

Annotated List of Summer Research Programs and Internships

Initiated by William Yslas Vélez (The University of Arizona)

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When William Vélez was Director of the Math Center at The University of Arizona (UA) he wanted more mathematics majors to apply to summer research programs (REU) and internships. However, when one looks at the list of programs supported by the National Science Foundation (NSF), one sees that most require upper division mathematics courses and programming skills. Most do, but not all.

The importance of computing skills cannot be over-emphasized for undergraduates. Not only are these skills important in being competitive for summer programs, but they are also important locally. There are positions on campus where programming skills can provide not only an educational experience but also a source of income for students. Some firms actually hire undergraduates to perform programming work for them.

Vélez decided to go over the list of REU sites on the NSF website to look for unusual programs, programs where a talented first or second year student could apply. Initially, the Annotated List was directed towards UA students. At one of the national mathematics meetings, Frank Morgan asked Vélez to give this broader dissemination. To accomplish this meant giving the Annotated List more content and more information about internships. We hope that this list proves useful to the mathematical community.

Latest Annotated List

Summer REU and Internship programs, 2022
Annotated List by William Yslas Vélez, December 29, 2021

Information about summer REU programs is available at the NSF website:

http://www.nsf.gov/crssprgm/reu/list_result.cfm?unitid=5044

The AMS website, <http://www.ams.org/programs/students/emp-internships>, displays a wealth of information about opportunities available to the mathematical community. Once at this site, click on “Mathematical Opportunities”. On the left of that webpage, you will find filters to zero in on your educational level.

The following website, Pathways to Science, contains several hundred links for summer research opportunities.

https://pathwaystoscience.org/programs.aspx?u=Undergrads_Undergraduate+Students&sm=&sd=&sy=&dd=SummerResearch_Summer+Research+Opportunity&submit=y&dhub=SummerResearch_Summer+Research+Opportunity

Mathematics majors, who have a background in programming, and have taken some biology or chemistry, can be quite competitive for programs in the sciences and biostatistics. Students need to apply broadly.

Many mathematics majors take courses in computer science. Mathematics majors who have a strong background and interest in computer science should also look into summer REU programs that are funded through Computer and Information Science and Engineering at NSF. **For those students who have an interest in data science, machine learning, security issues dealing with communication etc., there are many opportunities at these sites.** In looking through some of the websites, I could not find minimal requirements, except for the ability to program in some language. These programs do not list mathematics as one of the majors that they are interested in but they do state, “or related major”. Some of these sites provide support for international students (like RISS at Carnegie Mellon) Here is a link.

https://www.nsf.gov/crssprgm/reu/list_result.jsp?unitid=5049

The division of Education and Human Resources funds REU programs that focus on STEM education. Here is a link to those programs. https://www.nsf.gov/crssprgm/reu/list_result.jsp?unitid=10021

Most of the REU programs in mathematics are for students in their junior year who have completed at least one proof intensive course and at least some upper division course work in algebra, analysis or linear algebra.

We have read over the descriptions of the proposed activities for the REU sites and commented on programs that did not have the above-mentioned prerequisites. In particular, we looked for those programs that students who have not started upper division courses could apply to. Many REU sites do

not list the minimum prerequisites or we may have overlooked some so please look carefully at the REU websites. In cases where we could not determine prerequisites, we did not refer to them.

Most of the summer REU programs require some computing background, so we will not list it separately as a requirement. This computing requirement may consist of either programming skills in some language or facility with some computational package.

Some summer programs that do not appear on the NSF website

1. Brown University, ICERM, Computational Combinatorics
(<https://icerm.brown.edu/summerug/>)
2. USC Viterbi (<http://gapp.usc.edu/sure>) . Two summer programs are listed here .
3. PRIME: Pomona Research in Mathematics Experience:
<https://pages.pomona.edu/~ehga2017/prime.html>
4. RUSIS@IU: This long-standing program just moved Indiana University; description of program:
<https://mail.google.com/mail/u/0/#inbox/FMfcgzGmtXFICZgRsjskDmGnHZgnvzk?projector=1&messagePartId=0.2>. Application:
<https://mail.google.com/mail/u/0/#inbox/FMfcgzGmtXFICZgRsjskDmGnHZgnvzk?projector=1&messagePartId=0.1>

Assist High School students

1. PROMYS (<https://promys.org/home>) This is a program for gifted high school students and math majors can apply to be counselors to work with these high school students. There are opportunities for international students.

