Diversity and Inclusion Action Plan  
Department of Mathematics

The Mathematics Department at Brown values its welcoming atmosphere as a distinguishing point of strength relative to our peer departments. Our recent external review corroborated the sense that we cultivate an ‘active and friendly atmosphere that is welcoming and supportive to students, to young mathematicians, and to women.’ Yet despite our concerted efforts, mathematics as a discipline has a problem: the recruitment and retention of women and members of Historically Underrepresented Groups. This is an issue bigger than any one university; it begins very early for students in mathematics programs across the country.

We applaud the Senior Administration’s interest in confronting the issue of diversity and inclusion with a comprehensive University-wide effort. We welcome the opportunity to plan within the parameters outlined in the *Pathways to Diversity and Inclusion: an Action Plan for Brown University*, and to have the benefit of University’s support to realize these goals.

Through our meetings, consultations with students, staff, lecturers and with junior faculty, we have arrived at an array of new initiatives and proposed practices, many of which represent significant innovations as compared with previous practice. Some examples include:

1. The institution of a Departmental Diversity and Inclusion Committee, chaired by a faculty Ombudsperson,
2. A pilot Proposal to modify our normal policy of hiring only at the tenure level for the next five years,
3. A new peer-to-peer graduate-to-undergraduate mentoring program for women in math
4. A summer “liftoff” program for incoming graduate students who are women,
5. A new Undergraduate TA Program for introductory concentration (1000-level) courses, specifically identified by Undergraduates as an important means to retain at-risk students in the concentration, and
6. A new first-year course proposal intended as an on-ramp to the concentration that does not require extensive Advanced Placement Calculus work as a prerequisite, but rather emphasizes mathematical thinking and rigorous proof in a number of mathematical areas.

These examples represent a sample of the plans we have carved out in this process. They illustrate well the naturality of the process of giving due consideration to Diversity and Inclusion in our normal Departmental planning processes, and we are fortunate to have had the impetus to consider these proposals seriously. They are also works in progress, and very much at the
pilot stage; we will welcome input and assistance from the Office of Institutional Diversity and Inclusion on these and other proposals. We look forward to addressing these challenges as a Department, as a STEM community and as a University Community.

This document is roughly organized along the lines of addressing issues at the different levels in our Departmental community, beginning with our Senior Faculty, and working our way down to issues that confront our youngest students, and even outreach to the local K-12 community. We have paid particular attention to the issue of gender equity, even while we are strongly committed to attracting and retaining members of historically underrepresented groups into our ranks as well.

Recruitment and Retention of Faculty

The matter of diversity and inclusion at the faculty level has historically been a challenge for mathematics departments nationally, especially those with highly ranked Ph.D. programs. Indeed, with one tenured female faculty member out of a roster of nineteen and one female tenure-track faculty member, Brown’s Mathematics Department is actually in a comparable position to many of our peer departments.

We will discuss below strategies to address increasing the ranks of women in our faculty. Our recent external review supported our instinct to consider hiring at the tenure-track level as a potential means to address this problem, and we were fortunate to attract Melody Chan last year. We propose to continue this approach, and also to consider making better use of one of our precious resources, our Tamarkin Assistant Professor program, into which we have recruited many women and some professors from Historically Underrepresented Groups.

The Tamarkin Assistant Professor (TAP) position is a three year non-renewable appointment of early-career mathematicians (usually fresh Ph.D.s). As we discussed in our recent external review, all of the top Mathematics Departments in the US have such named term-faculty positions; they are similar to the Prager Assistant Professors in the Division of Applied Math (DAM).

We view this term-faculty program as a particularly strong recruiting tool for future senior faculty hiring, though it has not been our practice to hire directly from our existing Tamarkin Assistant Professor pool for reasons we will elaborate below. We feel we may well be under-utilizing this excellent program for our faculty recruitment. Indeed, many Tamarkin Assistant Professors have gone on to have excellent professional careers at other institutions, and many of these excellent professors are women; though some have been members of
Historically Underrepresented Groups, we struggle to recruit members of Historically Underrepresented Groups even at this junior level.

Our practice, like many of our peer and competitor institutions of smaller size, has been to hire at the level of Associate or Full Professor. Our recent External Review largely endorsed this hiring practice to the extent that the goal is maintaining a consistently excellent standard for scholarship. But the Review Committee reflected on this policy’s role in broadening diversity and inclusion as follows:

“We believe that not having a tenure track can in certain cases be disadvantageous to women. A primary reason for this is by the time they have research results identifying them with the star status necessary to be hired from the outside with tenure, they may have made roots in their personal lives that make it difficult for them to move. If the Department identifies an extremely promising younger woman either among its own Tamarkin Assistant Professor or from outside, who is not yet ready for tenure, we would suggest that they consider the possibility of hiring her on tenure track.”

