

Dear Students,

Beyond what we covered in class, I would strongly suggest finishing reading Chapter 11 which gives an overview of methods for solving **integer programming** problems. The modeling discussion in Chapters 10 and 12 is important and useful for those interested in applications.

If you want to go beyond what's covered in our textbook on Integer Programming, then Nemhauser & Wolsey, *Integer & Combinatorial Optimization*, is considered a classic but it's not very reader friendly. Wolsey, *Integer Programming* together with Chen, Batson, Dang, *Applied Integer Programming*, might be easier to follow. *Optimization over Integers* by Bertsimas & Weismantel is another good option.

Other than Simplex Algorithm(s), the other family of methods used in practice to solve LPs is Interior Point method(s). Chapter 9 gives a nice overview of these.

**Network optimization** is fundamental to a wide variety of applications from ECE, CS, Transportation engineering, to Biology and more. The starting point for solving these problems is Linear programming. Chapter 7 gives a good overview of its basic techniques, especially by interpreting Simplex methods in terms of network structures. The Network Simplex algorithm is especially beautiful and practical (I talked about it in the last lecture discussion). If you want to go beyond what's covered in our textbook on network optimization, then *Network Flows* by Ahuja, Magnanti & Orlin is a classic for optimization over networks. In general, network flow problems form a subclass of what is called Combinatorial optimization, essentially optimization over discrete structures (not just calculus, but even linear algebra is often useless here). *Combinatorial Optimization* by Korte & Vygen is an excellent book for this topic.

If you want to go beyond linear optimization, I would suggest starting with the excellent textbook on **Convex Optimization** by Boyd & Vandenberghe  
<https://web.stanford.edu/~boyd/cvxbook/>  
Many ideas from linear optimization generalize naturally (with some limitations) to convex optimization.

For **nonlinear optimization** checkout the aptly named book by Bertsekas.

For a detailed survey of algorithms for all sorts of optimization problems (linear/nonlinear, etc.) try Nocedal & Wright, *Numerical Optimization*.

**There is so much more to learn, discover and create!** Don't hesitate to ask. I hope you feel confident in your ability to understand and apply ideas from this course as you go beyond just simple, mechanical applications of linear optimization (and even more fundamentally, applications of linear algebra).

I am always available if you need any help learning mathematics at any time.

I hope to see you in my classes, or at least hear from you, in the future. Although the course is over, I am always available to listen and to help.

Related to this, I also want to dispel a notion many students have - that teachers only like or respect "A" students. Your teachers and mentors respect you as a person, not as a grade-producing blackbox. Majority of my past students who are still in touch with me, received grades like B,C,D, W, or even E. The point of saying this is that don't hesitate to ask your teachers for help regardless of what your grade or performance is. We do not know the circumstances of your life and your life's journey. We understand (and hopefully you do too) that the worth of a person does not come from their grades or money or any such extrinsic quality.

Our success is NOT measured by exams and grades, but by our individual progress on our own path to learning with understanding. Pursuit of knowledge, and learning with understanding gives us direction and can keep us calm and graceful under pressure of exams, projects, and such. I am purposefully using 'us' and 'our' here, because your teachers are fellow travelers on the same path; and wish for nothing more than you to join them on this journey.

I wish you the best in all your future endeavors.  
Take care and be kind not just to others but also to yourselves.

Hemanshu

p.s. Here is a wish, in the words of A.R. Ammons, for each one of you:

*May happiness  
pursue you,*

*catch you  
often, and,*

*should it  
lose you,*

*be waiting  
ahead, making*

*a clearing  
for you.*