Undergraduate Research in Mathematics and Statistics

Presented by
Dr. Thanh Nguyen
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What is student research?

• Collaborate with a mentor (professor or supervisor) on a research project to solve a mathematical/statistical problem of interest to the academic community or motivated by industry.

• Devote a certain number of hours/week to work on the project and meet regularly with their mentor.

• Different types of problems: theoretical, applied (industry), computational (programming)

• Different opportunities: internal/external to Rowan, paid/unpaid, internships, REUs.
Why do research as an Undergrad?

- Educational Benefits
- Professional Benefits
- Personal Benefits
Educational Benefits

- Experience firsthand what research is
- Enhance understanding and knowledge of your academic field.
- Apply what you learn in class to real-world projects.
- Learn new things that aren’t covered in classes
- Earn academic credit
- Prepare for graduate study
- Improve/Acquire Skills:
  - communication (written and oral)
  - critical thinking
  - problem-solving
  - teamwork
  - time management
Professional Benefits

- Explore your interests and clarify your career goals
- Gain academic credentials to build up your resume
- Find a mentor
- Develop strong relationships with faculty (think recommendation letters!!!).
- Network with experts in your field (Future employers).
- Check out potential graduate school programs/Build liaisons (Off Campus)
Personal Benefits

- Build confidence in your skills.
- Sharpen your critical and analytical thinking skills.
- Meet new people with common goals and interests.
- Travel to a new place (Off Campus research or Conference presentation).
- Earn scholarships, stipends, and/or awards for having conducted research.
- Confront a fear/learn something new.
- Life changing experience.
Before getting involved consider

- What do you hope to gain from research experience?
- What are your interests?
- What do you know about research in your field?
- How much time can you realistically commit to working on a research project?
  - Consider summer programs
- Are there particular skills you need to aid you in your research project?
- Are there courses you should take before doing a particular research project?
- What type of learning environment do you prefer?
Selecting a Mentor

- What do you expect from a research mentor?
- What are your scholarly interests and career goals?
- Which faculty shares your interests?
- Who do you enjoy working with?
- What is your preferred research environment?
- What type of training do you want?
- What skills do you want to develop?
Where do I find one?

- **On Campus:**
  - Paid or Unpaid options
  - Semester long or Summer (5 or 10 weeks available)
  - Talk to your professors
  - Go to departmental colloquium to get an idea

- **Off campus**
  - Usually over summer
  - Search internet (Key words: Summer undergrad research/internships)
  - Check out Local Businesses (Large companies: Banks, Pharmaceuticals, etc.)
  - National Science Foundation REU program: [https://www.nsf.gov/crssprgm/reu/](https://www.nsf.gov/crssprgm/reu/)
How do you get one?

- Plan in advance (Off campus deadlines from early Dec – April)
- Take courses that will help you be a strong candidate (consider Math 01.390 – Mathematical Research)
- Pick a variety of programs including what might look to be ones that aren’t as “exciting”
- Talk with your faculty advisor about the application
- Don’t underestimate yourself
- Apply on time with a complete application
- Apply! Apply! Apply!
Applications

- List of relevant coursework or transcripts
- Letter(s) of Recommendation
  - Don’t wait until the last minute
  - Try to give all at once with link to program, addresses and deadlines
- Personal Statement (important)
- Resume (write a good one – get help)
- Ask for a second opinion from advisor
Start Now!

- Sign up sheet to talk to a Math professor for opportunities
Dr. Nasrine Bendjilali

- Research Interests:
  - Statistical genetics/methodologies.
  - Genetic risk factors contributing to development of complex human diseases.

- Potential Projects:
  - Genetic risk factors contributing to development of cardiovascular diseases.

- Time frame: No immediate plans

- Student Skills required:
  - Some experience using programming languages such as R and C++.
  - Knowledge of statistics.