Although our recent history includes one successful instance of hiring a woman at the senior level, she subsequently left for Yale after many happy years at Brown. With this said, we concur with the Committee’s assessment, and indeed we acted upon it last year, with the hire of a woman into a tenure-track Assistant Professorship. But we became aware of this candidate’s interest through an application that was not aimed at the tenure level, despite our advertisement indicating the position would be senior - how many others might have applied had we advertised indicating the tenure-track level?

We also concur with the Committee’s suggestion that looking inward to our Tamarkin ranks is an excellent idea, and we should be open to the idea of breaking tradition and promoting an outstanding candidate from this pool into a tenure-track position.

The committee also notes, however, that:

“The Brown Department of Mathematics is in excellent shape. It brings distinction to the University as one of the best mathematics departments in the country (and, according to the ratings, one of the best departments at Brown). When combined with the Division of Applied Mathematics and the ICERM, it is increasingly recognized as one of the world centers of the mathematical sciences. In creating an active and friendly atmosphere that is welcoming and supportive to students, to young mathematicians, and to women, the Brown Department of Mathematics is simply without peer, so far as we know.”
We note this because we feel strongly that Brown is in an excellent position to attract the best female faculty.

As such we propose the following, noting that this significant departure from our current practice will require further review and ratification by the faculty in the fall.

**Proposal.** *Over the next five years, broaden the advertising of positions to include exceptional tenure-track applicants. Work with the Dean of the Faculty to make further use of the Target of Opportunity program if excellent candidates emerge without a roster vacancy.*

The Diversity representative of the hiring committee will be responsible for generating a report to the Chair concerning the review of applicants who are women and members of HUGs.

**Joint Hiring.** The recent *Data Science Initiative* at Brown has emerged as a new opportunity for growth in the Faculty among the core departments (Applied Math, Biostatistics, Computer Science and Mathematics) and other units connected to its core mission. Despite its deep roots in statistics, mathematics and computing, Data Science has emerged as a science unto itself, with a new scientific culture and cultural norms. All indications are that the field of Data Science will have a more inclusive and more broadly open culture to women and members of Historically Underrepresented Groups. Indeed our first two postdoctoral hires in the Data Science Initiative have been women, and we have already identified a very strong female candidate as a potential joint hire between Math and DAM that would serve as a strong signature for Brown’s Data Science Initiative.

We have also been engaged in discussions with the Physics Department to pursue the possibility of bringing a high-profile theoretical physicist to Brown who is African-American, and who seeks a joint appointment in mathematics and physics. Under discussion was a cluster hire involving bringing two Tamarkin Assistant Professors to the Department as support for his work. Naturally, such efforts are opportunistic, but we will continue to work with the administration to identify and pursue such opportunities.

**Proposal.** *Over the next five years continue to identify and recruit outstanding mathematics candidates who are women and members of Historically Underrepresented Groups into joint or collaborative positions with other Departments and Initiatives.*

**Visiting Professor Programs.** We note that the Provost’s Visiting Professors program, the University-wide initiative to bring clusters of exceptional faculty from historically underrepresented groups (HUGs) to Brown for periods ranging from 6 to 24 months, would also
be an excellent way to introduce members of HUGs to the Mathematics Department and its inclusive culture, with the ultimate hope of recruiting them to Brown.

The Mathematics Department’s own Distinguished Visitor program represents another lever for recruiting women and members of HUGs to the Department. No recent Distinguished visitor has been a woman though we have had recent Latin American scholar in this role. We are pleased to note that our Distinguished Visitor Position next year will be shared and that one of the two visitors will be a woman.

**Proposal.** *Work aggressively to identify attractive candidates who are women and members of HUGs to bring to Brown in the Distinguished Visitor position or the Provost’s Visiting Professors Program.*

**Tamarkin Hiring.** These efforts are equally important at the level of the Tamarkin Assistant Professor ranks. The climate of the Department benefits enormously from its active and energetic Tamarkins, and to set a positive tone of diversity and inclusion at this level provides models and narratives for our graduate and undergraduate students.

Our Tamarkin hiring competes with the best departments in the country for new PhDs - though our practice used to prioritize a campus visit for those on our short-list, we have abandoned this practice due to too many instances of losing out on attractive applicants because we were not able to act quickly. Nevertheless, we feel our Department culture is one of our true selling points, so we propose to offer targeted invitations to campus for interested applicants to whom we have made offers.

