KEITA ALLEN (HE/HIM)

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MATHEMATICAL INTERESTS

Algebra, topology, geometry, and their intersections.

EDUCATION

Massachusetts Institute of Technology   Cambridge, MA
Candidate for B.S. in mathematics, GPA: 4.9/5.0   *2019 − 2023*

· (*Summer 2019*) Participant in Interphase EDGE summer scholar enrichment program

The University of Chicago   Chicago, IL
Participant in Leadership Alliance SR-EIP & Mathematics REU   *Summer 2022*

Southland College Prep Charter High School   Richton Park, IL
High school, GPA: 4.50/4.00   *2015 − 2019*

Chicago Futabakai Japanese School Saturday School   Arlington Heights, IL
Supplementary school   *2006 − 2019*

· Engaged in Japanese study according to Japanese curricula from grades K through 12.

PROJECTS

Computing the homology of the motivic lambda algebra.   The University of Chicago REU
Mentors: Mark Behrens, Peter May   *Summer 2022*

· Investigating generalizations of the Curtis algorithm (for computing the E_2 page of the Adams spectral sequence) to computing the E_2 page of the motivic Adams spectral sequences, over the base fields $\mathbb{C}$ and $\mathbb{R}$.

· Writing computer program to facilitate generation of Curtis tables, which allow us to reconstruct the motivic Adams E_2 pages. Some code is available at `https://github.com/ktallen/PyLambdaCalc`.

· Preliminary draft available at `http://math.uchicago.edu/~may/REU2022/REUPapers/Allen.pdf`; paper presents a Curtis algorithm for computing the $\mathbb{C}$-motivic Adams E_2 page.

Complexity of computing the homotopy groups of spheres.   MIT Math Dept.
Mentors: Robert Burklund, Haynes Miller   *Summer 2021*

· Studied complexity of algorithm outlined by E.H. Brown in *Finite Computability of Postnikov Complexes*, which allows for the computation of the homotopy groups of any space obtained as the realization of a finite simplicial set.

· Gave explicit bounds on the runtime of this computation in the case of finite homotopy groups, and as particular examples of spaces with infinite homotopy groups, gave explicit bound on the computation of homotopy groups of odd-dimensional spheres.

· Preliminary draft available at `https://math.mit.edu/research/undergraduate/urop-plus/documents/2021/Allen.pdf`; polished preprint available soon.

TEACHING

18.02 (multivariable calculus)   MIT Math Dept.
Undergraduate TA   *Spring 2022*

- Taught twice-weekly recitation section, created problems for recitation, held office hours and review sessions, and graded. Please find some of the material I created here.
- Student evaluations: *Stimulated interest*: 6.8/7.0, *Displayed thorough knowledge of subject material*: 6.9/7.0, *Helped me learn*: 7.0/7.0.

18.02A (accelerated multivariable calculus) MIT Math Dept.
Undergraduate TA *January 2022*

- Taught two twice-weekly recitation sections, held office hours and graded.
- Student evaluations: *Stimulated interest: 6.7/7.0, Displayed thorough knowledge of subject material: 7.0/7.0, Helped me learn: 7.0/7.0.*

MIT Talented Scholars Resource Room MIT Office of Minority Education
Tutoring Facilitator *Spring 2021 – Present*

- Tutoring MIT students in math subjects through one-on-one appointments, facilitated group study sessions, walk-in office hours, and exam reviews. Courses tutored include:

18.01/A	*single variable calculus*	18.02/A	*multivariable calculus*	18.03	*differential equations*
18.04	*complex variables*	18.06	*linear algebra*	18.600	*probability*
18.701	*abstract algebra I*				

- Overall rating: 5.0/5.0.

Interphase EDGE MIT Office of Minority Education
Residential Calculus Facilitator *Summer 2020, 2021*

- TA for course in multivariable calculus, during residential program for rising MIT first-year students from underprivileged backgrounds.
- Responsible for crafting problem sets and recitation sheets, recitations twice weekly, holding office hours, and holding exam review sessions. Please find some of the material I helped create here.
- Hosted events as peer mentor/consultant for program participants in order to facilitate successful transition into MIT.

TALKS

The lambda algebra in classical and motivic homotopy theory. August 2022
The University of Chicago REU *Chicago, IL*

Computing the homology of the $\mathbb{C}$-motivic lambda algebra. July 2022
Leadership Alliance National Symposium *Virtual*

Spectra and cohomology theories. June 2022
Chroma 2022 summer homotopy theory seminar *Virtual*

GUIDED READINGS

Higher algebra and topological cyclic homology. MIT Math Dept.
Mentor: Arpon Raksit *Fall 2022*

- Learning basics of ∞-category theory, with a view towards understanding topological Hochschild homology and topological cyclic homology. Following online lecture videos by Thomas Nikolaus and Achim Krause on the Homotopy Theory Münster channel.

Towards the Milnor-Quillen theorem on MU. MIT Math Dept.
Mentors: Arpon Raksit, Jeremy Hahn *Spring 2022*

· Learned fundamentals of stable/chromatic homotopy theory. Texts referenced include Lurie's notes for Harvard Math 252x, and Rudyak's *On Thom Spectra, Orientability and Cobordism*.

Basic homological algebra.   MIT Math Directed Reading Program (DRP)
Mentor: Robert Burklund   *January 2021*

· Learned basic homological algebra. Text referenced is Osborne's *Basic Homological Algebra*.

OTHER ACTIVITIES

Associate Advisor – MIT Office of Minority Education   Fall 2021 – Spring 2023

· Leading activities for advising group of first-year students and acting as peer mentor.

Chroma 2022   Summer 2022
Harvard/MIT summer seminar in stable/chromatic homotopy theory.   *Co-organizer*

· Helped organize an undergraduate-focused seminar in stable/chromatic homotopy theory. Covered foundational topics in stable homotopy theory, building towards the chromatic point of view.

Grader – MIT Math   Spring 2020

· Graded problem sets for 18.03 (differential equations).

HONORS

MIT Math Dept. Teaching and Learning Award   May 2022
Presented by MIT Math Dept. for excellence in undergraduate teaching.

Questbridge National College Match Finalist   October 2018

SKILLS

Language   English (Native), Japanese (Native)
Programming & Markup   Comfortable with Python, TeX