



Tips for PhD

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Feb 24, 2016

Updated Feb 2, 2022

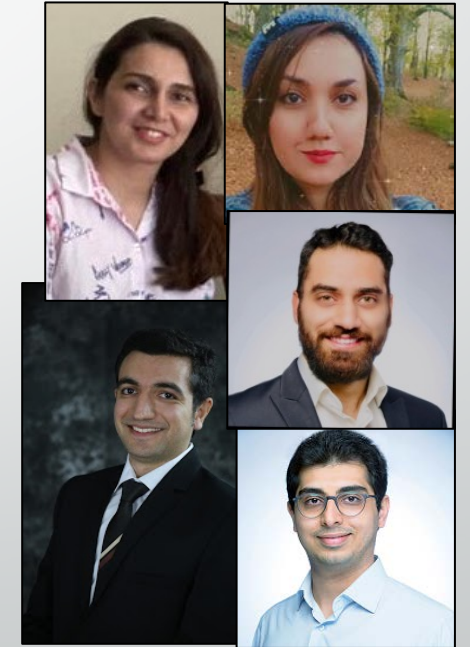
Academic and Professional Background



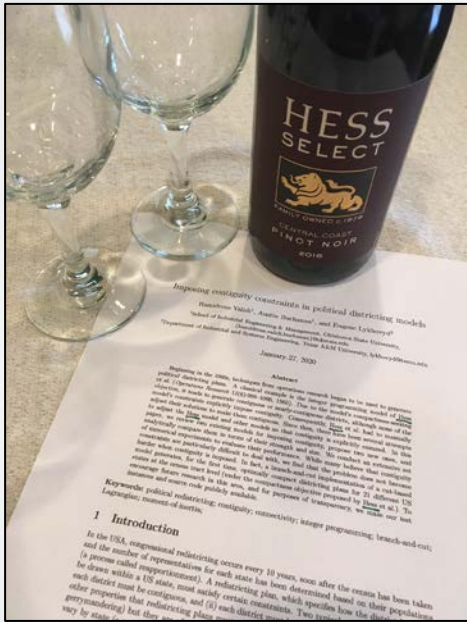
BS IEM (2007-2011)



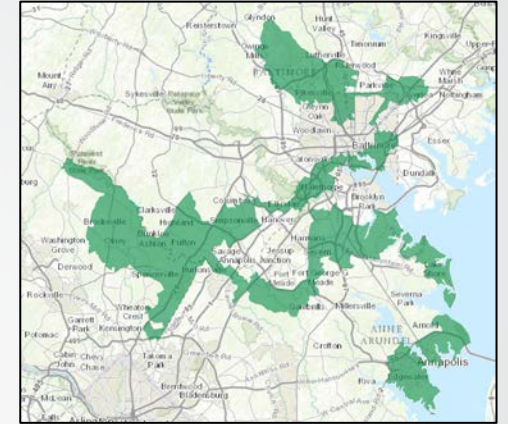
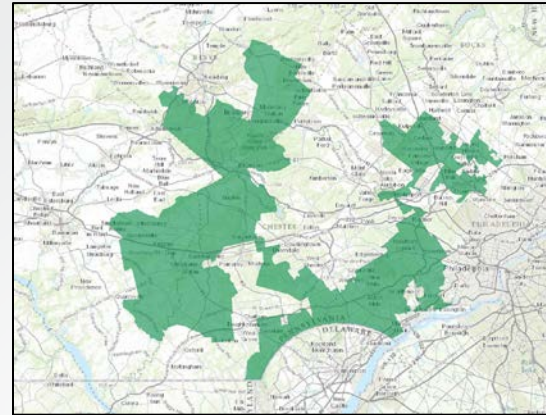
PhD ISE (2011-2015)