Furthermore, the diversity officer for the Tamarkin Assistant Professor searches will start early in the year to identify strong PhD students who are women or members of HUGs by working with the faculty to network with their colleagues and encourage direct contact. Attractive candidates can be invited to campus prior to the deadline for seminar talks as appropriate. Summarizing we propose the following enhancement to our Tamarkin searches.

**Proposal.** *Via direct contact with our faculty, the Diversity Representative of our Tamarkin Assistant Professor hiring committee will leverage the faculty’s network of colleagues to identify attractive candidates who are women and members of HUGs and encourage them to apply to the Tamarkin Assistant Professor position. Once offers are made to candidates the Department will offer to fund visits to campus, time permitting. The Diversity Representative will generate a report on these efforts for the Department Chair.*
Climate and Outreach. We believe a central role in improving diversity and inclusion in the mathematics department will be played by maintaining a presence at national meetings of societies such as the AMS and SACNAS, and assembling promotional material and literature that communicates our positive climate and our ‘active and friendly atmosphere’ to prospective students and faculty. Though we do not currently allocate resources to these kinds of activities, having a Departmental representative at the National Meetings of AMS sends a message of interest.

Proposal. The Mathematics Department will send staff and faculty representatives to the national meetings of the AMS to promote our graduate and Tamarkin Assistant Professor programs. Likewise we will advertise positions in SACNAS, and work with ICERM staff to promote the Mathematics Department’s programs at the ‘Modern Math Workshop’ at SACNAS.

We note that ICERM already has a strong presence at these activities, and we will work with them to increase visibility for the department through their presence there as well.

The Graduate Program

Broadly speaking, we do well in recruiting women into our graduate program. Of the 48 students who are currently enrolled, 19 are female. In our past five years of admission, 17 out of 48 or 35% of our entering classes were women.
### Entering Class Statistics for Mathematics

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<tr>
<td>2014-2015</td>
<td>18</td>
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</tr>
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### Graduate Enrollments at Peer Institutions

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<td>19</td>
</tr>
<tr>
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<tr>
<td>Penn</td>
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In regard to climate, in our external review and our more recent graduate program review the program was praised for its inclusive nature and positivity. In the program review, the graduate council noted

“...In this regard the survey of graduate student opinion showed a remarkably warm relationship with the faculty generally and included very high ratings for mutual respect, feedback on work, and personal and career development. The same feelings were noted by the external reviewers. Such cordial relations are unusual and commendable.”

Nevertheless, we see some key areas where we might make efforts toward better recruiting and retention. We outline plans below, which range from a summer program for incoming women students, to professional training workshops at ICERM, as well as peer to peer mentoring programs for graduate students and undergraduates.

**Graduate Admissions.** Each January a graduate applications review committee is formed consisting of 3-4 faculty (either tenured, tenure-track, or TAP). Special effort has been made to include a female faculty member on this committee, and in recent years, two female Assistant Professors for participated. This review committee has always made an effort to carefully examine all applications in which the applicant has self-identified as minority. Moreover, the number of female applicants has been limited (about 30 out of 190 in the last two years), so female applications are also specially noted in our review.

- With 190 applications, limited human resources for review, and inevitable time constraints, it is possible that not every application will be read closely. By making a special note of minority applications, we work to ensure that all minority applications are completely and properly reviewed, and reduce the possibly of a decision error for these applicants. For example, if there are four committee members, perhaps only two will review each application, but all four will review each minority application.
- Applicants are typically judged in part on the following basic metrics: test scores, grades, research experience, and letters of recommendation. With minority applications flagged, we can decide if the applicant’s special circumstances, such as lack of available education resources, compensate for weaker application metrics, and determine if the

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applicant still has the potential to excel, perhaps after additional coursework or other preparatory training.

Up to now, this review of minority applications has been conducted without a special report on these applicants.

Proposal. *Beginning with the January 2017 graduate application review, the review committee will produce a report on its review of applicants who are women and members of HUGs. This report will be delivered to the Department Chair.*

Summer “liftoff” Program for incoming Graduate Student Women. The plan *Pathways to Diversity and Inclusion* makes suggestions that are consonant with part of our existing planning. It suggests that departments

“...Develop residential summer seminars for aspiring Ph.D. students: We will fund departments to enable them to run summer immersion programs, which provide a two-week summer residential program with intensive coursework and mentoring to help undergraduate students from underrepresented groups aspiring to enter Ph.D. programs. This program was successfully piloted at Brown in summer 2015 and will be expanded to more departments. Interested departments may request funds to support this effort as part of their Departmental Diversity and Inclusion Action Plans (DDIAPs).”

