Frankfurt School Exchange Student Information

Overview of Winter Semester 2026

MSc Modules

Master in Financial Technology *

Please note that some combinations of courses might not be possible.
These incompatibilities will be indicated on the selection platform.

Quarter Schedules courses:

Quarter 1: Academic period: 27 August – 17 October 2026

Exam Week: 19 October – 24 October 2026

Quarter 2: Academic period: 26 October – 12 December 2026

Exam Week: 14 December – 19 December 2026

Course	Quarter
Financial Software Engineering**	1
Foundations of Finance**	1
Foundations of Financial Technology	1+2
Algorithms in Finance	2
Fintech - Innovations in Financial Technology	2

**This course is scheduled across Q1 and Q2*

*** Module descriptions tbc*

Foundations of Financial Technology
[FIN71054]

Module Coordinator		Bindseil, Ulrich			
Programme(s)		Master in Financial Technology			
Term		Semester 1 Q1			
Module Duration		1 Semester			
Compulsory/Elective Module		Compulsory Module			
Credits:		6			
Frequency		Annually			
Language		English			
Total Workload	150 h	Academic Teaching Hours:	44	Remaining Workload:	Self-study
		One academic teaching hour corresponds to 45 minutes.			
		Self-study includes lesson preparation and follow-up activities, reading assignments, assessment preparation, take-home assignments, etc.			
Prerequisites		Foundations of Finance			

Content	This master's-level course on the Foundations of Financial Technology offers an in-depth exploration of the technological, architectural, and infrastructural elements transforming the financial industry. The course begins with an overview of the architecture, infrastructure, and institutions of the financial system, encompassing both wholesale and retail services. It then examines how information technologies are reshaping these components. In addition, students will explore topics such as financial intermediation, financial instruments, and markets, as well as emerging business models of non-bank payment service providers. The course also covers new technologies that challenge the current architecture of finance, including fast payments, QR codes, APIs, and multi-asset programmable platforms. It investigates the broader trend toward continuity and immediacy in money and finance and considers how this trend may evolve in the future. Furthermore, the curriculum addresses the challenges and opportunities these innovations present for both the financial industry and public policy. A comprehensive examination of payment systems, payment instruments, and financial market infrastructure forms a central component of the course. Students will study traditional digital payment mechanisms, such as Real-Time Gross Settlement (RTGS) and net deferred settlement systems, as well as fast payment systems and front-end payment instruments like cards, UPI, and Pix. The course also provides a global perspective on monetary architecture and cross-border payments, including innovations such as the interlinking of fast payment systems, closed-loop solutions, and the use of global stablecoins. In this context, the ongoing work of the G20 to improve cross-border payments, along with its progress monitoring, will be critically examined. The course further introduces central bank digital currencies (CBDCs) and explores the implications of both issuing and not issuing CBDCs for monetary and payment architectures. Beyond payments, the course examines global wholesale infrastructures, including (international) central securities depositories ((I)CSDs), central counterparties (CCPs), the Continuous Linked Settlement (CLS) Bank, and SWIFT as a provider of network services and message standards. It also considers ongoing developments related to technology and sovereignty in these areas, including initiatives for new global wholesale platforms such as Agora and Global Layer One. Solutions aimed at achieving "atomic" settlement, and thereby reducing settlement risk, are analyzed, alongside broader risk management considerations. Finally, the course addresses regulatory issues and implications across all elements of financial architecture. Given the highly regulated nature of the industry (driven by factors such as network effects and market power, systemic importance, and the externalities associated with inadequate risk management) an understanding of regulatory frameworks is essential