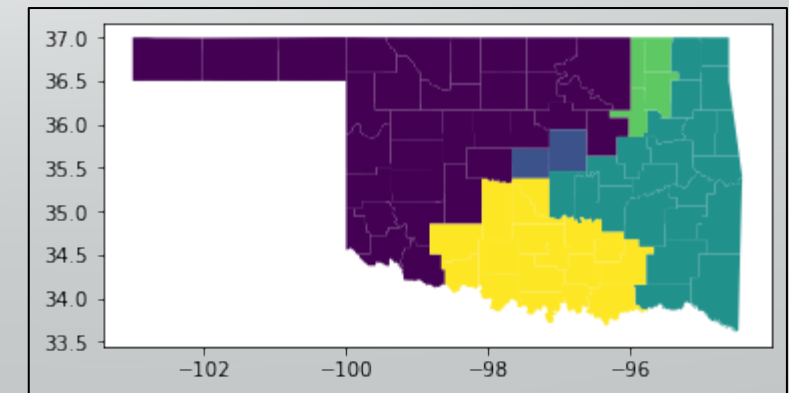
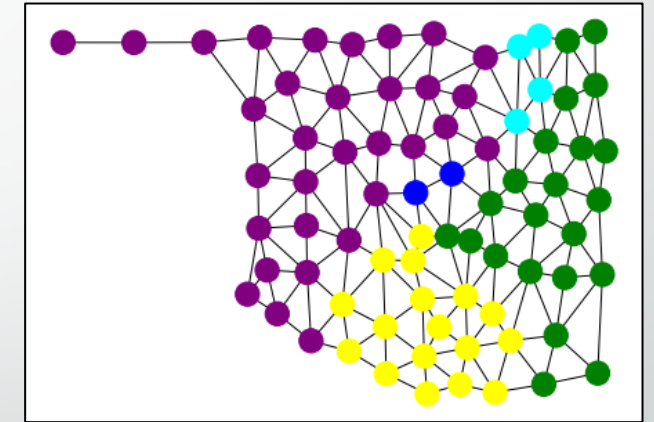
Assistant Prof (2015-2021)
Associate Prof (2021-now)



Research



- Applications:
 - Political redistricting
 - Problems with connectivity/contiguity constraints
 - Problems with distance/compactness/latency constraints
 - Problems relating to clustering and cluster detection
- Methodology:
 - Integer programming; graphs; networks; polyhedral combinatorics; combinatorial optimization; ...





Overview

- Classes
- Research
- Writing Papers
- Pitfalls
- Online Tips



Listener beware:

IMO.YMMV.



One take-home message:


“Academics judge you by your publications.”

Classes

- Take classes related to your research
 - To prepare you to write good papers
 - Other classes not so important...
- My research requires mathematical and computational skills
 - Take optimization courses from IE&M, proof-based Math courses, algorithms from CS
- Ask your adviser and (strong) classmates
- The goal in PhD is research/publications---not a 100% in every class.
 - See Deirdre McCloskey's "How to be a good graduate student"
http://www.deirdremccloskey.com/docs/pdf/Article_315.pdf

Research

- Understand your adviser's research area/strengths
 - Read their papers
- Know the 5-10 historically great/important papers/ideas in your field
 - For example, if you're working in optimization, you should know "optimization = separation"
 - You can read other papers as needed
- Generate *many* ideas
 - Almost all will be awful.
 - If the idea passes the *smell test*, record it in an "ideas" notebook.
 - Be curious; try things out. Test if the idea is worth pursuing.
 - Work on several research topics at once.
- Know your strengths; exploit them
 - Collaborate to help with your weaknesses
- Dissertation = 3 papers + staple



“If you don't spend almost all of
your time feeling like an idiot,
you're not really doing research.”

-Jeff Erickson, CS prof, UIUC

[@jefferickson](#)

Research Quality

- (Journal) Quality is important
 - For some business schools, 1 paper in OR or MS = 4 papers in EJOR
 - Know the top journals in your field
 - When academics see your CV, they'll see where you published; hard to (quickly) judge what you published
- Book chapters and many conference proceedings are practically worthless on a CV
 - Exceptions: CS-focused conferences

Research

- Try to finish one paper every semester.
 - If some don't work out, it's ok; you'll have ~8 chances.
 - It's good to collaborate.
 - 4 four-author papers is viewed much more favorably than 1 single-author paper.
- If you get stuck:
 - It's okay to take a break; go for a walk. (grab a drink?)
 - Ask your labmates/adviser
 - Set the problem aside for a couple weeks.
 - Can you solve a simpler problem?
 - See George Polya's "How to Solve It"

