ORAL QUALIFYING EXAM

March 9, 2010

Jorge Cantillo
(email: cantillo@math.rutgers.edu)

Committee (in alphabetical order) : R. T. Bumby, H. Iwaniec (chair), S. D. Miller, J. Tunnell

Analytic Number Theory
a) Analytic properties of Riemann Zeta function and Dirichlet L-functions.
b) Dirichlet's Theorem on primes in arithmetic progressions.
c) Prime Number Theorem.
d) Zero-free regions of Dirichlet L-functions and the exceptional zero problem.

Algebraic Number Theory
a) Ring of integers in a number field: integral basis, discriminant, and different.
b) Decomposition of primes.
c) Class group and finiteness of class number, Minkowski's constant.
d) Dirichlet's theorem on units

Modular Forms
a) Modular forms for the modular group and its congruence subgroups.
b) Eisenstein and Poincare series.
c) Structure of the ring of modular forms.
d) Hecke operators.

Elliptic Curves
a) Elliptic curves over $\mathbb{C}$.
b) Hasse's theorem, Hasse-Weil L-functions.
c) Mordell's theorem.
d) Torsion points, Lutz and Nagell's theorem.