	for assessing business models and their feasibility. By combining theoretical knowledge with practical insights, the course prepares students to effectively contribute to and navigate the rapidly evolving landscape of financial architecture and technology.
Intended Learning Outcomes	Knowledge: Upon successful completion of this module, students will have a detailed understanding of how the different components of the infrastructure of the financial system work together to facilitate an efficient and secure flow of funds and settlement. Skills: • Identify the key components of financial market infrastructure used by financial institutions in the creation of financial instruments. • Distinguish between real-time gross settlement (RTGS) systems and net deferred settlement systems. • Understand the potential of fast payment technologies and assess their current achievements. • Identify the main payment rails and explain their core features. • Evaluate the strengths and weaknesses of the euro area payment infrastructure. • Describe how centralized exchanges match buyers and sellers. • Explain how centralized exchanges use clearing houses and settlement systems to facilitate transactions and manage risks. • Understand the pervasive role of layering in monetary and financial architecture. • Critically assess common but potentially misleading narratives in payments and interpret the interests underlying them. • Understand the nature of cross-border payments and explain how alternative approaches ultimately solve the decomposition into two domestic transactions. • Explain the key risks in payments and settlement, how these risks have been mitigated, and which risks remain. • Explain the rationale for regulatory interventions in payments and market infrastructure, and identify unresolved regulatory challenges, particularly in the context of declining global cohesion. Competences: On successful completion of this module, students are able to design themselves monetary and financial architectures, instruments and solutions and implement projects and products in the realm of money, payments, and finance.
Forms of teaching, methods and support	Lectures, exercises, and case study discussions

<table>
<tr>
<td>Type of Assessment(s) and performance</td>
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<table>
<tr><th>Type of examination</th><th>Duration or length</th><th>Performance points</th><th>Due date or date of exam</th></tr>
<tr><td>Class participation</td><td></td><td>20</td><td>During class</td></tr>
<tr><td>Case studies or academic papers with group presentation</td><td>20 min</td><td>30</td><td>During the module</td></tr>
<tr><td>Written exam</td><td>70 min</td><td>70</td><td>Exam week</td></tr>
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<tr>
<td>Recommended Literature</td>
<td>
• Bindseil (2020), “Tiered CBDC and the Financial System”. ECB Working Paper No. 2351.
• Bindseil and Pantelopoulos (2023), “Towards the holy grail in cross-border payments,” ECB Working Paper No. 2693.
• Bindseil and Malekan (2025), “Public crypto networks as financial market infrastructures”, Journal of Payments Strategy & Systems,19 (4), 410-426. also available at SSRN.
• Bindseil and Malekan (2025), “Towards continuity and immediacy in money and finance?”, Journal of Financial Market Infrastructures, 12(3), also available at SSRN.
• Bindseil (2025), “Regulatory responses to the financial stability implications of stablecoins”, SAFE Working Paper No. 470.
• Bindseil and Senner (2025), “Monetary sovereignty – addressing the challenges of a digitalized and multipolar world”, available at SSRN.
• Bindseil (2026), “Innovations and the Layering of Money and Payments”, SAFE Working Paper No. 473
• Bindseil (2026), “Public discourse on retail payments and the case of CBDC”, SAFE Working Paper No. 47X.
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</table>

Module Structure	Information Technologies in a Changing Financial System 1. Information technologies in Finance 1. Financial intermediation 2. Instruments 3. Markets 2. New business models 1. APIs, 2. Microservices 3. SaaS 3. Challenges and opportunities 1. Industry 2. Public policy Financial Market Infrastructure 1. Payment systems 1. Traditional payment systems (RTGS vs net settlement systems) 2. Payment rails (debit- and credit cards, qr codes, etc.) 3. Rapid payment systems (TIPS, Pix, UPI, Payshap, etc.) 4. Cross-border payments 5. Target2 and T2S 6. Remittances 7. Open payments 2. Central Bank Digital Currencies and the Digital Euro 3. Exchanges 4. Settlement systems and clearing houses Financial Software Development 1. Introduction to financial software development practices 2. Software architectures (client-server vs microservices) 3. Agile development and scrum 4. Version control 5. DevOps
Usability in other Modules/Programmes	Subsequent modules in the Master□s program and Master□s thesis.
Last Approval Date	2026/04/02

Algorithms in Finance [FIN71055]

Module Coordinator		Georg, Co-Pierre			
Programme(s)		Master in Financial Technology			
Term		Semester 1 Q2			
Module Duration		1 Semester			
Compulsory/Elective Module		Compulsory Module			
Credits:		6			
Frequency		Annually			
Language		English			
Total Workload	150 h	Academic Teaching Hours:	44	Remaining Workload:	Self-study
		One academic teaching hour corresponds to 45 minutes.			
		Self-study includes lesson preparation and follow-up activities, reading assignments, assessment preparation, take-home assignments, etc.			
Prerequisites		Financial Software Engineering;The prerequisite for participation in the final examination is proof of knowledge by completing the graded homework.			

