



SUMMER RESEARCH PROJECTS FOR UNDERGRADUATES AND HIGH SCHOOL STUDENTS

AMERICAN UNIVERSITY DEPARTMENT OF MATHEMATICS AND STATISTICS

Summer 2024

The American University Department of Mathematics and Statistics is seeking applications from American University undergraduates or high school students wanting to participate in student research projects in the mathematical sciences during the summer of 2024. The summer research program will support at most six students who will work on small projects guided by a mentor from the department. Students will conduct their research remotely but may meet with their mentor over Zoom or in person as determined by the mentor. In addition to participating in a research project, successful applicants will be eligible for a \$2,000 support payment.

Applications and transcripts or grade reports must be submitted per the instructions below by May 8, 2024.

MINIMUM ELIGIBILITY

To qualify, applicants must be:

- an **American University (AU) undergraduate** with a declared major in Science, Technology, Engineering, or Mathematics (STEM), or,
- a **rising Senior or Junior in high school** who has successfully completed Algebra and Geometry, with a grade of B or better, and who has an interest in the mathematical sciences associated with careers in STEM.

All AU students and local DC, Maryland, and Virginia area high school students with an interest in STEM are encouraged to apply. Preference will be given to applicants who identify with groups historically underrepresented in STEM fields, from high school students who have not participated in a prior research project, and/or, applicants who are Pell Grant Eligible or eligible for a Free or Reduced Lunch Program at their high school.

DATES AND PLACE

The program will run for approximately eight to ten weeks during the Summer of 2024. Exact dates will be chosen by individual mentors. Meetings may be virtual via Zoom or in person as determined by the mentor.

PROGRAM DESCRIPTION

Applicants will pursue a project from the list below. Participants will investigate real-world phenomena or theoretical challenges using methods and tools from the mathematical sciences and create a poster and/or presentation about their results and experience. Project posters and presentations may be shared with the public.



PROJECTS

- 1. A Statistical Relationship Analysis between Mean NFL team Salaries and NFL Team winning percentages per season:** The goal and purpose of the study is to statistically expose an informative connection between mean salaries per team and the success or lack of success of an NFL team over a specified number of years. There are 32 NFL teams, Ten of these teams will be randomly selected for the study over a five-year period. The study will feature Data Visuals (plots and graphs), standard statistical tests, and explanatory script to investigate this issue. The creation of a Regression model that predicts a team's winning percentage using the team's mean salary as a predictor will be a culminating study outcome. (Mentor: Dr. James C. Dickens)
- 2. Exploring Mathematical Algorithms through Coding:** This topic integrates mathematics with computer science, offering students a unique opportunity to see how abstract mathematical concepts can be implemented through coding. By using the R programming language, students will not only learn programming skills but also gain insights into mathematical algorithms and their real-world applications. This interdisciplinary approach fosters problem-solving abilities and computational thinking, which are valuable skills in both mathematics and computer science. (Mentor: Dr. Hamid Semiyari)
- 3. Exploring Probability through Games:** Probability is a fundamental concept with wide-ranging applications and introducing it through games makes it more engaging and relatable for students. By analyzing popular games of chance, students can explore theoretical probabilities, conduct simulations, and compare them with experimental results. This hands-on approach allows students to develop a deeper understanding of probability theory and its practical implications in various contexts. (Mentor: Dr. Hamid Semiyari)
- 4. Exploring Data Visualization Techniques:** Data visualization is a crucial skill in today's data-driven world, and this topic offers students a practical guide to creating effective visual representations of statistical data. Through experimentation with different types of graphs and charts, students will learn how to select the most appropriate visualization method for different datasets. This project encourages hands-on learning and critical thinking, empowering students to communicate complex information visually. (Mentor: Dr. Hamid Semiyari)
- 5. Exploring Political Awareness Among Youth: A Century of Statistical Polling Techniques:** This project examines political awareness among young people over the past century, focusing on statistical polling techniques used in the US and globally. By analyzing historical data and methodologies, we aim to uncover trends in measuring youth political knowledge. Insights gained will inform future research and policy efforts to enhance youth civic engagement. (Mentor: Dr. Mary Gray)



ADMINISTRATIVE REQUIREMENTS

- **Access to Computers and Internet:** Applicant must have routine access to a tablet or laptop computer that allows them to execute mathematical analysis. They must also have sufficient access to the internet to support their research and potential Zoom teleconferences with their mentor.
- **Support Payments:** All participants will receive a \$2000 student support payment. Note the payment is taxable so participants must submit tax-related paperwork. All participants will receive payment upon completion of the required tax forms.
- **Release Forms:** Participants must sign a release form so American University has non-exclusive unlimited rights to any materials produced during the experience to include any video recordings of participant presentations. Participants under the age of 18 must have a parent or legal guardian sign the release form.

HOW TO APPLY

COMPLETE THE APPLICATION ONLINE AT

<https://forms.office.com/r/876VZ3iMVZ>

AND

EMAIL A COPY OF YOUR TRANSCRIPT OR GRADES REPORT TO:

mathstatstudentrsrch@AMERICAN.EDU.



The application deadline is May 8, 2024. No late applications will be considered.

- Answer each question on the form to the best of your ability.
- Rank the projects from 1-3 based on your interests. AU students may rank and propose a topic appropriate to a mentor from the list.
- Complete the acknowledgements section. **If under 18, you must email a picture of the statement on the application that is signed and dated by a parent or legal guardian.**

If you have any questions, please send an email to mathstatstudentrsrch@american.edu with the subject: Question on 2024 Student Summer Research Projects.