

Teaching Committee report to the Faculty Board

Examinations for Parts IA, IB and II of the Tripos, 2021

1 Introduction

The examinations in 2021 returned to the usual format as described in the Schedules. They were timed, invigilated, classed and summative. About 85% of each cohort took the exams in person in the University Sports Hall and Studio, and the remainder took the exams remotely at exactly the same time, with online invigilation provided using ProctorExam or Teams.

The examination timetable was stretched over 2.5 weeks, including Saturdays, rather than the usual 7 weekdays, owing to the limited availability of the Sports Hall. Scripts were scanned, sorted and marked electronically. The Examiners met on zoom and borderline scripts were considered on Sharepoint after electronic resorting of scripts by candidate.

The external examiners, without exception, commented very favourably on the way that the Faculty and University had managed to hold largely in-person, fully invigilated, timed exams in the Mathematical Tripos and thereby maintained the integrity and the rigour of the results. The six external examiners' reports include comments such as:

I am impressed that the University managed to run sit-down exams, and was also able to invigilate those candidates who had to take the exam remotely. Discussion [of classing] was both rigorous and sensible, with careful consideration given to borderline cases. I was satisfied that the final decisions on boundaries were fair and justifiable. (Part IA)

I hope that the students will have appreciated the efforts made this year to enable them to have as "normal" an exam experience as possible. Very few other UK departments/universities achieved this and it is particularly important in Mathematics where formal exams play such a vital role. (Part IB)

Marking was of a good standard, and a good range of marks and outcomes were achieved. Scripts and mark profiles at borderlines were scrutinised carefully to ensure accurate classifications. (Part IB)

I am extremely impressed that the mathematics departments managed to run in-person examinations for around 85% of candidates, given the current pandemic. In addition, considerable effort was spent in ensuring that the candidates who took the examinations remotely did so in a fair manner (e.g. with two cameras on them). (Part II)

I am amazed that Cambridge was able to offer in person examinations to the bulk of the students, and deal with that efficiently and fairly. That system of examination was clearly in the interests of the students, improved their experience during a very difficult period. And the University should be congratulated on this success. (Part II)

I would like to praise the department for being able to conduct in-person exams during this unprecedented time of the pandemic. There will be very few, if any, other universities in the UK that managed to do this for a Mathematics degree. The in-person exams ensure that the very high standards and quality of the degree have been maintained. (Part II)

and finally

It is abundantly clear to me why Cambridge has such a high reputation for undergraduate study in Mathematics. (Part II)

The Committee met three times, for two hours each, to consider the 2021 undergraduate Tripos examinations. For each part of the Tripos, we looked at:

- the examiners' report;
- the external examiners' reports;
- the examination statistics;
- the analysis of the end-of-term lecture questionnaires;
- and the responses to the end-of-year questionnaires.

There follows a summary of points raised in the examiners' reports which the Committee believe need the attention of the Faculty Board.

2 General Matters

2.1 Errors

This year 13 errors were discovered before, during or after the examinations, in a total of about 280 questions: 7 errors in Part IA; 2 errors in Part IB (both discovered before the examination, which barely count); and 4 errors in Part II. Careful attention was paid during marking to ensure that no candidate was disadvantaged. In line with previous recommendations, examiners refrained from making clarifications and restricted announcements to substantive corrections.

The number of errors in Part IA was much larger than usual, and the examiners **recommend** to their successors that more time needs to be devoted to the fourth proof-reading meeting. The number in Parts IB and II were below average. Three of the errors in Part II were on Paper 4, and we remind all examiners of the **recommendation** to read through the papers in *reverse* order at the fourth meeting. Given the considerable dislocations of remote working and lack of in-person conversation, we consider that the examiners did very well to keep errors down in Parts IB and II.

A number of appeals centred on claims that time was wasted by candidates worrying about corrections. The *Schedules* now has a paragraph explicitly describing the mechanism for raising a query during the exam, and we **recommend** that the pre-exam email describing rubric, coversheets, etc., also mentions that errors do occur and advises candidates to raise a query and move on.

