Part IA and Part IB, and Part (i) of any question in Part II(A)) is:

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

The Committee were of the opinion that, in some cases, examiners had not adhered to this description sufficiently strictly.

In Part IA, one of the two Section I Probability questions attracted 227 attempts but only 69 alphas and one of the two Section I Differential Equations questions attracted 202 attempts but only 78 alphas. It seems that these two questions (which comprise half of Section I on Paper 2) did not fit this description. This perhaps partly accounts for the complaints by a number of students that Paper 2 was ‘obscure’ and ‘very difficult’.

In Part IB, Professor Duck comments on ‘a lot of instances of candidates scoring badly (e.g.0/10) in Section I questions, but then scoring superbly (e.g. 20/20) in the corresponding Section 2 question’. This suggests that some of the short questions may have been inappropriate. The Committee noted that the take-up rate for Section I Applied questions (38%) was lower than the take up rate for Section II Applied questions (44%) and the same is true for the Statistics

area. However, candidates are only permitted to answer 4 short questions (compared with 6 long questions), so 38% is in fact about right.

The Committee **recommend** that item (5) in the Chairman of the Faculty Board's letter to the Chairmen of Examiners be rewritten to emphasise the importance of the above description.

### **Inexperienced examiners**

Professor Jones suggests that guidance should be given to new examiners. The Committee felt that this task might reasonably be undertaken by the mentor of the new examiner and **recommend** that heads of department consider including this explicitly in the duties of mentor.

### **Continuity of examiners**

This year, as last year, External Examiners comment on the desirability of some continuity in examiners from year to year. In particular, there was very little continuity of IB examiners this year. The Committee recognise the difficulty the Heads of Department face in this respect but **recommend** that they should bear in mind the situation in the following year when nominating examiners; in particular, a possible chairman should be identified.

### **Standards**

External Examiners were unanimous in saying that the classes obtained by most students were appropriate. However, it was suggested (by Professor King, Part II) that some students might have appeared in a lower class (or have failed) at other universities. Professor King later explains why he thinks that his argument might be invalid: he points out that because of the format of the examinations (in which the number of courses tackled is not fixed) the spread of marks is much greater than at other universities. The Committee are convinced that comparisons of our system (non-modular, unscaled marks) with very different systems used at other universities (in particular with modular systems with a fixed number of papers and scaled marks) do not provide a reliable guide to placing border lines.

Dr Kropholler asks whether the Faculty Board 'needs or wishes to have any procedures for guaranteeing and demonstrating that academic standards at the lower end of the class list are comparable with other university mathematics departments'. The Committee believe that such comparisons are not possible (for the reasons mentioned above).

### **Noise**

Several students complained (in the e-mail questionnaires) of the high levels of noise in the Mill Lane Lecture Rooms. Some of the noise is due to the attendants chatting outside the doors and some due to the noise in the street outside. This might be alleviated by installing double glazing in the one lecture room that does not already have it and by putting 'Quiet please' notices outside the building. We **recommend** that these possibilities be investigated.

## **Part IA**

### **Distribution of Algebra and Geometry questions**

In the general comments section of the annual e-mail questionnaire, a number of students complained about the distribution of the Algebra and Geometry questions between Papers 1 and 3: for example, the orbit-stabiliser theorem was examined on Paper 1 despite being in the second half of the course. This point has been previously discussed by the Faculty Board, and on that occasion

the Board confirmed its original intention that Algebra and Geometry should be treated as a single course and examined as such. Students' complaints were therefore based on a misconception (perhaps arising from a distribution of questions in a previous examination).

## **Marks for Papers 5 and 6 of Part IA**

Last year, there was some criticism of the algorithm for assimilating the marks for Papers 5 and 6. This year, a new algorithm proposed by the Teaching Committee (and Dr Lister in particular) was implemented and the Examiners were of the opinion that it worked well.

## **Processing master cover sheets**

The Examiners recommend that the information from master cover sheets should be read into the computer early in the marking process. One member of the Committee noted that in the Natural Sciences Tripos this information is used to speed up the input of marks by providing prompts for individual examiners (the computer skips over the questions that the candidate has not, according to the master cover sheet, attempted). The Committee **recommend** that the Computer Officer be asked to consider the feasibility of implementing this process.

