

VCU Graph Theory Computational Discovery Lab

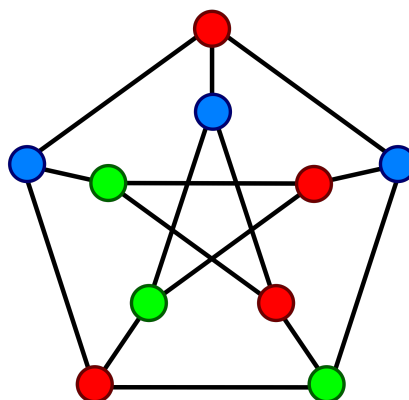
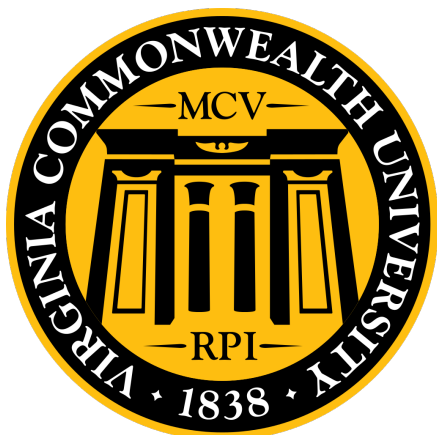
(Graph Brain Project)

Summer 2017

May 22—June 16

MTWThF, 9:00-1:00

2106 Harris Hall



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. If interested, or for more information, please **contact**:

Craig Larson, VCU Mathematics

clarson@vcu.edu

- **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/>
 - 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/mathlum/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.