2.2 Venue

It was generally agreed that the Sports Hall provided a calm, spacious, well-ventilated and uniform environment for candidates, and was a significant improvement on the Mill Lane Lecture Rooms (which are now no longer available). We **recommend** that the Faculty open negotiations with the University and endeavour to secure the Sports Hall and a reasonable timetable for 2022. There will be more sessions in total, but presumably more competition for in-person venues from other Triposes.

2.3 Covid mitigations

In line with University policy on mitigations for the effects of the pandemic, the examiners were appropriately inclined towards generosity, particularly at the 1st/2.1 border and the Pass/Fail border. We **recommend** that next year's examiners do not regard this year as the 'new normal', but consider performance in the context of pre-pandemic years and the Faculty Board recommendations in the *Schedules*.

2.4 Electronic setting, marking and script handling

The examiners in all three parts recommend continued use of Sharepoint for the setting of examinations and are enthusiastic about continued use of electronic marking of scripts.

Nevertheless, they detail a large number of problems encountered with the new procedures for scanning, sorting, distribution of scripts, and checking against coversheets. Among the key recommendations are:

- (i) re-instate manual checks that the master coversheets have the reverse side completed and that candidate BGN's are valid.
- (ii) introduce electronic check of the list of questions discovered against the list of questions claimed **before** scripts are distributed for marking.

- (iii) introduce electronic checks of the list of candidate scripts distributed against the list of all entrants **before** marking is complete.
- (iv) scripts should be distributed as bundled pdfs per question, not individual pdfs per candidate.
- (v) continue the usual electronic check of marks entered against the output from (ii).
- (vi) a more thorough briefing of the (human) mark checkers (easier in person).

Items (i)–(iii) would have avoided a significant amount of grief. We **recommend** that the new procedures are thoroughly tested on last year’s scripts (for one Part), ideally during the Lent Term and well in advance of this year’s examinations.

2.5 External examiners’ reports

The University now provides external examiners with a standard form containing a list of generic questions and some tick-boxes. The Teaching Committee found less to chew on than with the old free-format reports. The Faculty might like to consider whether the University form provides enough information and comment for the Faculty’s needs. We **recommend** that examiners be encouraged to comment on other matters as they see fit, or not to use the form for comments if they prefer to give a free-format report.

2.6 Administrative and Computer Officer support

The examiners’ reports all remarked on the outstanding efforts and support provided by Kati Sexton, Mycroft Rosca-Mead, Denise Champion and John Sutton, in particular, and the administrative and IT staff more generally. The pandemic required introduction of new procedures and many staff worked long and unsociable hours. We **recommend** that the Chair of the Faculty Board warmly expresses the appreciation of the Board to all for their hard work.

We also **recommend** that the Chair warmly express the gratitude of the Faculty Board to the Examinations Office, in particular Jenny Green, for the assistance provided in making the in-person examinations in the Sports Hall both possible and so smoothly running.

3 Part IA

3.1 Difficulty of questions

The long questions on Pure mathematics were found a bit easy this year and we **recommend** that next year’s examiners pay careful attention to the statistics and to the guidelines on question setting in the letter from the Chair of the Faculty Board.

The short questions on all courses were appropriately short and straightforward, and we hope this is maintained next year.

3.2 Number and range of examiners

The examiners suggested increasing their number from 6 to 8. The Teaching Committee did not agree, noting that IA examiners are already responsible for fewer questions per examiner than in other Parts (albeit with a greater marking load).

The Teaching Committee did agree that the expertise of the examiners should span the range of IA courses and, in particular, there should normally be an examiner from the Stats Lab (or someone with equivalent expertise who has agreed) to examine Probability.

3.3 Report

The examiners’ names should be appended to the report as a matter of record.

4 Part IB

4.1 Difficulty of questions

On average, the questions in the areas of Pure, Applicable and Applied Mathematics were found of equal difficulty.