Content	Algorithms in Finance provides an implementation-oriented introduction to algorithms and complexity analysis for financial technology. Students learn how to specify algorithms, reason about correctness at an intuitive level, and analyze computational cost using asymptotic growth rates and simple resource models. Throughout the module, theoretical analysis is paired with empirical profiling and scaling tests to develop sound algorithm-engineering judgement. Using recurring examples, students implement and benchmark (i) constrained mean-variance portfolio optimization in the long-only setting, including continuous and cardinality-constrained variants; (ii) Monte Carlo pricing and risk estimation, focusing on a European call option under geometric Brownian motion and on Value-at-Risk (VaR) and Expected Shortfall (ES); and (iii) search and cryptography-relevant baselines, including brute-force search, time-memory tradeoffs (meet-in-the-middle), and sample implementations for factoring and discrete logarithms. The final part introduces the complexity of algorithms in a pragmatic way. Students learn how to interpret statements about polynomial time (P), nondeterministic polynomial time (NP), NP-completeness, and NP-hardness, and how reductions justify hardness claims for real problem families. Approximation methods, heuristics, and randomized algorithms are discussed as practical responses to computational hardness, including the role of bounded-error probabilistic polynomial time (BPP) and the distinction between worst-case and typical-case performance. The course closes with a disciplined benchmarking framework that students will apply when evaluating quantum approaches against strong classical baselines. Lastly, the course will transition from analyzing the complexity of algorithms to the study of the complexity of regulations, which formally rests on the same set of methods.

Intended Learning Outcomes	*Knowledge* Upon successful completion of this module, students will be able to: - Explain core concepts of algorithm design and analysis, including asymptotic runtime and space complexity, and relate these to empirical profiling results. - Describe standard algorithmic paradigms and identify when they are applicable. - Explain the computational structure of core finance workloads and articulate the main drivers of computational cost. - Explain how constrained optimization problems can be represented as discrete formulations using penalty methods. - Explain foundational notions of computational complexity. *Skills* Upon successful completion of this module, students will be able to: - Analyze and estimate the time and space complexity of algorithms at an implementer level. - Implement, test, and benchmark classical algorithms, including scaling experiments and reproducible performance reporting. - Implement classical baseline methods for constrained mean-variance portfolio optimization. - Implement Monte Carlo estimators for option pricing and risk metrics and apply variance reduction techniques; quantify accuracy versus compute budget. - Implement small search and number-theory baselines relevant for cryptography and compare performance empirically. - Formulate a small combinatorial portfolio selection problem as a QUBO model and solve it using brute force and simple heuristics; compare results to alternative baselines. *Competences* On successful completion of this module, students will be able to: - Select appropriate algorithmic approaches and baselines for a finance problem, balancing accuracy, runtime, and implementation complexity. - Evaluate algorithmic claims using a combination of complexity reasoning and empirical benchmarking, including sensitivity checks and fair comparison principles. - Communicate algorithmic tradeoffs and performance results clearly to finance and technology audiences, connecting problem formulation, method choice, and computational constraints. - Transfer classical benchmarking skills to the subsequent Quantum Finance module when assessing quantum approaches against state-of-the-art classical methods.
Forms of teaching, methods and support	Lectures, exercises, and short in-class programming labs; optional tutorials for extended coding exercises.