Prior to the plan’s release, Professor Melody Chan had proposed to develop a two-week summer program targeted to undergraduate women concentrating in mathematics finishing their junior and senior years as part of her upcoming NSF CAREER proposal submission. Her program would be centered around two minicourses, with daily lectures and problem sets, on topics that (a) involve important basic mathematics such that students would learn things that are useful in graduate school and (b) are interesting and colorful enough that students would be motivated to attend and would feel ownership over a cool piece of math. With the support of the Math Department, the program would recruit grad students to assist as TAs and run problem sessions, and senior colleagues to give occasional guest lectures.

The purposes of the program would be

- to provide instruction in interesting areas of mathematics,
- to allow the students to build mathematical confidence, which they can take with them into the academic year, by engaging with topics that are central enough to be useful in future study, and also
- topics that are specific and interesting enough that students gain a sense of ownership and expertise; for example they could go back to their home institution and give a great "math club" style talk,
to build vertical community, between students and instructors, providing an informal opportunity for mentorship, and also
between junior- and senior- student participants, especially between students who are considering graduate school as an option and students who are already heading to grad school, and
to advertise higher mathematics as one of many possible options for post-graduation.

Creating a program that is open to all students who are female or identify as as a woman and features at least some women mathematicians who are prominent in their fields as part of the teaching team would work in service of all of those goals.

Proposal. The Department will put its full support behind the ‘summer lift-off program for women’ which we see as a potential signature program toward increasing participation by women in the graduate program and the profession more broadly. The Department would provide modest stipends to the graduate students involved in the program, and encourage Tamarkin Assistant Professors to serve in the role of mentors.

We note that one of the potential ‘traps’ of developing Diversity and Inclusion Action Plans such as ours, is that enthusiastic junior faculty who seek changes in the Diversity landscape readily volunteer their precious time and energy to developing plans and proposals such as those proposed above. This time and energy can come at the expense of time spent on research and scholarship that will be critical to promotion to tenure, which should be viewed as a clear primary goal for any junior faculty member. The Department Chair and the Ombudsperson described below will review with Professor Chan, or any other junior faculty, the level of effort and time devoted to such activities, helping to find assistance and ensure that adequate time is retained for scholarly development.

Other Methods. To increase our success in recruiting and retaining talented women and members of Historically Underrepresented Groups at the Graduate level the Department will, implement over the next five years the following strategies.

1. Actively recruit from institutions known for having members of HUGs by sending promotional material and communicating to our faculty and postdocs about how best to promote Brown as a potential graduate program.
2. Have a single graduate recruitment activity in which admitted women graduate students come to campus as a group to network and connect; we propose an evening dinner and talk the night before the normal recruitment day.
3. Work with Graduate School Associate Dean of Diversity Initiatives and Dean of the Graduate School to create attractive recruitment packages for women and members of Historically Underrepresented Groups.

4. Conduct more regular climate surveys to track concerns and performance, including entrance and exit surveys.

5. Coordinate with the DAM to develop and deploy such opportunities in concert with their efforts in Diversity and Inclusion.

ICERM’s Professional Development Round-Tables. The professional development round-tables run at ICERM to enhance professional development of graduate students and postdocs in ICERM’s programs also are open to participation from members of the Math Department (and the DAM). These activities also serve as the ethical training workshops required by NSF for postdoctoral fellows at ICERM. The NSF requires training in ethical and responsible conduct of research for any undergraduate, graduate student and/or postdoc who is supported by any of their grants. These round-tables employ panels from the programs and from the campus to discuss in an open forum topics in and around issues diversity and inclusion in the profession and are extremely valuable to our students.

The Mathematics Department will work with ICERM and the Division of Applied Mathematics to develop discussions in these round-tables that address the ‘stereotype threat’ and ‘unconscious bias’ - graduate students and Tamarkin Assistant Professors would then be required to attend these training sessions. We would ask for assistance from the Office of Institutional Diversity and Inclusion to develop these training sessions.