- Contact Info:
  - bendjilali@rowan.edu, Robinson 228D.
Dr. Abdul Hassen

- Research Interests:
  - Analytic Number Theory
  - Partition Functions
  - Bernoulli and Euler Polynomials and Numbers
- Potential Projects:
  - Number theory related problem (TBD)
- Looking for two committed students
- Initially unfunded, with funding Fall 2020
- Time frame: Late Spring 2020 and beyond!
- Student Skills required:
  - Discrete math, Calculus III
- Contact Info:
  - hassen@rowan.edu, Robinson 229E
Dr. Marlena Herman

- Research Interests:
  - The Golden Ratio and Other Ratios that Share its Characteristics
- Potential Projects:
  - mathematical investigation with the use of dynamic geometry software and computer algebra systems
- Looking for 1-2 students
- Funding: maybe (CGCE or college)
- Time frame: available now. Student's first task will be to read a book on Golden Ratios
- Student Skills required:
  - familiarity with dynamic geometry software and computer algebra systems;
  - strong knowledge of algebra, geometry, precalculus, trigonometry, and calculus
- Contact Info:
  - herman@rowan.edu, James Hall 3074
Dr. Hieu Nguyen

- Research Interests:
  - Coding Theory, Frame Theory
- Potential Projects:
  - Error-correcting codes for interactive communication
  - New constructions and partitions of equiangular tight frames for communication
- Looking for up to 2 students
- Funding available
- Time frame: Academic year 2019-2020
- Student Skills required:
  - Discrete math (coding theory), linear algebra (frames)
  - Computer programming experience
- Contact Info:
  - nguyen@rowan.edu, Robinson 228N
Dr. Thanh Nguyen

- Research Interests:
  - Ordinary and partial differential equations;
  - Optimization;
  - Applications in engineering and industry
- Potential Projects:
  - Inverse problems in heat transfer and in wave propagation and scattering
  - Fractional differential equations
- Looking for up to 4 students, in particular from underrepresented groups
- Funding: potentially available in summer 2020 and fall 2020.
- Time frame: from late fall 2019
- Student Skills required:
  - Linear Algebra and Ordinary differential equations.
  - Programming experience (Matlab/Python/C++)
- Contact Info:
  - nguyent@rowan.edu, Robinson 230C
Dr. Juming Pan

- Research Interests:
  - Statistical Learning
  - Longitudinal Data Analysis

- Potential Projects:
  - Cutting-edge Methods for High-Dimensional Data Analysis
  - Sample Size Estimation for Longitudinal Studies

- Funding available


- Student Skills required:
  - Diligent and enthusiastic about research
  - Easy to communicate with
  - Basic statistics knowledge
  - Some experience in programming

- Contact Info:
  - pan@rowan.edu, Robinson 228 I
Dr. Babis Papachristou

• Research Interests:
  • Statistical Genetics, Biostatistics (Analysis of Biological Data), Epidemiology, Statistical Computing (Writing Software Packages in R or C/C++)

• Potential Projects:
  • Data analysis
  • Statistical programming

• Looking for up to 2 students

• Funding may be available

• Time frame: Now or End of July-August (4 weeks)

• Student Skills required:
  • At least an Intro Stat course (Required)
  • Experience in statistical programming (R, C/C++ desired)

• Contact Info:
  • papachristou@rowan.edu, Robinson 230D
  • Available Tuesday and Thursday 9:30-10:30am
Dr. Uma Thayasivam

• Research Interests:
  • Statistical Learning, Predictive Modeling in Big Data, Robust Estimation

• Potential Projects:
  • Student predictive modeling
  • Telemedicine and Telehealth Statistical learning
  • Advance statistical computing for modeling big data
  • Robust methods for high dimensional data
  • Open to student driven projects on statistical/data mining

• Looking for interesting students who are willing to gain experience
• Initially unfunded with potential for future funding support
• Time frame: Fall 2019 and beyond!

• Student Skills required:
  • Basic Statistics course
  • Some experience in computing programming
  • Desire to learn and willing to commit some quality time

• Contact Info:
  • thayasivam@rowan.edu, Robinson 228F
Dr. Marcus Wright

- Research Interests (more details available upon request):
  - Geometry of Julia Sets Associated to Root-Finding Methods (Newton, Halley, Secant, ???) (see images below)
  - Constructive Algorithms for Elementary Number Theory (Fermat Two Squares, Factorization, Chirality of Triples/Quadruples)
  - I am willing to collaborate with other professors and their students

- Potential Projects:
  - Using Mathematica to Image/Analyze Julia Sets
  - Understand the Zagier Algorithms for Solutions of the Two Squares Problem
  - Using a constructive algorithm for Zagier’s Fermat Two-square proof to factor
  - Generalizing Chirality of Triples to n-tuples
  - Open to student driven projects!

- Looking for up to 2 students
- Unfunded for now
- Time frame: Spring 2020 and beyond!
- Student Skills required:
  - Your brain should be open.
  - Basic programming/Mathematica could be useful for some projects

- Contact Info:
  - wright@rowan.edu, Robinson 229D
Questions?