<table>
<tr><td>Type of Assessment(s) and performance</td><td>
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<tr><td>Type of examination</td><td>Duration or length</td><td>Performance Points</td><td>Due date or date of exam</td></tr>
<tr><td>Exercises</td><td></td><td>40 points</td><td>Throughout the course</td></tr>
<tr><td>Written Exam</td><td>80 minutes</td><td>80 points</td><td>Exam week</td></tr>
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Throughout the module, several exercises are completed as homework. These are corrected and students are required to achieve at least 50% in the homework exercises to qualify for the final exam. The final exam is a written exam of 80 minutes duration + 10 minutes reading time.
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<tr><td>Recommended Literature</td><td>- Jon Kleinberg and Eva Tardos, Algorithm Design.
- Steven S. Skiena, The Algorithm Design Manual.
- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms.
- Michael Sipser, Introduction to the Theory of Computation (selected chapters for complexity notions).
- Rajeev Motwani and Prabhakar Raghavan, Randomized Algorithms (selected chapters).
- Stephen Boyd and Lieven Vandenberghe, Convex Optimization (selected chapters).
- Paul Glasserman, Monte Carlo Methods in Financial Engineering.</td></tr>
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Module Structure	Class 1: Algorithms and performance: specification, correctness intuition, asymptotic runtime/space analysis, and empirical profiling. Class 2: Core building blocks and design patterns I: sorting and searching, hashing, recursion and divide-and-conquer, and amortized-analysis intuition. Class 3: Design patterns II: dynamic programming and greedy methods; randomized algorithms and estimation basics. Class 4: Benchmark algorithms I (search and cryptography baselines): brute-force search, time-memory tradeoffs (meet-in-the-middle), and toy factoring/discrete logarithm exercises. Class 5: Benchmark algorithms II (portfolio optimization): long-only mean-variance optimization (continuous) and cardinality constraints (discrete). Class 6: Benchmark algorithms III (simulation for pricing and risk): Monte Carlo pricing of a European call under geometric Brownian motion; Value-at-Risk (VaR) and Expected Shortfall (ES); variance reduction and quasi-random ideas. Class 7: Complexity foundations: polynomial time (P) and nondeterministic polynomial time (NP), reductions, NP-completeness and NP-hardness; finance-motivated examples using portfolio selection and knapsack-style problems. Class 8: Approximation and heuristics for hard problems: local search, simulated annealing, and practical evaluation of heuristic quality. Class 9: Randomization and complexity in practice: worst-case versus typical-case performance, bounded-error probabilistic polynomial time (BPP) intuition, and sample complexity for Monte Carlo estimation. Class 10: Benchmarking discipline and synthesis: baseline selection, fairness, scaling tests, sensitivity analysis, and reproducibility. Class 11: From algorithmic to regulatory complexity: Applications of complexity measures across disciplines.
Usability in other Modules/Programmes	Subsequent modules in the Master□s program, including Quantum Finance, and the Master□s thesis.
Last Approval Date	2026/04/17

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FinTech - Innovations in Financial Technology [FIN71056]

Module Coordinator		Schoenleber, Lorenzo			
Programme(s)		Master in Financial Technology			
Term		Semester 1 Q2			
Module Duration		1 Semester			
Compulsory/Elective Module		Compulsory Module			
Credits:		6			
Frequency		Annually			
Language		English			
Total Workload	150 h	Academic Teaching Hours:	44	Remaining Workload:	Self-study
		One academic teaching hour corresponds to 45 minutes.			
		Self-study includes lesson preparation and follow-up activities, reading assignments, assessment preparation, take-home assignments, etc.			
Prerequisites		Basic understanding of business administration and financial management.			
Content		This module offers an engaging introduction to the dynamic field of fintech, where technological innovation is transforming the design and delivery of financial services. New business models, applications, processes, and products are reshaping financial markets and institutions, while redefining how financial services are created, distributed, and consumed. Aimed at students seeking to understand the frontier of financial innovation, the module equips participants with a comprehensive perspective on the integration of technology and finance. It explores key technological developments that are currently redefining the sector and examines their capacity to enhance efficiency, reduce informational frictions, and generate network-driven value. Students will develop an understanding of the complex interplay between finance and technology, and will be encouraged to reflect critically on the opportunities and challenges arising from these transformations. The module concludes by examining decentralized finance (DeFi) as an increasingly important area within fintech, with particular emphasis on its potential to introduce new forms of financial intermediation, coordination, and market organization.			