The Undergraduate Program

Simply put, we face a challenge both in absolute terms and relative to our peer Departments in STEM disciplines in recruiting women and members of HUGs to the mathematics concentration. To address these concerns we met with undergraduate leaders to assess their own ideas about how the Mathematics Department could perform better in regard to retention of prospective concentrators. It became clear through these meetings that there are relatively simple activities that can play a mutually beneficial role in recruiting and retention of women and members of HUGs in the concentration while improving climate overall in the Department. We have already acted to implement some of these changes, but seek support through our DIAP for expanded and improved activities toward these goals. We detail our specific proposals below to

1. Develop our Undergraduate TA Program,

2. Build support for a peer-to-peer mentoring program developed this year connecting graduate student women with undergraduate women concentrators, and
3. *Develop and launch a new first-year ‘gateway to the major’ course.*

**Undergraduate TA Program.** In response to extensive discussions with our undergraduate concentrators, we are making two new changes which we hope will dramatically improve our ability to retain women in the concentration as well as members of HUGs. We are launching in 2016-2017 a Departmentally funded (initially) Undergraduate TA Program, in which courses that are entry points to the concentration are supplied with excellent Undergraduate TAs who are current concentrators. Current DUG leaders felt strongly that having peer mentors during the difficult courses that mark the entrance to the major (e.g., Honors Linear Algebra MA0540, Abstract Algebra MA1530, and Introduction to Analysis MA1130, and Analysis: Functions of One Variable MA1010) would provide crucial support and catalyze community-building at these critical junctures early in the major, in courses that are anecdotally points of attrition for the concentration. Through our DIAP we seek to bolster and grow this program, specifically looking toward excellent female concentrators and members of HUGs to play a leadership role in the program.

Because of the important role they will play in setting the tone for the concentration, we will plan for the undergraduate TAs to participate in climate and diversity training, which we will coordinate with the Office of Institutional Diversity and Inclusion. We note that ICERM’s Summer@ICERM program for undergraduate research in Mathematics already incorporates such training for their participants and TAs focusing on how to work as a team and the value of a supportive community. ICERM has agreed to coordinate with us in the development of our training for our Undergraduate TAs. At least one component of the climate training will be conducted “in-house” by math faculty, in order to signal as strongly as possible that the department itself is committed to diversity and inclusion, from within.

**Peer-to-peer mentoring.** Beginning this year, Professor Melody Chan has launched the *Mentoring Network for Women in Mathematics at Brown*, a program that matches undergraduate women concentrating or intending to concentrate in mathematics with graduate student women mentors, meeting 3-4 times per semester in a peer-to-peer mentoring context. Currently *14 undergraduates* and *9 graduate students* are participating in this “pilot” semester. Starting next year, we plan to expand participation in the Mentoring Network by having faculty members advertise it broadly in the entry courses to the concentration and via the Math Departmental Undergraduate Group.

Additionally, we understand the the Division of Applied Mathematics is organizing a similar peer-to-peer mentoring program. We plan to coordinate with the Division to organize once-per-semester group meetings with these two groups.
New first-year course for Math concentrators. The Undergraduate Curriculum Committee met extensively this year to develop a new first-year course for potential concentrators. This effort came in response to much interest expressed by our undergraduate concentrators in having a course that ‘builds community’ in the concentration through innovative topics without a ‘forced-march’ through the calculus sequence. We describe this in more detail in our Curriculum section below but our motivation is to increase ‘on-ramps to the mathematics concentration’. Historically, calculus has been the first course taken by entering students, but it also has served as a gatekeeper course for many disciplines. Indeed, our external review commented:

“All of the undergraduates we talked to were unhappy with the sequence of courses leading into the mathematics major. Their objections were not expressed in an organized manner, but the gist of it was that the calculus sequence is regarded as ‘a long slog.’ It turns away people who would really like mathematics and who would appreciate its power and beauty, but who don’t like calculus so much. They wanted alternative courses that would provide routes into the major, such as discrete mathematics, where the attraction of the study of mathematics would be more quickly apparent. We note that the Department is very good at managing the calculus sequence, in terms of matching the starting point in the sequence to the background of the individual student, and providing calculus courses of different levels.”

Our discussions with our current Undergraduate concentrators strongly concurred with this assessment. They worked with our committee to develop the course we will describe below, which will introduce a breadth of topics, in a modular form, with an emphasis on how to write proofs in each topic.

How does this contribute to the recruitment and retention of talented students who are women or members of HUGs? Students succeed in traditional college calculus classes largely based on the quality of their high school mathematics training, especially their participation in strong Advanced Placement courses. The ‘accelerated math track’ within high schools can be exclusive and hostile to women and members of HUGs; thus social or socio-economic barriers to participation in mathematics are perpetuated. Our new course will not require a specific level of training in calculus but rather will be an introduction to mathematical thinking and the intellectual culture of ‘pure mathematics.’ Second, many STEM fields use college calculus as a screening tool for their disciplines; this promotes a competitive rather than a collaborative atmosphere. Our course will take a more inclusive approach, through S/NC grading and reduced emphasis on high-stakes examinations. Third, the course will be team taught, exposing entering students to a broad cross-section of the department’s faculty.
This course will be integrated into a larger program for recruiting diverse students to our major. First, the department will seek to advertise the new course to entering students, both through public announcements and targeted email contact.

