Examiners' Report: Preliminary Examination in Mathematics and Philosophy
Trinity Term 2017

November 8, 2017

Part I

A. STATISTICS

(1) Numbers and percentages in each class

See Table 1. Overall, 17 candidates were classified.

Table 1: Numbers in each class (Preliminary Examination)

	Numbers					Percentages %				
	2017	(2016)	(2015)	(2014)	(2013)	2017	(2016)	(2015)	(2014)	(2013)
Distinction	4	7	6	4	11	23.53	50	42.86	30.77	61.11
Pass	13	4	7	8	5	76.47	28.57	50	61.54	27.78
Partial Pass	0	3	1	1	2	0	21.43	7.14	7.69	11.11
Fail	0	0	0	0	0	0	0	0	0	0
Total	17	14	14	13	18	100	100	100	100	100

(2) Vivas

No vivas were given.

(3) Marking of Scripts

In Mathematics, all scripts were single marked according to a pre-agreed marking scheme which was strictly adhered to. There is an extensive checking process. In Philosophy, all scripts were single marked except for failing scripts, which were double-marked.

B. New examining methods and procedures

There were no new examining methods or procedures this year. This was the fifth year of the new examining structure following the change in 2013 from Honour Moderations to Preliminary Examination.

C. Changes in examining methods and procedures currently under discussion or contemplated for the future

There are no changes under discussion.

D. Notice of examination conventions for candidates

The Notice to Candidates, containing details of the examinations and assessment, including the Examination Conventions, was issued to all candidates at the beginning of Trinity term. All notices and examination conventions in full are on-line at https://www.maths.ox.ac.uk/members/students/undergraduate-courses/examinations-assessments/examination-conventions.

Part II

A. GENERAL COMMENTS ON THE EXAMINATION

Timetable

The examinations began on Monday 19th June at 2.30pm and ended on Friday 23rd June at 12:30pm.

B. EQUAL OPPORTUNITIES ISSUES AND BREAKDOWN OF THE RESULTS BY GENDER

The breakdown of the final classification by gender is as follows. In accordance with University policy, data is not included for years where some of the cohorts contained fewer than 6 candidates.

Table 2: Breakdown of results by gender

Class	Number								
	2017			2016			2015		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
Distinction	2	2	4						
Pass	5	8	13						
Partial Pass	0	0	0						
Fail	0	0	0						
Total	7	10	17						
Class	Percentage								
	2017			2016			2015		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
Distinction	28.57	20	25.53						
Pass	71.43	80	76.47						
Partial Pass	0	0	0						
Fail	0	0	0						
Total	100	100	100						

C. DETAILED NUMBERS ON CANDIDATES' PERFORMANCE IN EACH PART OF THE EXAMINATION

Mathematics I

	Maths and Philosophy		Single School	
Question	Mean	Std Dev	Mean	Std Dev
Q1	12.60	2.75	14.21	2.85
Q2	15.50	2.71	15.69	4.08
Q3	13.30	4.97	12.04	5.03
Q4	10.46	2.96	10.16	3.76
Q5	11.08	2.90	11.25	4.02
Q6	8.75	1.95	8.55	3.63
Q7	6.20	2.49	8.95	3.66

Mathematics II

	Maths and Philosophy		Single School	
Question	Mean	Std Dev	Mean	Std Dev
Q1	11.00	3.62	11.89	3.66
Q2	8.71	1.11	10.64	4.32
Q3	10.43	4.04	14.58	3.76
Q4	8.77	3.27	10.38	3.91
Q5	7.75	4.79	10.17	5.15
Q6	8.00	4.56	9.03	4.54
Q7	4.00	2.73	4.62	3.86

Mathematics III(P)

	Maths and Philosophy		Single School	
Question	Mean	Std Dev	Mean	Std Dev
Q1	15.18	2.86	16.17	3.35
Q2	9.00	6.40	14.36	4.76
Q3	10.93	5.88	16.10	3.62
Q4	11.50	4.08	13.28	4.27
Q5	13.64	3.54	14.98	3.51
Q6	11.00	2.00	14.76	3.42

Elements of Deductive Logic

AvgUSM	StdDevUSM
65.35	13.78

Introduction to Philosophy

AvgUSM	StdDevUSM
63	5.32

D. COMMENTS ON INDIVIDUAL PAPERS

See the Mathematics report for reports on the following papers:

Mathematics I

Mathematics II

Mathematics III(P)

Report on Elements of Deductive Logic

This report on the EDL paper covers students in Computer Science & Philosophy, Maths & Philosophy, and Physics & Philosophy.

Comments

All scripts were single marked except for failing scripts, and those near the pass/fail borderline, which were checked by a second marker.

The mean for Computer Science & Philosophy was 62.5, for Maths & Philosophy 65, and for Physics & Philosophy 63. The mean for Computer Science & Philosophy would have been closer to those of the other two schools if it had not been dragged down by a fail script with a very low mark. The standard deviation for Computer Science & Philosophy was 22.4, in contrast to 13.8 and 14.9 for Maths & Philosophy and Physics & Philosophy.

