Oral Qualifying Exam Syllabus

Aurora Hiveley

Fall 2025

1 Major Topic: Experimental Mathematics

1.1 Maple

- Maple syntax
- Dynamic programming

1.2 Basics (The Tetrahedron) - Ch. 1

- Quicksort algorithm (1.1)
- Recurrence relations (1.2)
- Symbolic sums (1.3)
- Generating functions (1.4)
- Asymptotic estimates (1.5)

1.3 Formal Power Series - Ch. 2

- Basic definitions & operations (2.1)
- Derivation & integration (2.2)
- Sequences of FPS (2.3)
- Truncated FPS (2.6)

1.4 Polynomials - Ch. 3

- Polynomials as power series (3.1)
- Polynomial sequences (3.2)
- Closure properties

1.5 C-Finite - Ch. 4

- Recurrences with constant coefficients (4.2)
- Closure properties (4.3)

1.6 Famous Examples

- Fibonacci numbers (4.1)
- Binomial theorem (5.1)
- Catalan numbers (6.1)
- Harmonic numbers (7.1)

2 Minor Topic: Graph Theory

2.1 Matching

- Konig's Theorem
- Hall's Theorem
- Stable matching
- Augmenting paths

2.2 Planarity

- Euler's Formula
- Kuratowski's Theorem

2.3 Coloring

- Brooks's Theorem
- Vizing's Theorem
- Heawood's (5 Color) Theorem
- List coloring

2.4 Connectivity

- Menger's Theorem
- Max Flow Min Cut
- Ford-Fulkerson Algorithm
- Kruskal & Prim spanning tree algorithms
- Eulerian circuits & trails