Second, at the end of the first semester we will conduct an exit survey to track satisfaction with the course - this survey will be given to all students who reach the halfway point in the semester. At the end of the year we will conduct a second survey to assess the attrition and reasons for it. Finally, we will keep track of the proportion of students taking this course that successfully complete mathematics majors.

**Summer Workshops.** The *Summer@ICERM* program is an exciting undergraduate mathematics research program that features a proven technique to foster interest in research mathematics, privileging the group collaboration format over the individual research project. To date, the Summer@ICERM program has hosted Brown-funded students through UTRAs or group UTRAs or from other sources of funding such as NSF RTGs. The summer@ICERM program has an excellent track record in regard to diversity and inclusion. We propose to increase specific Departmental funding for undergraduates to benefit from this excellent program, and to work to identify promising women and members of HUGs who will benefit from exposure to this unique opportunity. We will also work with ICERM to identify Faculty Leaders and TAs who are women and members of underrepresented groups.

**SUMS.** The ‘Symposium for Undergraduates in the Mathematical Sciences’ or ‘SUMS’ is a remarkable student run conference geared toward the local community of undergraduate mathematics concentrators in the area. Students come from New England undergraduate institutions to hear talks by Brown or other local faculty that are geared toward undergraduate mathematics concentrators, and some undergraduates present their own research projects. Recent SUMS conferences have featured excellent talks by women, both at the senior level and at the undergraduate level. We have had 8 women undergraduates give talks over the last three years.

<table>
<thead>
<tr>
<th>SUMS Participant Data</th>
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Surveys and Data Collection. Though we have access to course evaluation data, it is difficult to extract information from these data alone on how well we are retaining women or members of HUGs. We feel it is vital to collect and analyze these data to understand how effective our efforts are and with what impact. Such surveys are subtle to design, and we propose to do so with the assistance of those at Brown with expertise in this area.

The Mathematics Department plays a significant service role at the University through our calculus offerings, which serve yearly on the order of 1300 students. Likewise, our linear algebra courses and others are required for various concentrations around campus. As such we have a responsibility to examine and investigate the impact of these courses on the diversity and inclusivity in STEM fields as well as other concentrations requiring introductory mathematics courses.

In our administration of these courses we are able to collect and track significant amounts of internal data in the form of placement exam scores, performance, and ultimately course evaluation feedback, to examine what we might do better to increase inclusion and retention in the concentrations our courses serve. What we have not done in the recent past is to cross-reference this internal data with external data, such as demographics, AP exam scores, and planned concentrations. In short, we are aware that students struggle in calculus, and we already try to provide resources to alleviate that struggle; but we lack information on what types of students tend to encounter difficulties, and knowing more about which students will likely need help and why could help us improve and target those resources.

The gathering and cross referencing of this additional information presents a significant challenge in terms of time and administration, and we seek the assistance of the Office of Institutional Diversity and Inclusion in the design and implementation of meaningful data collection approaches and methods of analysis.

Proposal. In collaboration with the Office of Institutional Diversity and Inclusion, design and implement a data-driven approach to analyze our success in recruitment and retention of women and members of Historically Underrepresented Groups in planned concentrations requiring calculus or other introductory mathematics courses.

It may be that the goals of retention in STEM or other mathematics based concentrations is in some sense independent from the goal of improving the climate for women and members of HUGs in our introductory courses. We set this out as an independent but related goal. It has
been brought to our attention by undergraduates with whom we met that merely asking the question of whether a student felt welcomed or ‘validated’ in the classroom environment can have a dramatic effect on the student’s experience. We feel we need the assistance of the Office of Institutional Diversity and Inclusion and the Dean of the College to design such climate surveys for those in our service courses, but we view it as an important goal to do so.

Proposal. *We with the assistance of the Office of Institutional Diversity and Inclusion, design and implement surveys that track appropriately the experience and satisfaction of women and members of HUGs in our introductory courses.*

Curriculum

As our curriculum comprises in all but a few exceptional cases *abstract* mathematics, it lacks obvious opportunities for enrichment along the axis of diversity and inclusion. As suggested above, however, we feel that it is important for the Department to address the question of access and availability of the concentration to students who are mathematically able but lack specific preparation in the form of High School AP classes. We have focused on this aspect of the curriculum in terms of the concentration, but also on joint curricular efforts with other Departments and Initiatives where diversity and inclusion are more naturally central concerns.

