

Qualifying Exam Syllabus – Sami H. Assaf

DATE: Monday, April 14, 2003

COMMITTEE: D. Eisenbud, M. Haiman, D. Sarason (chair), T. Speed (Statistics)

Major Topic: COMBINATORICS

Counting: ordinary generating functions, the Twelvefold Way, inclusion-exclusion; exponential generating functions, Lagrange inversion, the Matrix-Tree theorem. Posets and lattices: incidence algebra, Möbius function and Möbius inversion, Eulerian posets, Euler characteristic, simplicial complexes, h -vectors, Cohen-Macaulay complexes.

Symmetric functions: classical bases, Hall inner product, Schur functions, Robinson-Schensted-Knuth correspondence, raising operators, Pieri formulas, Jacobi-Trudi identity.

Reference: Stanley, *Enumerative Combinatorics* Vol. I & II

Major Topic: COMMUTATIVE ALGEBRA

Localization; Associated primes and primary decomposition; Integral dependence, Nakayama's lemma, going-up, going-down; Hilbert's Nullstellensatz; Filtrations; Artin-Rees lemma; Completions, Hensel's lemma; Noether normalization; Principle ideal theorem, systems of parameters; Valuation rings, discrete valuation rings; Hilbert-Samuel polynomials; Cohen-Macaulay rings.

Reference: Eisenbud, *Commutative Algebra with a View Toward Algebraic Geometry*

Minor Topic: COMPLEX ANALYSIS

Analytic functions, Cauchy-Riemann equations; Cauchy's integral formula, Morera's theorem, Liouville's theorem, Open mapping theorem; Fundamental theorem of algebra; Argument principle, Maximum modulus principle, Schwartz's lemma, Residue theorem, Rouché's theorem.

Reference: Ahlfors, *Complex Analysis*