





Faculty Member Contact Information

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Contact Info	
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1 Funded URCA Assistant

	This position is ONLY open to students who have declared a major in this discipline.	M
	This project deals with social justice issues.	
	This project deals with sustainability (green) issues.	
	This project deals with human health and wellness issues.	
	This project deals with community outreach.	
	This mentor's project is interdisciplinary in nature.	I

Are you willing to work with students from outside of your discipline? If yes, which other disciplines?

- Only similar fields

How many hours per week will your student(s) be required to work in this position?

(Minimum is 6 hours per week; typical is 9)

- 9 hours

Will it be possible for your student(s) to earn course credit?

- No

Location of research/creative activities:

- There is no restriction on location as the main requirement is that the student can write/run code and network simulators wherever they do the work.

Brief description of the nature of the research/creative activity?

Succinctly, the student will be analyzing the undergraduate course pre-requisite network (CPN) and related curriculum graph of SIUE -- networks which they are currently navigating. With my group, we have already extracted these network along with performing preliminary analysis about meta-majors, critical nodes, and other curricular aspects. The extended abstract results were presented as a poster in the Complex Networks 2023 conference, which subsequently resulted in an invitation to the journal special issue currently under preparation. We have expanded to including four additional midwestern universities in an enhanced analyses with new graph theoretic measures. My group continues such CPN and curriculum graph analyses establishing relationships between the network properties and aggregate longer term student outcomes (currently with publicly available information). An aspect of this project in which I expect the URCA Assistant to contribute most directly includes the automatic extraction and optimal visualization of the bachelor's degree graph for whichever degree the user enters. As our current project is implemented in python and networkX, the student would need familiarity with python at a minimum.

Brief description of student responsibilities?

The student will be contributing to a CPN and curriculum network representation and analysis project (as described above) implemented in python and networkX. While the student is welcome to work on other aspects of this project that interest them, the URCA assistant's direct responsibility is the coding of the project component involving automatic representation and visualization of the bachelor's *degree network* corresponding to a given degree entered by the user. As we already have the CPN represented, the degree network is just a subgraph of the network we already have, hence just extracting from the data we have in combination with the description of required courses for each major. The more intensive part of the project is the implementation of better visualization (layout) algorithms for each such network so that (i) no edge points upward, and (ii) crossing edges are minimized or eliminated completely in the layout. The project is both open-source and expected to be useful to our wider university community, especially undergraduate students navigating college like the URCA Assistants themselves. Therefore, the resulting code is to be made available publicly (e.g. GitHub), both to credit the student contributors and for general usability.

URCA Assistant positions are designed to provide students with *research or creative activities* experience. As such, there should be measurable, appropriate outcome goals. What exactly should your student(s) have learned by the end of this experience?

First, there are the technical aspects of student learning: The student will be learning fundamental graph theoretic algorithms and get first-hand experience implementing the

algorithms in python+networkX. The student will be investigating literature on some of the algorithms to study which algorithms are most applicable, and potentially modify existing algorithms to better suit the project requirements. The student will also be analyzing graph-theoretic properties of the specific networks created, potentially contributing to novel observations. In such cases of novelty, e.g. exhibiting algorithmic improvement or new analyses, the student would also be an author on a publication.

Then, there are some para-technical aspects: Since the networks analyzed are networks the student and their friends navigate currently, there may be opportunities for unexpected observations in addition to better understanding student pathways through programs (including their own). The student will also be working closely with graduate students, including a doctoral student, hence learning how to collaborate on programming projects and research together in a team.

Requirements of Students

If the position(s) require students to be available at certain times each week (as opposed to them being able to set their own hours) please indicate all required days and times:

- N/A

If the location of the research/creative activities involves off campus work, must students provide their own transportation?

- N/A

Must students have taken any prerequisite classes? Please list classes and preferred grades:

- I require that my students have taken CS111 with grade of A.

Other requirements or notes to applicants:

- I prefer that the student has familiarity with the NetworkX Python library.