**New first-year course.** Over the course of the spring, faculty met extensively with undergraduate concentrators concerning ways to improve recruitment and retention to the major without such a strong focus on calculus. Based on feedback from these students and recommendations from our external review committee, the Department has proposed a new year-long course for entering students considering concentrations in mathematics and related fields. The class will have no prerequisites or required background. It will be team taught by some of our strongest instructors. The enrollment will initially be limited to 40 students to ensure personal contact with the instructor. We also plan to have a mandatory S/NC requirement to promote cooperation and intellectual risk-taking -- the material will be challenging but students should be able to rise this challenge without fear of a poor grade.

Over the next five years after the launch of the course, we will grow its size to meet demand, with greater TA and UTA support for the course. We will pay particular attention to the composition of this body of TAs and UTAs to ensure that it projects an inclusive and diverse representation of mathematics at Brown.

The specific topics covered will include:

- Foundations: logic, sets, mathematical induction, and contradiction -- the building blocks of rigorous mathematical writing and thinking
• Combinatorics: permutations, combinations, trees, and graphs -- presented with a view toward applications in probability and networks
• Algebra: basic formal structures of abstract algebra -- a conceptual recasting of notions from high school
• Analysis: inequalities, real numbers, continuity, differentiation, and sequences -- the concepts behind limits and calculus
• Number theory: factorization into primes, Euclidean algorithm (aka long division), modular arithmetic -- some mathematics behind modern cryptography
• Geometry: Pythagorean Theorem, conic sections, projective geometry, polygons and polyhedra -- an opportunity to integrate all that came before

This course is innovative in several ways. First, it emphasizes a deep, research-oriented perspective on elementary mathematics, especially topics relevant to current developments in the field. Second, it will focus on concrete examples rather than building theory; indeed, students will be encouraged to move on to more specialized courses in algebra, analysis, geometry, and number theory. Third, the course will emphasize clear and rigorous reasoning and writing throughout. Fourth, the shared experience of taking such a class will build community among the students -- and personal contacts that will follow them through their time at Brown and beyond. (We are optimistic this will also improve retention in the concentration.)

Data and Society. As part of the Data Science Initiative, the Mathematics Department will be actively involved in the planning and launch of a course in Data and Society, to be a central distinguishing feature of the recently approved Sc.M. in Data Science. This course, which will be co-taught by faculty from the initiative but initially planned and organized by a faculty member from the Mathematics Department, will address the pervasive role data now plays in society, confronting directly the ethical and societal concerns raised by the influence of data on society. A particular focus will concern unintended bias in big data algorithms, and the role of big data in structural and systemic discrimination. Indeed it is well established that there can be unintended pernicious consequences of algorithms and we feel that a much stronger role should be played by institutions such as Brown in levying deeper cultural critique against the widespread acceptance and normalization of these kinds of societal forces. As a contributor to this course and its development the Mathematics Department will demonstrate its relevance to the aims of the course and the power of these kinds of curricular activities like this in fostering a more diverse and inclusive environment.

Course on “Race and gender in the scientific community”. We are pleased to have the opportunity to collaborate with our colleagues in the Division of Applied Mathematics on a new exciting course offering. The GISP on race and gender in the sciences that was coordinated in 2014 the Division of Applied Math was very well received, and their students recommended
that this be taught as a regular course. We plan to coordinate with DAM’s effort to launch this course, assisting with its development, and co-teaching it in future years.

**Community and K-12 Outreach**

We see many opportunities for raising awareness of mathematics in the local community, building an inclusive and diverse climate in the process. By projecting to the greater public the excitement and interest our students and faculty have in mathematics, and projecting a diverse and inclusive environment we hope to build our reputation as an inclusive and diverse mathematical culture.

**Outreach to local schools and mathematics programs.** In any discussion of diversity and inclusion in mathematics, it is important to acknowledge that special challenges for girls and members of HUGs begin early in the pipeline. It is challenging for a University Mathematics Department to address these challenges in the normal course of their programming. We mention, however, that recently two of the Department’s graduate students (Kenneth Ascher and Mamikon Gulian) have started an outreach program to Classical High School where they plan to teach algebra via computer experiment to high school students.

“we are running an outreach effort this summer to educate and inspire a small group of high achieving students in Providence urban high schools. With no computer sciences offered at their high school, these students face barriers to STEM majors and careers. Our program gives them hands on lessons in mathematics and programming, focusing on combining the two to solve real world problems. At the end of the program, the students will work in groups on a final project. This allows them to leave with a portfolio of programming projects, that they can continue to build with their own projects and show to colleges.”

Together with ICERM, Department will support this effort by assisting in organizing a campus visit to ICERM and the Mathematics Department.

