

CMSC 691 Optimization, VCU
Fall 2016, Course Project
Due: Friday, December 9, 2016 in class

Total marks: 30 marks.

One of the goals of this course is to start making you comfortable with adapting tools from class or your own reading to your research. For this reason, for your project, you will complete precisely one of the following two options (you are free to pick whichever of the two options you prefer; however, to encourage independent research, I will grade option 1 more leniently than option 2!):

1. (Independent research) For this option, you can pick any research problem within your general area of research, and try to model and/or solve your problem via tools from class. You will **not** be marked based on whether you solved the problem or not; rather, you will primarily be graded based on three criteria:
 - (a) (10 marks) **Problem Statement:** How well do you formalize and explain the problem you are interested in? Can you demonstrate that you have understood the problem and its significance?
 - (b) (10 marks) **Expected Outcomes:** Can you correctly model your problem as an optimization problem? Can you argue why you believe the techniques from class might prove useful in studying your problem?
 - (c) (10 marks) **“Actual Work”:** Do you make a reasonable and correct attempt at applying the techniques from class? Do you formally and correctly document the results of your attempts? Can you outline future open questions or research directions worth pursuing?

2. (Independent learning) An important part of research is independently learning new techniques to apply to your problem. For this option, pick a research paper related to optimization, and summarize the main ideas behind the paper. Your summary should consist of three parts:
 - (a) (10 marks) **High-Level Overview:** Can you justify why you chose this research paper, i.e. why is it significant? What are the main contribution(s) of the paper at a high-level? Can you briefly summarize the techniques used to show the main results without going excessively into detail?
 - (b) (10 marks) **Logical Structure of Paper:** What are the main components of the paper? How do they fit together to prove the claimed results (i.e. how is one lemma used to show another theorem)?
 - (c) (10 marks) **Proofs of claims:** You likely will not be able to summarize the proofs of the paper into the length requirements for this project, so choose one or two of what you feel are the most significant technical lemmas/theorems in the paper and summarize their proofs (i.e. technical details, written cleanly, concisely, and with proper explanations are required here). Can you justify why you felt these lemmas/theorems were the most significant? Can you highlight any particular technical tools used in these proofs which might find uses elsewhere?

Format: Your project should be:

- Prepared in LaTeX.
- Be about 2 to 4 pages long (2 pages is only allowed if you do the independent research option; for the independent learning option, the minimum is 3 pages), single spaced, 11 point font with normal margins.
- Have roughly the following sections in this order: Abstract, Introduction (containing statement of results, overview of proof techniques, significance, etc), Organization of Paper, Preliminaries, Technical Content. See e.g. <https://arxiv.org/abs/1409.3182> for an example of how to set such a paper up. The goal is to get you comfortable with writing research papers here.