

Oral Qualifying Exam Syllabus

Pablo Blanco

October 2025

1 Experimental Mathematics

1. Maple Skills

- Maple Syntax
- Dynamic Programming

2. Basics

- Selection sort and Quicksort algorithms
- Recurrence equations
- Generating Functions
- Asymptotic Estimates

3. Formal Power Series

- Differentiation and Division
- Sequences of Power Series
- The Transfer Principle

4. Polynomials

- Polynomials as power series
- Polynomials as sequences
- The Tetrahedron for polynomials: symbolic sums, asymptotic estimates, generating functions, recurrence relations

5. C-Finite Sequences

- Fibonacci Numbers
- Recurrences with Constant Coefficients
- Closure properties
- The Tetrahedron for C-Finite sequences: symbolic sums, asymptotic estimates, generating functions, recurrence relations
- System of C-Finite Recurrences

2 Graph Theory

1. Matchings

- Konig's Theorem
- Hall's Theorem
- Tutte's Theorem
- Stable matchings

2. Connectivity

- Menger's Theorem
- Max Flow - Min Cut Theorem
- Kruskal's Algorithm
- Prim's Algorithm
- Dijkstra's Algorithm
- Matrix-Tree Theorem
- Cayley's Formula

3. Coloring

- 5-color Theorem
- Brook's Theorem
- Vizing's Theorem
- Ramsey Theory

4. Extremal Graph Theory

- Turan's Theorem
- Szemerédi Regularity Lemma
- Triangle Removal Lemma