Dr. Larson says, “We discuss the use of modern computer tools and resources to systematically advance our shared mathematical goals. In this talk we will discuss the available tools in the context of a summer 2017 project to find bounds for the independence number of a graph. The independence number is the cardinality of a maximum independent set in a graph. Two conjectured theorems will be discussed, together with a selection of three interesting open conjectures.”

Monday, October 30
Jepson Hall 109
4:30 PM
mathematics & computer science colloquium

All are welcome. Python programming experience would be useful. Enthusiasm is necessary. We will use Sage and an automated conjecturing program to do research on the cutting edge of a widely-studied Graph Theory problem: finding necessary or sufficient conditions for graph hamiltonicity. If interested, or for more information, please contact:

Neal Bushaw (nobushaw@vcu.edu) or Craig Larson (clarson@vcu.edu)
VCU Mathematics
**BACKGROUND.** Larson and Nico Van Cleemput have developed the **Conjecturing** program which can produce conjectures in any area of mathematics. Graph Theory is defined in part by its published concepts (invariants and properties), examples and counterexamples, theorems, and open problems.

**WHAT EXISTS.**

- The **Conjecturing** program, available at: [http://nvcleemp.github.io/conjecturing/](http://nvcleemp.github.io/conjecturing/)
- Initial coding of graphs and concepts, together with a graph database manager (so that hard-to-compute invariants do not need to be recomputed), available at: [https://github.com/math1um/objects-invariants-properties](https://github.com/math1um/objects-invariants-properties)

**WHAT MUST BE DONE.** Code all published concepts (invariants and properties), examples and counterexamples, and theorems. This is a long-term, massive project, which will ultimately require the work of a community of interested researchers, similar to say Sage development. More proof of concept conjectures that are of real use to practicing graph theorists in their investigation of existing open problems.

**FOOD FOR THOUGHT.** With all known concepts (invariants and properties), examples and counterexamples, and theorems, no human can produce a simpler conjecture, true for all known objects, and which improves on all known theorems.

**AIMS.**

- To produce conjectures that will advance graph theory research.
- To advance research on open mathematical problems.
- To explore what is possible in the automation of mathematics.

**STUDENT COLLABORATORS WANTED.** The most useful skills are:

- Python coding experience,
- comfort with a large codebase and GitHub,
- an adventurer’s spirit—this is a cutting-edge, unique project, that has the potential to make a major contribution both to Graph Theory and Artificial Intelligence,
- and knowledge of Graph theory—while useful, is less important.

**PAYOFF.**

- New conjectures and theorems that advance graph theory.
- Proof of a methodology that is applicable to any area of mathematics.
- Approach the limit of what can be automated in mathematics.

**FOR MORE INFORMATION.** Contact Craig Larson at clarson@vcu.edu. Read our paper: C. E. Larson and N. Van Cleemput, Automated Conjecturing I: Fajtlowicz’s Dalmatian Heuristic Revisited, Artificial Intelligence 231 (2016) 17-38.

**COLLABORATORS.** Nico Van Cleemput, Vikram Kamat, Neha Shrestha, VCU, VT and UVa students from 2015 and 2016 summer projects.