For students interested in research on mathematics education

1. Illinois State University: For pre-service mathematics teachers.(<https://about.illinoisstate.edu/reu/>)
2. North Dakota State University: (<http://www.ndsu.edu/cider/reu/>). Collaborations in Discipline-Based Education Research.

For students who have completed two semesters of calculus

1. Florida International University: (<https://case.fiu.edu/mathstat/opportunities/amrpu/index.html>), and completed sophomore year.
2. Mathematical Staircase, Inc.:(<http://www.mathily.org/mathilyest/>), The website states this program is for exceptional first-year students.
3. Michigan State University: (<https://lbc.msu.edu/about/suriem.html>) Students must be in their early stages of education.

4. North Carolina State University: (<https://math.sciences.ncsu.edu/undergraduate/drums/>) The website states that this program is for students who are non-traditional or have just begun their mathematical studies.
5. Prairie View A& M University: (<https://www.pvamu.edu/bcas/reu/>). The site states that college algebra and basic computer programming are required.
6. North Carolina State University and Elon University: <chromeextension://gphandlahdpffmccakmbngmbjnjjiahp/http://www.ncat-elonjointreu.info/2022REUFlyer.pdf>.
7. St. Mary's College of Maryland: (<http://faculty.smcm.edu/sganzell/reu/>).

For students who have completed three semesters of calculus

1. Texas Tech University: (<https://www.math.ttu.edu/undergraduate/reu2021/>)

For students who have completed a course in statistics, multivariable calculus, and a course that requires programming

1. Embry-Riddle Aeronautical University: (<http://reudeim.com/>)

For students who have completed multivariable calculus and linear algebra

1. Ithaca College: (<https://www.ithaca.edu/academics/school-humanities-andsciences/mathematics/nsf-reu-dynamical-systems-ic>)

A Summer Program in Puerto Rico

1. East Tennessee State University will hold its REU in Ponce, Puerto Rico. <https://www.etsu.edu/cas/math/activities/reu.php>

Industrial Mathematics

1. Institute for Pure and Applied Mathematics research program in industrial mathematics. There is also available in Singapore. (<http://www.ipam.ucla.edu/programs/student-research-programs/research-inindustrial-projects-for-students-rips-2022/>)

International Opportunities

1. DIMACS: (<http://dimacs.rutgers.edu/REU/>) A small number of participants will spend the last 2 weeks of the program at Charles University, in Prague.
2. IPAM: <http://www.ipam.ucla.edu/programs/student-research-programs/research-in-industrialprojects-for-students-rips-2022-singapore/>

International Opportunities or Programs Open to International Students

Several programs now state that international students may apply, though no funding is available for them since NSF restricts funding to U.S. citizens and permanent residents. International students who have the funds to enroll in summer classes at their undergraduate institutions might instead use those funds to participate in a summer research program. Some of the following programs allow international students to self-fund their participation or have funding available for a limited number for international students.

1. University of Minnesota, Minneapolis: (<http://www.math.umn.edu/~reiner/REU/REU.html>). Recently we have been able to provide some funding for international students.
2. Cold Spring Harbor Laboratory: (<https://www.cshl.edu/education/undergraduate-research-program/>). Of course a background in the biological sciences is required. Students of any nationality are eligible for the program.
3. ICERM at Brown University Brown University, ICERM: (<https://icerm.brown.edu/summerug/>) . Funding is available for a limited number of students who are not US citizens or permanent residents.
4. IST in Austria: (<https://phd.pages.ist.ac.at/isternship/>)
5. Professional Opportunities for Student Workforce to Experience Research (HS-POWER) Program: (<https://zintellekt.com/Opportunity/Details/DHS-POWER-2022-International>)

