

NGU DANG

Email: ndang [at] bu [dot] edu
Website: nathandang97.github.io
[LinkedIn](#) | [Github](#)
Boston, MA, 02215

RESEARCH SUMMARY

I'm a sixth-year CS PhD candidate who enjoys **computational complexity** with a focus on **circuit complexity** and its connection to **meta-complexity**. In particular, I study how popular and fundamental techniques (such as Gate Elimination) can be used to characterize optimal Boolean circuits—fan-in/fan-out, wiring patterns, and compositional “shapes.” Beyond these structural questions, I explore how meta-complexity questions (e.g., the algorithmic detectability of small circuits) can leverage structural characterizations of explicit functions. My long-term goal is to build a toolkit that connects circuit shape, provable lower bounds, and meta-complexity hardness.

EDUCATION

Department of Computer Science, Boston University Boston, MA
Ph.D. in Computer Science 2020 - 2026 (expected)

- Advisor: Prof. Steven Homer.
- Research area: Algorithms Design, Circuit Complexity, and The Minimum Circuit Size Problem (MCSP).
- GPA: 3.93/4.00 – Passed the PhD Candidate Qualifying Exam.
- Thesis Committee: Steven Homer, Marco Carmosino, Mark Bun, and Frederic Green.

Department of Computer Science, Clark University Worcester, MA
B.A. in Computer Science, Minors: Data Science and Mathematics. 2018 - 2020

- Advisor: Prof. Frederick Green.
- GPA: 3.93/4.00 — Graduated with Summa Cum Laude and High Honors.
- First Honors Dean’s List in 2018, 2019, and 2020.

LIST OF REFERENCES

1. Steven Homer, Ph.D., Professor in Computer Science at Boston University. Email: homer@bu.edu
2. Frederic Green, Ph.D., Senior Research Scientist in Computer Science at Clark University. Email: fgreen@clarku.edu
3. Marco Carmosino, Ph.D., Research Scientist at IBM and Adjunct Assistant Professor in Computer Science at Boston University. Email: marco@ntime.org

PUBLICATIONS & MANUSCRIPTS

1. Marco Carmosino, Ngu Dang, Tim Jackman. 2024. **Simple Circuit Extensions for XOR in PTIME**. To appear in STACS 2026. A preprint of this work can be found [here](#).
2. Marco Carmosino, Ngu Dang, Tim Jackman. 2023. **Formalizing Gate Elimination via Term Graphs Rewriting**. To be submitted to FSCD 2026. A preprint of this work can be found [here](#).
3. Ngu Dang. 2025. **A Survey on The Multiplexer (MUX)**. A preprint of this work can be found [here](#).

WORK IN PROGRESS

1. Ngu Dang, Tim Jackman. 2025. **Characterizing Minimal Equality Testing Circuits**.
2. Marco Carmosino, Ngu Dang, Tim Jackman. 2025. **On Tightening Multiplexer Lower Bound**.

PROFESSIONAL EXPERIENCE

Graduate Research and Teaching Fellow | Boston University 2020 - present
Undergraduate Research Assistant | Clark University 2019 - 2020

TEACHING EXPERIENCE

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| Graduate Teaching Assistant Boston University | 2021 - present |
| • CS131: Combinatorics Structures — Summer 2022, 2023. | |
| • CS132: Geometric Algorithms — Summer 2022. | |
| • CS235: Algebraic Algorithms — Spring 2021, Fall 2025 | |
| • CS237: Probability in Computing — Summer 2024. | |
| • CS332: Theory of Computation — Spring 2023, Fall 2023, 2024. | |
| • CS630: Advanced Algorithms — Fall 2021. | |
| Grader Boston University | 2023 - 2024 |
| • CS535: Complexity Theory — Fall 2023. | |
| Undergraduate Teaching Assistant Clark University | 2018 - 2019 |
| • CS120: Introduction to Computer Science — Fall 2018. | |
| • CS121: Data Structures — Spring 2019. | |
| • CS180: Automata Theory — Fall 2019. | |

OTHER SKILLS

Programming: Python, Java, C++, MySQL.

Libraries: Pandas, Numpy, Scipy, Tensorflow, PyTorch, Natural Language Toolkit (NLTK), Keras, Scikit-Learn, Seaborn, Z3.

Tools: Git, Jupyter, Google Colab, Visual Studio, Microsoft Office Suite.

Scripting: LaTeX, HTML, CSS.

OS: Windows, Linux.

CERTIFICATES

- **IBM Data Science by IBM on Coursera.** Certificate earned on 08.31.2023.
- **Neural Networks and Deep Learning by DeepLearning.AI on Coursera.** Certificate earned on 12.31.2024.

AWARDS AND HONORS

- **Outstanding Academic Achievements**, awarded by the Department of Computer Science at Clark University.
- **Inducted to Phi Beta Kappa**, Lambda of Massachusetts at Clark University on 05.24.2020.

ACADEMIC SERVICES

- **Reviewer for:** *Journal of Computer and System Science (JCSS)*.
- **Organizer for:** *Boston University Computer Science's Theory Seminar (Spring 2021)*.
- **Vice President for:** *Clark University Computer Science's Competitive Programming Club*.
Massachusetts at Clark University on 05.24.2020.