Summary of Mathematical and Programming Background

During five semesters of analysis studies, including three semesters of basic mathematical analysis, real analysis, and honors analysis at Edinburgh, I mastered advanced topics in measure theory and real analysis. These courses covered foundational set theory concepts such as set operations, mappings, cardinality, and limit points of sets. I delved into Lebesgue measure theory, exploring the relationships between measurable sets and Borel sets, the connections between measurable sets and rectangles, and the properties of non-measurable sets. In the study of measurable functions, I grasped their definitions and properties, convergence of sequences of measurable functions, and the relationship between measurable and continuous functions. Additionally, I studied Lebesgue integration, covering the integration of general measurable functions, the relationship between integrable functions and continuous functions, and the comparison between Lebesgue and Riemann integrals.

In advanced courses, I learned important concepts and properties of LpL^pLp spaces, Hilbert spaces, and Banach spaces. For LpL^pLp spaces, I mastered their definitions, properties, and structure, along with related norm formulas. In Hilbert spaces, I focused on inner product spaces, orthonormal bases, the projection theorem, the Fréchet-Riesz representation theorem, and applications of Hilbert adjoint operators and the Lax-Milgram theorem. In Banach spaces, I covered bounded linear operators, the Hahn-Banach theorem, the Baire category theorem, and the range and null space of operators.

In statistics, I studied the theory and application of maximum likelihood estimation (MLE), including the definition of MLE, asymptotic distributions, confidence intervals, and hypothesis testing for both single and multiple parameters. I also learned numerical methods such as the Newton-Raphson method and Fisher's scoring method in MLE. Bayesian inference covered the motivation for the Bayesian approach, its mathematical foundation, exact Bayesian inference with conjugate priors, and approximate Bayesian inference methods like Monte Carlo methods, Laplace approximation, and variational inference. In linear regression, I studied the construction, parameter estimation, and hypothesis testing of simple and general linear models, as well as their application in R. I also learned about generalized linear models (GLMs), including the exponential family of distributions, GLM fitting and diagnostics, and mixed-effects models.

In algebra, I studied fundamental topics such as matrix transformations, eigenvalues and eigenvectors, diagonal matrices, and the theory and application of Jordan canonical forms. I also explored groups, rings, modules, and fields, learning Lagrange's theorem, the fundamental theorem of group homomorphisms, and the correspondence theorem. I mastered the Chinese Remainder Theorem, the definitions and properties of maximal and prime ideals, prime elements, and irreducible elements. Additionally, I studied Euclidean domains, principal ideal domains, and unique factorization domains, the Gauss Lemma, and Eisenstein's criterion in polynomial rings. Through the classification theorem for finitely generated Abelian groups and the derivation of the Jordan canonical form, I deepened my understanding of group structures. In field theory, I mastered the definitions and properties of field extensions, including simple extensions, algebraic extensions, and algebraically closed fields, and explored their applications.

In numerical computation, differential equations, and algorithms, I studied both analytical and numerical methods for solving ordinary differential equations (ODEs) and partial differential equations (PDEs), including initial value problems and boundary value problems. I explored the Euler method, Taylor series methods, Runge-Kutta methods, and multistep methods, analyzing their convergence and stability. Additionally, I learned to use Laplace transforms to solve linear differential equations and applied the Sturm-Liouville theory. For linear systems, I mastered stability analysis and Lyapunov's method, as well as bifurcation theory and singularities. These courses not only provided theoretical knowledge but also enhanced my modeling and problem-solving skills through extensive computational examples and algorithm implementations.

In geometry, I mastered high-level knowledge, including the simplification and properties of quadratic curve equations, orthogonal transformations, affine transformations, and projective planes and their transformations. This included projective planes, homogeneous coordinates, the principle of duality, and their applications in geometry.

In terms of my programming background, I learned Python and C++, concluding each course with exams and individual projects. In the courses at Edinburgh, I completed R language projects in Statistical Computing and Applied Statistics.

During this summer, I worked on the Texera project under the supervision of Professor Chen Li at UC Irvine. This project is a data analysis platform based on machine learning, with Scala and Java as the underlying code, compatible with Python. I was responsible for the report output part and the development of the storyteller AI, adding new plugins.

Dalian University of Technology

At Dalian University of Technology, I majored in Information and Computing Science and completed several key courses in mathematics and programming.

Average Score: 89.2, Rank:10/195

First Year

- **Mathematics Courses**: Mathematical Analysis 1, Mathematical Analysis 2, Geometry 1, Geometry 2(94), Higher Algebra 1(93), Higher Algebra 2, Number Theory(98)
- **Programming Courses**: Python Programming Design, C++ Programming

Second Year

- **Mathematics Courses**: Mathematical Analysis 3 (91), Complex Function Theory (92), Ordinary Differential Equation (99), Probability and Mathematical Statistics,
- **Advanced Mathematics Courses**: Abstract Algebra (91), Real Variable Function Theory, Mathematical Modeling and Literature Search (96)

University of Edinburgh

While pursuing an honors degree in Mathematics and Statistics at the University of Edinburgh, I continued my studies and achieved excellent results in several key courses. At the University of Edinburgh, scores above 70 are considered an A grade.

Average score:77

Mathematics Courses

- Financial Mathematics (82)
- Numerical Ordinary Differential Equations and Applications (98)
- Honours Differential Equations (75)
- Honours Complex Variables (85)
- Honours Analysis (69)

Statistics Courses

- Statistical Computing (79)
- Statistical Methodology (75)
- Applied Statistics (69)