In response to a series of recommendations over the last three years, the difficulty of questions in Numerical Analysis received an overdue reset with some questions on the less routine parts of the schedule. This came as something of a shock to the candidates, who had grown used to the anomalously easy questions on this course. The Teaching Committee considered that the lower marks this year are likely due to the surprise factor and **recommends** that the level of difficulty of the questions on this course be maintained next year to keep it comparable with other courses.

4.2 Complex Methods/Analysis

The external examiners queried the separation between Complex Analysis and Complex Methods,¹ and commented on the small number of attempts on the specifically Analysis questions. The Teaching Committee noted that the take-up on the Analysis questions has historically been consistently lower than on both the joint Methods/Analysis questions and the specifically Methods questions, perhaps because the Analysis questions are drawn from the harder end of the course. One possibility might be to require (some of) the joint questions to have an either/or structure so that there are effectively more Analysis-only questions. We **recommend** that the Curriculum Committee revisit this thorny subject.

4.3 Geometry

The examiners also noted the very low take-up on the Geometry questions – about 20 attempts per long question and 10 attempts per short question. The Teaching Committee observed that the Schedule has changed relatively recently, and there is hope that take-up might increase as the course settles down and a history of past questions accumulates. From the student questionnaires on lectures, we **recommend** that the lecturer gives more examples in lectures and provides crib sheets for supervisors with information about the key points in questions.

4.4 Attainment statistics

The gender attainment statistics, and their possible causes, are very important and have been subject to extensive and ongoing analysis and discussion by the Faculty Board, the Equality, Diversity and Inclusion Committee and the Teaching Committee. In response to the examiners' request for IA statistics, we note that Faculty Board agreed (FB19.20(c)) that the attainment statistics should be appended to the examiners' reports without comment for others to consider. All marking and classification is, of course, done while anonymised. In response to Prof Dyson's comment that she is not familiar with similar problems at other institutions, an internal analysis indicates that the attainment gap at Oxford has over a number of years been comparable to ours, despite the differences in the form of our examinations. We remain committed to doing as much as we can to support all our students.

4.5 Carrying CATAM marks over for cases of intermission

It is very hard to see how this can be done automatically by the Faculty, as we have no record of student status and return from intermission is handled entirely between the College and the University. The CATAM handbook has a short paragraph at the end of the introduction stating that the Director of Studies should contact the CATAM helpline and Undergraduate Office if a student is returning from intermission, but some Directors of Studies may not be aware of this. We **recommend** that this paragraph be expanded both to explain what the rules are, depending

¹The current examination arrangement attempts to assign credit fairly to these overlapping but distinct courses

on the dates of intermission, and to tell the student that their Director of Studies needs to make an application on their behalf via the Undergraduate Office.

5 Part II

5.1 Difficulty of questions

On average, the questions in Pure and Applied had similar success rates, while those in Applicable were found a little more difficult. As usual, lecturers and examiners should aim to move this year's outlying courses back towards the centre.

5.2 Number of examiners

The Part II examiners observe that while Applied has 5 examiners for 16 courses and Applicable 2 examiners for 6 courses, Pure only has 4 examiners for 15 courses and it was tricky this year achieving a coverage that everyone was comfortable with. A fifth Pure examiner would have made a significant difference, and we **recommend** that this be considered seriously. If four examiners are generally thought to have sufficient breadth to cover the Pure courses, then the argument (in the context of recent proposals for Part II) that 15 examiners are necessary is surprising.

5.3 Late submission of questions

The problem of very late submission of questions seems to have been effectively addressed by the early prompting of late-returns by the Chair of Faculty Board and the threat of naming and shaming. We **recommend** that this firm approach be maintained.

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Henry Wilton	Alex Yan	Mike Tehranchi	Maria Bruna
Enrico Pajer	András Zsák	Jonathan Evans	John Lister (Chair)

December 1, 2021