Oral Qualifying Exam Syllabus
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Major Topic: Noncommutative Localization

(1) Noncommutative Ring Theory
   • Semisimple modules and rings
   • Wedderburn-Artin theory
   • Jacobson radical

(2) Basic Localization
   • Commutative localization
   • Localization of modules

(3) Examples and A Counterexample
   • Ore localization
   • Constructions of Jategaonkar and Fisher
   • Malcev’s example of a domain which is not embeddable in a division ring.

(4) Cohn’s Construction
   • Prime matrix ideals
   • Category of epic R-fields with specializations as maps
   • Correspondence between epic R-fields and prime matrix ideals
   • Sylvester domains
   • Construction of the free field over a Sylvester domain using prime matrix ideals

(5) Inversion Height
   • Amitsur’s construction of the free skew field over \( D\langle X \rangle \) for a division ring \( D \) which is infinite-dimensional over its center
   • Construction of the free skew field over \( D\langle X \rangle \) using rational series.
   • Minimal representations of rational series
   • Height structure of matrices and its relationship with inversion height of elements of \( D\langle X \rangle \)

Minor Topic: Representation Theory

• Maschke’s Theorem
• Structure of the group algebra \( kG \) when \( k \) is an algebraically closed field with \( |G| \) not divisible by the characteristic of \( k \)
• Characters
• Orthogonality relations
• Irreducible representations of \( S_n \) using Young diagrams