## **E-mail to candidates**

The Examiners recommend e-mailing candidates a short time before the examinations to inform them of the rubric and to explain it to them in a friendly way. The student representatives on the Committee thought that this would be a very good plan. The Committee **recommend** that such an e-mail be sent (by the Faculty Office). The Examiners provided a draft; the Committee would provide a final version if requested to do so.

## **Part IB**

### **Timing of Part IB examinations**

Professor Duck comments on the fact that candidates take two papers on the same day. He remarks that he made the same comment last year but that it was unheeded. This is not in fact correct: a statistical analysis was performed to see if candidates indeed performed worse on Paper 4, and no clear evidence for this assertion was found and therefore no precipitate action was taken. Nevertheless, the Faculty Board thought that the comment of the External Examiner should be taken seriously and this year (2003) the papers have been rescheduled so that no candidate sits two examinations on the same day in Part IA, IB or Part II of the Tripos.

### **Examiners' timetable**

Both External Examiners complained that they had almost no time to look at the questions before the meeting and that most of the meeting was taken up with typographical matters. The Committee **recommend** that the Part IB Examiners 2003 review the timetable.

### **Breadth of Curriculum**

Professor Jones comments that the system allows some candidates to pass by demonstrating moderate ability over a rather narrow range of topics, and that this may lead to difficulties in Part II. He advocates September resits as a way of encouraging weak students to do extra work. The Committee felt that the structure of the course, allowing considerable flexibility in the number of courses prepared for examination (which is a very different matter from the number of courses

in which the students are supervised over the year) is a strength of the system. The design of Part II(A), in which there are quite a few courses that do not require prerequisites, allows for the possibility of weaker students concentrating on a limited number of courses.

The matter of resits has been discussed previously and there are several good reasons why the Faculty would not want to advocate a change in the present University policy.

## Part II

### Format of Part II

Dr Kropholler comments that some students who are possibly ill-advised to follow Alternative B are nevertheless tempted to do so, and in some cases they find it too tough. He also points out that, more than any other UK Mathematics department, Cambridge has to provide a course suitable both for students who will become professional mathematicians and those who go on to non-mathematical careers; and that doing so has a national impact. The Faculty Board is aware that this may be the situation and it was one of the reasons that persuaded the Faculty Board to set up a committee to bring forward proposals for merging the two alternatives.

### Merit mark formula

The Examiners recommend that in future the merit mark formula be changed from  $2m + 7\alpha + 3\beta$  to  $2m + 10\alpha + 3\beta$ . This would be more consistent with the merit mark formulae used in Part IA and Part IB, though in these cases the merit mark takes a different form, with less credit for alphas, for candidates with fewer than a fixed number of alphas.

Even apparently significant changes in the merit mark formula in practice make very little difference to the order of merit. The effect of the proposed change on the order of merit (by merit mark) was investigated (by STCS) and it was found that there were small changes around the 1/2(i) borderline which reflected better the actual class list this year. In some other years, the proposed change would have meant that the order of merit was less well correlated with the class list.

The merit mark formula *from the previous year* is published in the Schedules booklet, which will therefore remain correct whatever decision the Examiners for 2003 take. However, the Committee **recommend** that if a different merit mark formula is used this year, candidates are notified.

Professor King believes that there is a need for greater transparency with regard to the weight placed on alphas in determining borderlines. The Committee considered this point in its recent deliberations on merit mark formulae and will report on the matter.

### Timing of the final meeting of Part II examiners

Following Professor Cremona's (External Examiner, 2001) suggestion the final meeting was this year moved from its traditional day (Saturday) to Monday. This year's Examiners recommend that the meeting be moved to Tuesday (which was in fact Professor Cremona's suggestion) in order to give the External Examiners the opportunity to read scripts on the Monday. The only reasons for not doing this would be the unavailability of the Computer Officer and the possible clash between the meeting and external examiners inspecting scripts for other parts of the Tripos.

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