Intended Learning Outcomes	This course prepares you to excel in the swiftly evolving landscape of financial technology. By engaging with this curriculum, you will achieve a deep and practical understanding of several critical dimensions: 1. Innovation and Application: You will be able to integrate cutting-edge fintech technologies and analytics into groundbreaking business models. You will drive market trends through strategic innovation. 2. Foundational Knowledge: Clearly articulate and critically evaluate the fundamental pillars of fintech based on rigorous scholarly research. 3. Sector-Specific Technologies: Navigate the application of fintech across diverse sectors, including banking, wealth management, securities trading, money and payment systems, and distributed ledgers. 4. Ecosystem Understanding: Analyse and detail the intricate interplay and synergies among the various stakeholders and technologies that define the vibrant fintech ecosystem, including the protocols, users, governance structures, and infrastructures that underpin decentralized finance (DeFi). 5. Critically Assess Risks: Upon completing this module, you will be thoroughly equipped with both the theoretical frameworks and the practical skills necessary to critically assess risks in financial technology and, in particular, in DeFi and the broader crypto industry. By mastering this module, you will be equipped not only with theoretical knowledge but also practical skills to build a path in the transformative field of fintech, ready to face its challenges and capitalize on its opportunities.

Forms of teaching, methods and support	This module is designed as an interactive learning experience that demands active engagement and a commitment to excellence from each participant. Attendance is compulsory to foster a cohesive learning environment. **Interactive Lectures:** Be prepared to engage in lectures that require not only attention but active participation. Your insights and inquiries will drive deeper exploration of key topics in fintech and decentralized finance. **Collaborative Assignments:** Engage in team-based projects that culminate in presentations, allowing you to harness collective intelligence and refine your communication skills while applying course concepts to contemporary developments in DeFi. **Peer Review:** Develop critical analytical skills by engaging in structured peer reviews of your classmates' work, providing and receiving constructive feedback. **Dynamic Participation:** Expect to demonstrate your engagement through a variety of in-class activities. These will include posing questions, participating in discussions, sharing relevant personal experiences, and responding to both spontaneous and structured quizzes. This module structure is designed to ensure that you not only absorb information but also apply it, preparing you to navigate and influence the fast-evolving domains of fintech and decentralized finance.

<table>
<tr><td>Type of Assessment(s) and performance</td><td>This module rigorously assesses your engagement and mastery of the subject through a structured and comprehensive evaluation system.

<table><tr><td>Type of examination</td><td>Duration or length</td><td>Performance points</td><td></td></tr><tr><td>Class Participation</td><td>Ongoing throughout the module</td><td>30</td><td></td></tr><tr><td>Written examination</td><td>90 minutes</td><td>90</td><td></td></tr></table>
Assessment Components and Criteria
1. Class Participation: Daily participation is crucial and will be evaluated continuously.
2. Written examination: The course culminates in a closed-book final exam that evaluates your comprehensive understanding and ability to apply fintech knowledge. This exam requires you to demonstrate mastery of critical concepts and the effective integration of information from diverse sources.

Competencies Evaluated
Class Participation: Reflection and introspection, effective communication, and complex reasoning.
Written examination: Knowledge application, strategic analysis, and synthesis of information within the FinTech domain.These assessments are designed to challenge you and refine your professional capabilities, ensuring you are well-prepared to contribute innovatively in the fintech industry.</td></tr>
<tr><td>Recommended Literature</td><td>Compulsory literature will be communicated prior to the course to include recent developments in the literature.</td></tr>
<tr><td>Module Structure</td><td>• The fundamental frictions of finance.
• The rise of fintech and the broader digital transformation of financial services.
• Methods and foundations of distributed ledger technologies, including cryptography, data structures, and consensus protocols.
• The core architecture of decentralized finance (DeFi) includes smart contracts and blockchain-based protocols.
• Stablecoins and digital currencies as emerging digital financial infrastructure.
• Tokenization and its implications for financial markets and business models.
• Major DeFi applications include decentralized trading, lending, and asset management.
• Risks, governance, and incentive mechanisms in DeFi ecosystems.</td></tr>
<tr><td>Usability in other Modules/Programmes</td><td>Elective "Blockchain and Digital Assets" and Thesis.</td></tr>
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Last Approval Date	2026/03/31