Writing Papers


- Start typing very early
 - If you work in OR, use LaTeX and BibTeX.
 - LaTeX >> MS Word for papers, but slides can be easier with PPT
- Write a (stunning, not-yet-true) abstract at the beginning
 - What you want the paper to be when you're done
 - Provides vision
- Create an outline; fill it in
- Constantly revise
 - Eventually become a stickler for details
 - Keep old versions
- Follow Cole Smith's writing tips:
http://people.clemson.edu/~jcsmith/tips/Tips_Home.html
- Read Laura Albert's blog post "just write, damn it":
<http://punkrockor.com/2015/05/04/just-write-damn-it/>

Maintain an Online Presence

hub.io

CMMI Operations Engine... INFORMS-J AFOSR ONR Code 31 ONR Opt-OR DTR

Austin Buchanan CV Research Students Links OF



About me

[Austin Buchanan](#) is an Associate Professor at [Oklahoma State University](#). He holds a PhD in [Industrial Engineering](#) from [Indiana University](#). His research focuses on solving problems, particularly those having connectivity or network structure. He currently serves as an Associate Professor at [Oklahoma State University](#) and as a Member of the [Center for Telecommunications & Network Analytics](#).

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@AustinLBuchanan

Associate Professor of @OkStateEM. Research in #forms #networks #districting. Blog: [farkasdilemma.wordpress.com](#)

Stillwater, OK he/him/his [austinlbuchanan.github.io](#) Joined August 2011

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Farkas' Dilemma

HOME ABOUT - AUSTIN BUCHANAN

[2020 update] Can my state redistrict at the county level?

[Leave a reply](#)

In a [previous blog post](#), I asked a basic question:

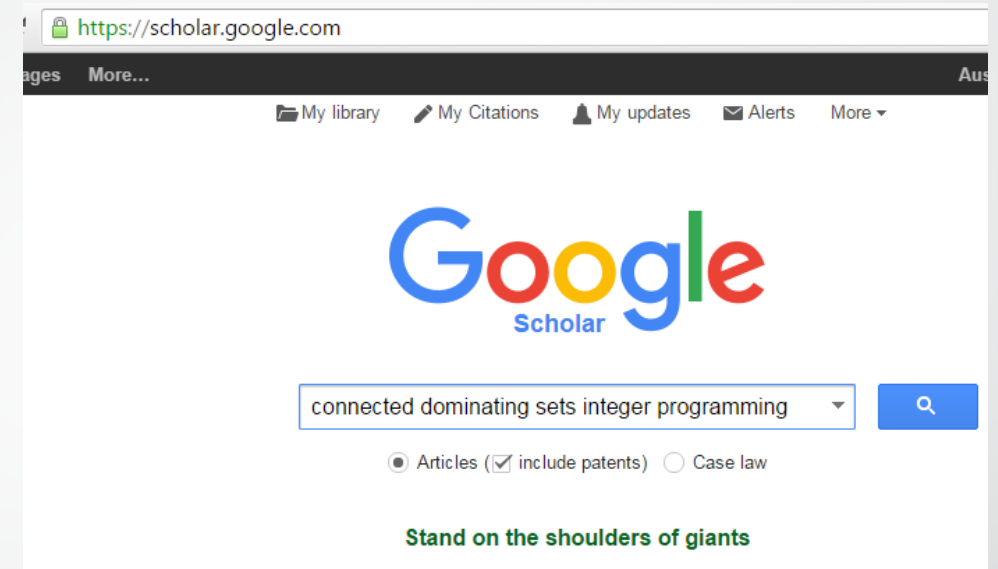
Can my state draw its congressional districts so that:

1. all districts have roughly the "same" population;
2. each district is contiguous on the map; and

Online Tips

- Use Google Scholar

- To find articles
 - Free versions + preprints
- Know Google search tips, like putting something in quotes
- To get BibTeX entries
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Solving the **connected dominating set** problem and power dominating set problem by **integer programming**

N Fan, [JP Watson](#) - Combinatorial optimization and applications, 2012 - Springer

Abstract In this paper, we propose several **integer programming** approaches with a polynomial number of constraints to formulate and solve the minimum **connected dominating set** problem. Further, we consider both the power dominating set problem—a special ...

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On connected multiple point coverage in wireless sensor networks

S Yang, F Dai, [M Cardei](#), [J Wu](#), F Patterson - International Journal of ..., 2006 - Springer

... **Integer Programming**: $\begin{array}{l} \text{Minimize } x_1 + x_2 + \dots \\ \text{Energy efficient area monitoring by sensor networks. IEEE Computer 37(2):40–46. 3. J. Wu and H. Li, On calculating } \end{array}$ **connected dominating set** for efficient routing in ad hoc wireless networks. Proc. ...