Comments on single questions

Question 1 (25 answers). Many candidates answered part (a) by writing that the size (cardinality) of the languages is infinite. For full points it was required to state that they are *countably* infinite. Part (b) (iii) contained a mistake: $\mathsf{Sen}(\mathcal{L}_1^{\Sigma})$ was defined for sets Σ of sentence letters. In (iii), however, Σ_1 and Σ_2 are sets of sentences that may be complex. During the examination a correction was added to the effect that, if Σ is a set of sentences, $\mathsf{Sen}(\mathcal{L}_1^{\Sigma})$ is defined as the sublogic of $\mathcal{L}_1$ generated by all sentence letters occurring in sentences in Σ. As far as is evident from the scripts, this correction did not cause any problems. Many candidates answered (c)(iii) by providing an adapted form of the compactness proof of the full language $\mathcal{L}_1$ instead of using earlier results on $\mathcal{L}_1^{\{P,Q\}}$-representative subsets. Correct proofs relying on either strategy were awarded full points.

Question 2 (12 answers). In (a)(i) details were often omitted, although almost all candidates had the correct proof strategy. Answer to (c) were often very compressed or incomplete.

Question 3 (28 answers). This question on duality was answered very well and had the best mean mark of all questions. Most candidates gave full proofs of the duality theorem in part (b). Part (c)(ii) caused some problems and some answers were incomplete.

Question 4 (34 answers). this question on disjunctive and conjunctive normal forms in propositional logic was the most popular question. Most proofs of the disjunction normal form theorem in part (b) were correct, but often lacked detail and precision. Part (b) caused problems and candidates did not know how to go about the proof. There are various ways to prove that $\forall x Px$ is not equivalent to any quantifier-free proof. An easy proof would have been to argue that no quantifier-free consistent sentence can entail all sentences Pc for all constants c by the Compactness Theorem for propositional logic.

Question 5 (11 answers). Candidates who attempted this question on formalization in predicate logic with identity often struggled. Mistakes were made in different places. Although candidates were asked to formalize the argument in $\mathcal{L}_=$, some did not use identity in the formalization. Answers to part (b) were often formulated by providing English sentences that were not idiomatic and mirrored the structure of the formal sentences very closely.

Question 6 (14 answers). In this question many candidates lost points by forgetting to add a condition expressing that R is a function in (i) and (ii). Some candidates did not know how to use the Compactness Theorem for $\mathcal{L}_=$ to prove that there is no sentence that is true in exactly the structures of infinite cardinality. With this proof it is only a small step to give a full answer to part (b).

Question 7 (35 answers). This question was the most popular and generally answered very well. In part (c) some candidates showed only that the set $\{\top, +\}$ is not expressively complete. However, candidates were asked to prove that $\{\top, \bot, \leftrightarrow, \neg, +\}$ is not expressively complete, although it is straightforward to show this once it has been proved that $\{\top, +\}$ is not complete.

Question 8 (8 answers). This question on proof theory was the least popular question with answers that varied significantly in their quality. Answers to (a)(i) often started with the correct idea for the direction $\Gamma \models \phi \Rightarrow \Gamma \vdash_P \phi$, but then it was not stated exactly what the proof of ϕ from Γ looks like. Most candidates attempting the question answered (b)(ii) incorrectly by claiming that $\Gamma \vdash \phi$

implies $\Gamma \vdash_T \phi$. However, if $\Gamma \vdash_T \phi$ and ϕ is not a tautology, then ϕ must be a sentence of the form $\neg\psi$, as an induction on the length of proofs shows.

Report on Introduction to Philosophy

General Philosophy Questions
To follow

Frege Questions

Question 7 (5 answers). The answers were of mixed quality. In some answers it did not become clear how fundamental the distinction is and why concepts cannot be viewed as special objects. The last part of the question on the importance of the distinction was answered in different ways with some candidates emphasizing the relevance for Frege's formal logic and the development of his logicism and others more philosophy of language aspects.

Question 8 (12 answers). This question on Frege's rejection of empirical accounts of arithmetic and Mill's account, in particular, was by far the most popular. Most answers were sound with the weaker answers being incomplete. Most answers could have been improved by clearly distinguishing between Frege's general reasons to reject empirical accounts and reasons aimed specifically at Mill. Some candidates focused almost exclusively on Frege's rejection of Mill's approach.

Question 9 (0 answers). Questions on Frege's rejection of psychologism are fairly standard. Thus it is somewhat surprising that no candidate answered this question.

Question 10 (6 answers). Answers to this question were generally very strong with very clear explanations of why Frege rejected the view that numbers are properties or can be obtained by abstracting away from specific concrete objects.

Question 11 (2 answers). The two candidates who attempted this question struggled somewhat with this question. They did specify clearly how the strategy set out in the quote is fundamental to Frege's method of defining numbers.

Question 12 (7 answers). This was a very standard question on the analyticity of Hume's Principle. There were some very strong answers. Some weaker answers focused to much on the failure of Frege's own attempt to establish the analyticity of Hume's Principle via Basic Law V.

E. RESERVED BUSINESS

Removed from public version of the report.

F. NAMES OF MODERATORS

- Prof. Jochen Koenigsmann (Chair for Preliminary Examinations)
- Prof. Oliver Riordan
- Prof. Volker Halbach
- Prof. Oliver Pooley