Jam Kabeer Ali Khan

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Research Interests

I am interested in the theory and implementation of programming languages, type systems, and formal methods, and their applications to specific domains, such as Security.

Education

Sept 2021 – June 2025 **University of Hong Kong** Hong Kong SAR
Bachelor of Engineering in Computer Science, Minor in Mathematics

Jan 2024 – May 2024 **Northeastern University** Boston, USA
Semester Exchange
Coursework: Programming Languages, Number Theory, Networks & Distributed Systems, Algorithms.

Sept 2018 – July 2020 **Nixor College** Karachi, Pakistan
GCE A-levels: 4 A*s & 2 As
Further Mathematics, Mathematics, Physics, Chemistry and Computer Science

Publications & Manuscripts

In-review **Traq: Estimating the Quantum Cost of Classical Programs**
Anurudh Pedhuri, **Jam Kabeer Ali Khan**, Gilles Barthe, Michael Walter.

Preprint **A Duality Theorem for Classical-Quantum States with Applications to Complete Relational Program Logics**
Gilles Barthe, Minbo Gao, **Jam Kabeer Ali Khan**, Matthijs Muis, Ivan Renison, Keiya Sakabe, Michael Walter, Yingte Xu, and Li Zhou.

PLDI'25 SRC **Capabilities as First-Class Modules with Separate Compilation**
Jam Kabeer Ali Khan
Gold Award (Undergraduate Category)

Presentations & Talks

PLanQC'26 **Traq: Estimating the Quantum Cost of Classical Programs**
[Slides] [Extended Abstract] [Talk]

PLDI'25 SRC **Capabilities as First-Class Modules with Separate Compilation**
[Talk] [Poster]

HKU CS Seminar **Maximal Violation of a Measurement Protocol with Simplex Bell Inequality**
[Presentation Slides]

Research Experience

April 2025 – Sept 2025 **Max Planck Institute for Security & Privacy** Germany
Research Intern; Supervised by **Gilles Barthe**;
collaborated with **Michael Walter**

- Extended the `Traq` **Haskell** package to support amplitude amplification and Simon's algorithm.

- Investigated compiler correctness in probabilistic/unitary settings and input-dependent quantum cost analysis.
- Formalized quantum lemmas (Dirac notation, Orthonormal Bases) in **Lean4**.
- Designed an extraction mechanism from a Relational Hoare Logic for Classical-Quantum prover using **OCaml** to well-typed **Lean4** specifications.

Aug 2024 – April 2025 **HKU Programming Languages Group** Hong Kong
Undergraduate Researcher; Supervised by **Bruno C. d. S. Oliveira**

- Researched statically-typed first-class environments, capabilities, and separate compilation correctness.
- Designed a language supporting capabilities as first-class modules and dynamic linking; formalized semantics via type-directed elaboration to a core calculus.
- Implemented the language in **Haskell**, mechanized proofs in **Rocq**, and utilized property-based testing.

June 2024 – Aug 2024 **HKU Quantum Information and Computation Lab** Hong Kong
Research Intern; Supervised by **Ravishankar Ramanathan**

- Utilized semi-definite programming (NPA Hierarchy) to find guessing probabilities for simplex Bell inequality.
- Performed sum-of-squares decomposition to demonstrate self-testing properties for protocol.

April 2022 – Oct 2022 **HKU Sleep Lab** Hong Kong
Student Research Assistant
- Deployment of CBT-therapy features to case-study participants via IOS and Android development.

Industry Experience

Oct 2025 – Present **Standard Chartered** Hong Kong
Haskell Quantitative Developer

- Learning industrial-scale Haskell.
- Implementing version control system and installation mechanism for the financial libraries, using Haskell/Mu.
- Contributing to an internal gRPC protoc compiler for protobuf specification; adding tooling support for protoc compiler.

June 2023 – Aug 2023 **ActusRayPartners Limited Hedge Fund** Hong Kong
Technology Intern
- Development of an internal utility library to automate database operations for traders.

March 2023 – Nov 2023 **All Round Education Academy** Hong Kong
Software Developer (Freelance)
- Designed and built an interactive education web application for IB examination preparation.

Teaching Experience

Fall '23, Fall '24 **Teaching Assistant**, University of Hong Kong
COMP2396 Object-Oriented Programming in Java

Spring '23 **Teaching Assistant**, University of Hong Kong
ENGG1340 Computer Programming (C++)

2022 – 2023	**Tutor (Math & CS)**, All Round Education Academy Regular tutorials IB and GCE A-levels curriculum for CS and Math.

Honors & Awards

2025	PLDI'25 SRC Gold Award
2022 – 2024	HKU Undergraduate Entrance Scholarship for Outstanding Academic Talents
2021 – 2024	HKSAR Government Scholarship Fund
2024	Rosita King Ho Scholarship
2023	Cathay Hackathon: 2^{nd} runner-up (Won flight to Boston, USA)
2021	HKU Foundation Entrance Scholarship
2020	Top in Sindh and Balochistan (GCE A-levels CS & Physics)
2018-20	100% merit scholarship to attend GCE A-levels at Nixor College.

Skills

Languages	**Haskell**, **OCaml**, Lean4, Gallina, Racket,C++, Java, Python
Formal Methods	Rocq, Lean4
Tools	Git & LaTeX