# Class Project

Choose an academic journal article published on a topic we have or will cover in class or is listed in the additional areas. Sample articles follow the writing instructions, but feel free to use Google Scholar (https://scholar.google.com/) and key terms such as "Genetic Algorithm", "Metaheuristic", "Integer Program", etc. to find an application you are interested in (try and focus on papers since 2010). All questions might not be applicable to all papers, but if possible, try and speak to as many as possible. Add any additional discussion you find interesting related to the topic and paper, the questions are mostly meant as a starting point. When referencing other papers use parenthetical citation e.g. (Dantzig et al. 1954) and a bibliography at the end. Aim for about 3 pages 1.5 spaced, but feel free to use additional space if needed.

## The Problem

Discuss the problem being addressed by the paper. If the problem is a general abstraction of a class of problems discuss the applications of these problems. How will solving this problem affect businesses and people? If possible, address the scope of the issue (i.e. If the paper is on ER nurse scheduling, try and find out how many ER nurses there are or how many people are treated in ERs every year, etc). Does the paper mention what system or decision-making process is currently in place (i.e. how are ER nurses typically scheduled)? Do you feel there were any gaps in explaining the context of the problem?

## The Methodology

Describe the methodology of the paper. What other methods do the mention in their literature review? What tools are the authors using in order to address the problem? Do you think the authors results merit the complexity of their approach? If they are using a simple method, are you surprised by how it performs? What baselines or previously published work do the authors compare their results to? How does the work relate to what we have covered in class? Feel free to use any tables or figures from the paper that you feel

## Implementation

Who or how would the solution or methods of the paper be implemented in real life? (i.e. a hospital administrator would adopt new ER nurse scheduling guidelines or software) Does the paper mention any challenges that might arise from trying to implement their solution or have they already tried?

## General Review

What were your thoughts on the paper? Do you have any questions you would ask the authors? What additional research might you want to see done? What real world nuances do you think might have been simplified in their treatment of the problem?

**Additional Topics:**

1. **Robust Optimization**
   **Example**: Gabrel, Virginie, Cécile Murat, and Aurélie Thiele. "Recent advances in robust optimization: An overview." *European journal of operational research* 235.3 (2014): 471-483. [Survey papers like this are a great way get an idea of available approaches as well as active areas of research]
2. **Stochastic Optimization**
   **Example**: Kingma, Diederik P., and Jimmy Ba. "Adam: A method for stochastic optimization." *arXiv preprint arXiv:1412.6980* (2014). [An extremely influential paper in machine learning]
3. **Game Theory/ Information Asymmetry**
   **Example:** Marden, Jason, Shalom Ruben, and Lucy Pao. "Surveying game theoretic approaches for wind farm optimization." *50th AIAA aerospace sciences meeting including the new horizons forum and aerospace exposition.* 2012. [An interesting application allows for distributed decision making, which can be easier to implement that a central planner type model]

**Example Papers**

Asterisks imply comments after citation

Alshibli, Mohammad, et al. "Disassembly sequencing using tabu search." Journal of Intelligent & Robotic Systems 82.1 (2016): 69-79.

Barnes, Sean L., et al. "Preventing the transmission of multidrug-resistant organisms (MDROs): modeling the relative importance of hand hygiene and environmental cleaning interventions." *Infection control and hospital epidemiology: the official journal of the Society of Hospital Epidemiologists of America* 35.9 (2014): 1156.

Lee, Bruce Y., et al. "A computer simulation of employee vaccination to mitigate an influenza epidemic." *American journal of preventive medicine* 38.3 (2010): 247-257.

Li, Xinyu, and Liang Gao. "An effective hybrid genetic algorithm and tabu search for flexible job shop scheduling problem." International Journal of Production Economics 174 (2016): 93-110.

Macal, Charles M., et al. "Modeling the transmission of community-associated methicillin-resistant Staphylococcus aureus: a dynamic agent-based simulation." *Journal of translational medicine* 12.1 (2014): 1-12.

*Mafarja, Majdi M., and Seyedali Mirjalili. "Hybrid whale optimization algorithm with simulated annealing for feature selection." Neurocomputing 260 (2017): 302-312. [There are a lot of biologically inspired algorithms in the metaheuristic space feel free to also search for ant colony optimization, artificial bee colony, etc.]

Mirjalili, Seyedeh Zahra, et al. "Grasshopper optimization algorithm for multi-objective optimization problems." *Applied Intelligence* 48.4 (2018): 805-820.

Sener, Ozan, and Vladlen Koltun. "Multi-task learning as multi-objective optimization." *Advances in Neural Information Processing Systems*. 2018.

Tjeng, Vincent, Kai Xiao, and Russ Tedrake. "Evaluating robustness of neural networks with mixed integer programming." *arXiv preprint arXiv:1711.07356* (2017).

*Vidal, Thibaut, et al. "A unified solution framework for multi-attribute vehicle routing problems." *European Journal of Operational Research* 234.3 (2014): 658-673. [This paper really highlights the power of a metaheuristic approach and shows its flexibility]

Vincent, F. Yu, et al. "A simulated annealing heuristic for the hybrid vehicle routing problem." *Applied Soft Computing* 53 (2017): 119-132.