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The minimum **connected dominating set** problem: Formulation, valid inequalities and a branch-and-cut algorithm

[L Simonetti](#), [AS Da Cunha](#), [A Lucena](#) - Network Optimization, 2011 - Springer

... Abstract. We consider the minimum **connected dominating set** problem. We present an **integer programming** formulation and new valid inequalities. A branch- and-cut algorithm based on the reinforced formulation is also provided. ...

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Linear kernels for (**connected**) **dominating set** on H-minor-free graphs

FV Fomin, D Lokshantov, S Saurabh... - Proceedings of the twenty ... 2012 - dl.acm.org

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Benders decomposition, branch-and-cut, and hybrid algorithms for the minimum connected dominating set problem

[B Gendron](#), [A Lucena](#), [AS da Cunha](#)... - [INFORMS Journal on ...](#), 2014 - [pubsonline.informs.org](#)

We present exact algorithms for solving the minimum connected dominating set problem in an undirected graph. The algorithms are based on two approaches: a Benders decomposition algorithm and a branch-and-cut method. We also develop a hybrid ...

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On connected dominating sets of restricted diameter

[A Buchanan](#), [JS Sung](#), [V Boginski](#), [S Butenko](#)... - [European Journal of ...](#), 2014 - [Elsevier](#)

Abstract A connected dominating set (CDS) is commonly used to model a virtual backbone of a wireless network. To bound the distance that information must travel through the network, we explicitly restrict the diameter of a CDS to be no more than s leading to the ...

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An integer programming approach for fault-tolerant connected dominating sets

[A Buchanan](#), [JS Sung](#), [S Butenko](#)... - [INFORMS Journal on ...](#), 2015 - [pubsonline.informs.org](#)

This paper considers the minimum k -connected d -dominating set problem, which is a fault-tolerant generalization of the minimum connected dominating set (MCDS) problem. Three integer programming formulations based on vertex cuts are proposed (depending on ...

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Title	1-20	Cited by	Year
Modeling hop-constrained and diameter-constrained minimum spanning tree problems as Steiner tree problems over layered graphs	L Gouveia, L Simonetti, E Uchoa Mathematical Programming 128 (1-2), 123-148	76	2011
Bilevel optimization applied to strategic pricing in competitive electricity markets	M Fampa, LA Barroso, D Candal, L Simonetti Computational Optimization and Applications 39 (2), 121-142	56	2008
Reformulations and solution algorithms for the maximum leaf spanning tree problem	A Lucena, N Maculan, L Simonetti Computational Management Science 7 (3), 289-311	23	2010
The minimum connected dominating set problem: Formulation, valid inequalities and a branch-and-cut algorithm	L Simonetti, AS Da Cunha, A Lucena Network Optimization, 162-169	14	2011
Hybrid heuristics for a short sea inventory routing problem	A Agra, M Christiansen, A Delgado, L Simonetti European Journal of Operational Research 236 (3), 924-935	13	2014
Modelling the hop-constrained minimum spanning tree problem over a layered graph	L Gouveia, L Simonetti, E Uchoa International Network Optimization Conference	12	2007
Benders decomposition, branch-and-cut, and hybrid algorithms for the minimum connected dominating set problem	B Gendron, A Lucena, AS da Cunha, L Simonetti INFORMS Journal on Computing 26 (4), 645-657	11	2014

Google Scholar

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Breno Piva
Luis Gouveia
Pedro Henrique González
Carlos Alberto Martinhon
Igor Machado Coelho

Pitfalls

- Starting research too late
- Sticking with a topic that's going nowhere
- Waiting on your adviser to push you
 - Push them! (kindly 😊)
- Failing to polish a paper

CV

- Create one now
 - What do you want it to look like when you graduate?
- Learn by reading other academics' CVs
- Have distinct headings/sections for:
 - Published/accepted papers
 - Working/submitted papers (if at all)
 - Some discourage including this. (I think it's fine---especially if you can link to a preprint.)
 - Conference presentations (if at all)
 - I think it's fine---especially as a grad student.
- Keep a current version on your webpage



Questions?