**Other K-12 Outreach Programs.** Finally, we have established a special relationship with a local independent mathematics program, *The Squared School Academy of Mathematics*. This school supplements training in mathematics for K-12 students who seek additional enrichment in an informal inquiry based program. We have agreed with Vitaly Sorkin, the School’s Director, to plan special visits by their students to the Mathematics Department and to ICERM - their population is quite varied and diverse, and we hope to have some direct impact on young
students with a clear demonstrated interest in mathematics by exposing them to what college level and research level mathematics looks like.

**Participation in ICERM programs.** As a general matter, we plan to develop a broader range of community outreach programs co-organized with ICERM outreach events. The ICERM Public Lecture series attracts high school students and their families already, to a broad range of popular topics such as the “Mathematics of Cooking” and the “Mathematics of Origami.” Future planned events include high school field trips to ICERM and will include faculty from Brown.

**Girls Get Math!** A jewel of the ICERM offerings for the community is the program *Girls Get Math!,* developed for high school girls to get a unique interactive inquiry-based learning experience with leading women mathematicians as their mentors. The Mathematics Department proposes to support Undergraduate and Graduate Student involvement as mentors in the program. We have pledged to ICERM to support two graduate student TAs in the program.

**Programming and Governance**

There are many opportunities for Diversity and Inclusion related programming in mathematics and the physical sciences broadly. We have worked to coordinate with other physical sciences Departments to arrive at programming plans that avoid duplication, but this effort to coordinate will continue. We describe some specific plans we will pursue with the help of other collaborating STEM departments.

**Lecture Series.** In our discussions with other STEM departments regarding programming, we agreed that bringing lecturers to campus to discuss matters of diversity in the sciences should be a top priority. We felt that this would be better accomplished collaboratively, and we plan to work with these departments to launch this programming in the fall.

**Data Science Initiative Lectures.** Furthermore, the Data Science Initiative’s focus on Data in Society will continue to bring academics and other high-profile Data Science figures from industry to speak on the role of data science and big data algorithms in issues of discrimination and bias. Examples where unintended consequences of algorithms lead to bias are multiplying, and with the Data Science Initiative we plan to take a leadership role in confronting the questions that surround these algorithms.
Governance. We feel that an important role in achieving our goals for this Diversity and Inclusion Action Plan will be played by an Ombudsperson, who is not currently a faculty officer (this would be an additional Departmental position to the current offices of Chair, the recently re-introduced Vice Chair, DUS, and DGS). This Ombudsperson would be tasked with three principal roles in the Department.

1. The Ombudsperson would be a tenured faculty member, who would chair a Departmental Diversity and Inclusion Committee consisting of members from all levels of the Department (one undergraduate concentrator, one graduate PhD student, at least one Tamarkin Assistant Professor, one Lecturer, one Staff member, and the Ombudsperson). The Committee would advise the Chair and the Directors of Undergraduate and Graduate Studies concerning issues around diversity and inclusion, including programming, outreach, recruiting and retention, and climate.

2. The Ombudsperson would be available to all members of the Department to address concerns about climate, or to address specific instances of concern that arise. The Ombudsperson would then raise these issues with the Committee or with the Chair directly as he or she deems appropriate.

3. The Ombudsperson and the Committee would review best practices for the training of Graduate TAs and Undergraduate TAs in regard specifically to issues around diversity and inclusion.

Because this task requires a high degree of sensitivity and training to be done well, we would implement this committee after a year one of the plan to provide for time to work with the Office of Institutional Diversity and Inclusion to ensure that this Ombudsperson would be trained appropriately for the role.

Conclusion

The Mathematics Department is prepared and indeed eager to take on a leadership role in issues of diversity and inclusion in Mathematics, in STEM, and generally at Brown. Competent training and performance in mathematics has been a gateway to many majors in STEM, including pre-med concentrations and social sciences concentrations in areas such as economics. At the same time, advanced training in mathematics is becoming a standard for employment in certain industry and government positions. Finally, the future health of mathematics in academia depends on attracting and retaining members of Historically Underrepresented Groups in this discipline.

In this document, we propose major structural changes in: our undergraduate curriculum, our departmental officer management structures, our hiring policies, and our training for
undergraduate student TAs, graduate students, and all faculty in issues related to diversity. Our Plan is a working document, subject to modifications that reflect the continued input we hope to receive from students, staff and faculty in mathematics, and from the Office of Institutional Diversity and Inclusion. It is ambitious, but it is not yet complete. It is feasible with administrative support, even with limited resources. Its core ideas represent essential efforts we must undertake in order to meet the department’s goals for achieving excellence in the coming decades.