A program in the Social and Life Sciences

1. Quantitative Research in the Life and Social Sciences Program: (<https://qrlssp.asu.edu/>).

Some REU programs in Mathematics and the Biological Sciences and Biostatistics

1. Summer Program in Biostatistics & Computational Biology at the Harvard T.H. Chan School of Public Health: (<https://www.hsph.harvard.edu/biostatistics/diversity/summer-program/>). Not sure if this program will run in 2022.
2. NC State and Duke University: (<https://statistics.sciences.ncsu.edu/undergraduate/academic-and-research-opportunities/sibs/>)
3. Indiana University-Purdue University Indianapolis: (<http://math.iupui.edu/reu>).
4. Ohio State University: (<https://mbi.osu.edu/education/summer-undergraduate-program/>). Not sure if this program will run in 2022.
5. University of Wisconsin-La Crosse: (<https://www.uwlax.edu/mathematics/activities/reu/>).
6. Cold Spring Harbor Laboratory: (<https://www.cshl.edu/education/undergraduate-research-program/>). Of course a background in the biological sciences is required.
7. Dordt College: (<https://www.dordt.edu/academics/research-and-scholarship/undergraduatesummerresearch/statistical-genetics-and-biostatistics>). Not sure if this program will run in 2022
8. University of Pittsburgh, School of Medicine: (<http://www.tecbioreu.pitt.edu/>).

9. Harvard Medical School, Program in Systems Biology: (<https://sysbio.med.harvard.edu/summerinternships>)
10. UCLA Institute for Quantitative and Computational Biosciences: (<https://qcb.ucla.edu/big-summer/>)
11. Harvard Systems Biology Summer Internship: <https://www.sysbiointernship.hms.harvard.edu/>

Programs with a focus on under-represented students

Many of the summer research programs indicate that they strongly encourage minority and female students to apply. The following programs specifically target minority students.

1. Big Ten Academic Alliance: (<https://www.btaa.org/resources-for/students/srop/overview>)
2. MSRI-UP <https://www.msri.org/web/msri/education/for-undergraduates/msri-up>
3. Pipelines in Quantitative Aging Research Summer Program: (<https://publichealth.nyu.edu/departments/biostatistics/pipelines-quantitative-aging-research-summerprogram>)

Programs where graduates can apply

1. Park City Mathematics Institute, (<https://www.ias.edu/pcmi>). The topic will be: Mathematical Cryptography
2. IPAM (<http://www.ipam.ucla.edu/programs/student-research-programs/research-in-industrialprojects-for-students-rips-2022/>)
3. US Department of Energy (<https://science.osti.gov/wdts/suli>)
4. Department of Homeland Security (<https://orise.orau.gov/internshipsfellowships/undergraduates.html>)
5. High Performance Computing Summer Internships (<https://www.zintellect.com/Opportunity/Details/DOE-EERE-HPC-2021>)

Many of the national labs have internship programs. These internship programs can be for the summer or for a semester. As examples look at the following.

National labs and Government Agencies that may not appear on the AMS website

1. Lincoln Laboratory, MIT (<https://www.ll.mit.edu/careers/student-opportunities/summerresearchprogram>)
2. US Department of Energy (<https://science.osti.gov/wdts/suli>)
3. EERE National Storage Internship Program (<https://zintellect.com/Opportunity/Details/DOE-EEREEnergyStorage-2022>)
4. EERE Robotics Summer Internship Program (<https://www.zintellect.com/Opportunity/Details/EERERobotics-2022>)
5. The National Science Foundation National Center for Science and Engineering Statistics Research Ambassadors Program (<https://orise.orau.gov/ncses/>)
6. Air Force Research Laboratory Research Participation Program (<https://orise.orau.gov/afrl/>)

7. DOE Office of Fossil Energy and Carbon Management
(<https://www.zintellect.com/Opportunity/Details/DOE-STP-FECM-2022-01>)

Data Science is a growing field where mathematically prepared students can apply. The following link has internship opportunities in statistics and data science for both undergraduates and graduate students.

1. NIH, National Heart, Lung, and Blood Institute: <https://www.nhlbi.nih.gov/grants-andtraining/summer-institute-biostatistics>
2. American Statistical Association: (<https://www.amstat.org/>). From there go to: <https://stattrak.amstat.org/2021/12/01/2022-internships/>