

Teaching Committee report to the Faculty Board

Examinations for Parts IA, IB and II of the Tripos, 2019

1 Introduction

The Committee met three times, for two hours each, to consider the 2019 undergraduate Tripos examinations. As usual we looked, for each part of the Tripos, at:

- the examiners' report;
- the external examiners' reports;
- the examiners' comments on their questions;
- the examination statistics;
- the examination papers;
- the analysis of the paper lecture questionnaires;
- the responses to the on-line questionnaires;
- the report from the CATAM assessors (Parts IB and II).

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 six external examiners' reports include comments such as:

The exams distinguished well between the good students and the standards achieved were very high. The changes to the shorter questions this year meant that that the exams were also very good at distinguishing between the weaker students. (Part IA)

The examination process is both fair and rigorous in assessing performance of the candidates. The examiners take a great deal of care in both the setting and marking of examination scripts and that the Faculty of Mathematics has robust systems for checking and compiling marks. (Part IB)

Discussion of borderline cases and the precise location of class boundaries was the main subject of the final meeting. Having spent the previous day examining scripts of the potential borderline candidates we were able to have a rigorous discussion that ensured the final classification was both fair and appropriate for the qualification. (Part IB)

The standard of the examination papers was very high, and the performance of the candidates was typically exceptionally strong. That Cambridge continues to hold strong in a time of grade inflation and not devalue its own currency is to be encouraged. (Part II)

The final papers represent a high, but not insurmountable, challenge for students, testing material at a challenging and appropriate level that matches or exceeds all other institutions in the UK (and, I suspect, internationally). (Part II)

My fellow external examiners and I met on the day before the final meeting to discuss borderlines and scrutinise the scripts. We found that the marking schemes had been applied consistently and the marking had been fairly and carefully done. (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 and the Undergraduate Office to pick up rather than the Faculty Board.

2 General Matters

2.1 Errors

This year only seven errors were discovered before, during or after the examinations, in a total of about 280 questions: no errors in Part IA; one error in Part IB; six errors in Part II, two fewer than last year. The Board of Examinations data suggests there were also four minor clarifications (which they count as errors) in Part II and one in Part IB, and they are much exercised by the total number of announcements. While the Board of Examinations may not appreciate the distinctive character of mathematics papers, we note that corrections, particularly in Part II, increase the likelihood of requests for Examination Review. (Questions with corrections are, of course, always marked generously by the examiner, and the final meeting will always consider whether border-line candidates might have been affected.)

We **recommend** that Examiners should refrain from making trivial clarifications and restrict announcements to substantive corrections. (This might have eliminated about three announcements this year.)

We also **recommend** for Part II that the detailed checking of questions by another examiner be moved to between the second and third meetings, by which time the questions will be closer to final form.

2.2 Mark-lists

In response to comments from examiners in Parts IA and II, we **recommend** some changes, as described in a separate paper, in the formatting of the computer-generated mark lists that are provided at the final examiners' meeting. The new formatting clarifies the presentation of information to the examiners, but the classification criteria and the merit mark, ranking and UMS percentage issued to candidates are unaffected.

2.3 Ranking

The University now requires students to be provided with an official ranking, which is posted on CamSIS. We **recommend** that the ranking be that on the Faculty results list, namely determined by merit-mark order within each class. Faculty Board previously decided not to put rank on the mark breakdown out of consideration for candidates whose results were disappointing.

2.4 Reprographics

The IB examiners strongly **recommend** negotiation of a later submission date for camera-ready copy to Reprographics. They point out that the current date requires an examiners' meeting and subsequent editing within the first week of Full Easter Term, which is full of other commitments. If the deadline could be delayed until the end of the second week, that might reduce the chance of errors. They note that the papers were, in fact, not copied until 31 May, two weekdays before the IB exams began.

2.5 Administrative and Computer Officer support

The examiners' reports remarked on the excellent support given by Ms Kati Sexton, Mr Mycroft Rosca-Mead, Ms Denise Champion, Ms Caroline Bell and Mr John Sutton, in particular, and the administrative staff more generally. The external examiners were likewise very complimentary about the administrative arrangements and the detailed information that was ready for them to assist their scrutiny of the borderline scripts. We **recommend** that the Chair of the Faculty Board warmly expresses the appreciation of the Board for their hard work.

3 Part IA

3.1 Difficulty of examination

This year's examination was found significantly easier than last year's, and perhaps an overcompensation overall when compared to the four previous years or to the target alpha rate on long questions. Nevertheless, the 60% beta rate on short questions was a welcome increase towards the 65–70% target. Prof. Watts (external examiner) commented very positively that the accessibility of the short questions gave weaker students a good chance to show what they knew.

We **recommend** that this year's examiners pay careful attention to the statistics from previous years and the guidelines on question setting in the letter from the Chair of the Faculty Board.

3.2 Dynamics and Relativity

Various negative comments were received in student feedback about the quirkiness of this year's questions, and the marks were lower than those on other courses. We wonder whether some of the stories built around the problem element were found over-elaborate or off-putting.

3.3 Re-use of old questions

Prof. Watts (external examiner) suggests that it would be helpful if the Faculty issued some guidelines on re-using questions verbatim. We thought we had provided some very clear guidelines in last year's report, and these were incorporated into the letter from the Chair of Faculty Board to examiners. We **recommend** some minor clarifications of the wording, and hope that the guidelines will be followed this year.

