

## DIVISION OF MATHEMATICAL AND PHYSICAL SCIENCES

### MSc in Mathematics and the Foundations of Computer Science Report of the Examiners (2012-2013)

#### Part I

#### 1. Results

Entries	19
Passed	7
Distinctions Awarded	10
Failed TT hurdle	1
Failed	1

#### 2. Vivas

Seventeen candidates who submitted dissertations had vivas.

#### 3. Number of scripts multiply marked

Each written assignment (mini-project) was marked by the lecturer for that course (who was therefore appointed as an assessor if he was not already an examiner) and was also marked by a 2<sup>nd</sup> assessor and then moderated by the examiners. Each dissertation was marked by one reader, and then moderated by the examiners taking into consideration comments supplied by the dissertation supervisor.

#### 4. Distribution of topics

Of the 35 topics available, the numbers taken were as follows:

<i>Michaelmas Term</i>	<i>Passed</i>	<i>Failed</i>
Algebraic Topology	1	0
Analytic Topology	0	0
Commutative Algebra	1	0
Introduction to Representation Theory	4	0
Lambda Calculus & Types	4	0
Lie Algebras	1	0
Model Theory	2	0
Modular Forms	1	0
Algebraic Geometry	3	0
Applied Probability	1	0
Categories Proofs & Processes	5	0
Communication Theory	1	0
Foundations of Computer Science	3	0
Graph Theory	9	0
Quantum Computer Science	3	0
Combinatorics	8	0
Machine Learning	0	0
Probability & Computing	1	0

<i>Hilary Term</i>	<i>Passed</i>	<i>Failed</i>
Algebraic Number Theory	1	0
Godels Incompleteness Theorems	1	0
Group Theory and an Intro to Character Theory	4	0
Homological Algebra	3	0
Infinite Groups	2	0
Representation Theory of Symmetric Groups	6	0
Axiomatic Set Theory	5	0
Concurrency	2	0
Automata Logic & Games	4	2

Computational Algebraic Topology	2	0
Elliptic Curves	6	0
Probabilistic Combinatorics	5	0
Categorical Quantum Mechanics	2	1
Theory of Data & Knowledge Bases	1	0

<i>Trinity Term</i>	<i>Passed</i>	<i>Failed</i>
Computational Number Theory	1	0
Combinatorial Geometry	4	0
Networks	2	0

## 5. Assessors

There were 43 assessors appointed to help with the examination. Of these, 2 were not required at all.

### A. Changes in examination methods and procedures this academic year

None

### B. Changes in examining methods and procedures envisaged

None

## Part II

35 courses were offered. 2 courses failed to attract any students. The performance was of a high standard, with 13 mini-project scripts receiving marks of 90 and above, 27 receiving 80 and above, 26 receiving 70 and above, 23 receiving 60 and above, 11 receiving 50 and above, and 3 failures. The overall standard of dissertations was very high this year. 2 were awarded a grade of 90 and above, 4 at 80 and above, 7 at 70 and above, 3 at 60 and above, 1 at 50 and above, and one fail.

The dissertation topics, which all had some (theoretical or practical) computing aspect to them, were as follows:-

- Rational Points on Varieties
- Intersection Types and the Inhabitation Problem
- Generalizing the Spectral Presheaf
- Structural Approximation for Metric Structures
- Permutation Modules of Brauer Algebras
- Combinatorial Auction with Externalities
- Three Valued Semantics and Abstraction-Renement in Model Checking
- Sheaf Cohomology and Exact Sequences for Quantum Non-locality and Contextuality
- Bismash products and group algebras
- On the structure of Specht modules over a field of prime characteristic.
- On the topology of measurement contexts for asymmetric multipartite spin systems
- Fourier transforms for symmetric inverse semigroups
- Deniability using 3 variables in Monadic Logic of Order and Metric
- Optimal Revenue Mechanisms for Auctions
- Balanced routing of random calls in sparse networks
- Moment Maps on Symplectic Manifolds
- Categorical models for quantum mechanics
- Random Perfect Graphs

Each candidate showed a good knowledge of his or her chosen area in the oral examination.

V Flynn  
A Jung  
A Wilkie  
B Coecke (Chairman)