4 Part IB

4.1 Difficulty of questions

There was good overall balance in difficulty between the long questions in Pure, Applied and Statistics. We agree with the recommendation in the examiners' report regarding the need to keep the short questions accessible in all subject areas, and we **recommend** that this year's examiners pay attention to the comments of Prof. Harlen (external examiner) regarding two outlying courses.

4.2 Number of questions

Profs. Harlen and Talbot (external examiners) comment that the structure of the examination gives students a large choice of questions to attempt and hence the flexibility to decide on the breadth of topics to attempt. We agree that for almost all students this is a good thing, and it allows students to optimise their strategy in line with their interests and abilities. We agree that the candidate who (just) achieved a 2.ii by answering questions on only two courses well (and CATAM) is a highly unusual anomaly (and a high-risk strategy), and we note that they will almost certainly have attended lectures and supervisions on other courses during the year. Prof. Harlen suggests that the Faculty might consider slightly reducing the number of questions available. This has, in fact, been done this year with the reduction of the number of short questions on 24-lecture courses from 3 to 2 and with the incorporation of Metric and Topological Spaces into Analysis & Topology (a net loss of 3 questions).

5 Part II

5.1 Difficulty of questions

We were very pleased to note that there were again no significant differences in difficulty between the major areas of Pure, Applied and Statistics. The measures introduced in 2018, in particular

putting greater emphasis on the responsibility of lecturers to consider Faculty guidelines regarding difficulty and the desired direction of travel from previous years' statistics, seem to be broadly effective at avoiding systematic variation between areas and reducing variation between courses. The examiners' report **recommends** continuation of all procedures and we again **recommend** continued vigilance regarding individual courses which may have been slightly too easy or too hard this year, and special attention to courses that have been systematic outliers over several years.

5.2 Late submission of questions

Lecturers are required to submit draft questions with model answers to the Undergraduate Office by the Monday of the week before Full Lent Term. Of 36 lecturers, 23 were on time or within 1 week i.e. by the start of Full Term. However, 7 provided questions only within 2 weeks, 4 within 3 weeks and 2 within a month! Late submission of this magnitude significantly complicates the task of both the examiners and the Undergraduate Office. It prevents the questions being considered properly and checked in advance of the second meeting, it makes it difficult for the examiners to moderate difficulty between courses, and it probably contributes to the number of errors (either directly, or by distracting the examiners from other courses).

The quality of our examinations is, of course, of great importance to the Faculty because it is important to our students (and the University), and this is a needless spanner in the works. The Undergraduate Office can prompt lecturers about upcoming or missed deadlines, but, in our opinion, it is not fair to expect them to pursue unresponsive lecturers. Accordingly, we **recommend** that Faculty Board follow through with its previous decision to name at its first meeting of Term all those who are still late. We also **recommend** that the Chair of the Faculty Board email all those whose questions are still outstanding on the first Friday in Term, and cc. their Head of Department. And we **recommend** that the Chair of Faculty Board email those who were significantly late in the previous year (if still lecturing) reminding them of their responsibilities.

5.3 Reporting of errors

The examiners' report should detail all errors and clarifications, and not just give the corrected versions of significant errors.

5.4 Number of duty examiners

The Part II examiners decided to follow last year's precedent and have three duty examiners present at each examination rather than the traditional two. This was again found beneficial in dealing with the larger volume of queries that are almost inevitable in Part II. We **recommend** that Faculty Board confirm that having three duty examiners should be standard practice in Part II.

5.5 Equality, diversity and inclusion

In response to the concerns of Prof. Johnson (external examiner), we repeat that statistical analysis has failed to show any appreciable difference in the strategies pursued by male and female candidates, in contrast to stereotypical assumptions that are easily made. The Faculty is committed to addressing all issues of equality, diversity and inclusion, and has a number of committees and working groups thinking hard about these issues.

5.6 CATAM

Prof. Garrett (external examiner) notes that the CATAM projects are of significant benefit to students and, similarly to last year, the 5 students who did not submit projects all got 3rds or Failed. The Faculty does email all IB students with graphs showing the very clear contribution that a CATAM mark typically makes to a student's overall performance. The median CATAM mark was 115/150.

This year candidates were allowed to submit more than 30 units of projects, with an algorithm for discarding or scaling the weakest projects down to 30 units of credit. Six students went more than one project over 30 units, and one of these went more than two projects over. The Teaching Committee considers that (i) the new rules are fairer and have been a success (ii) the number of excess projects is small and at an acceptable level (iii) attempting excess projects, like doing excess questions in an examination, is to be discouraged as not in the students' interests, but that is not the same as trying to prohibit it. We were unpersuaded by a suggestion from CPAC that the number of submittable units should be capped, but will review the situation next year.

6 Summary of recommendations

(The exact recommendation is described in the section indicated.)

- 2.1 Examiners to refrain from trivial clarifications.
- 2.1 Detailed checking of questions in Part II to occur between the second and third examiners' meetings.
- 2.2 Change the format of the preliminary mark lists.
- 2.3 Ranking defined to be that on the Faculty results list.
- 2.4 Negotiate a later submission date of camera-ready copy to Reprographics.
- 2.5 Thanks the individuals who provided administrative and computer officer support.
- 3.1,4.1 This year's examiners to give attention to the statistics and comments on the difficulty of last year's examination.
- 5.1 The new measures to even difficulty of questions to remain in place, vigilance to be maintained.
- 5.2 Various measures to put more pressure on lecturers to submit their draft questions on time.
- 5.4 Part II examiners to have 3 duty examiners at each examination as standard practice.

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