#### MAE / ENE 539

#### Optimization Methods for Energy Systems Engineering

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Fall 2020

***Homework 1 (HW1)***

Posted: Wednesday, September 9th

**Due: Monday, September 14th, before 8pm**

**10 points in total for this assignment (and worth 5% of total course grade)**

**Question 1. Working with your first model (5 points)**

For Question 1, load the IJulia/Jupyter notebook from the Github at <https://github.com/east-winds/power-systems-optimization/tree/master/Homeworks> and complete this question in the Notebook. Provide answers in the blank cells provided in the Notebook and save your Notebook and upload along with your answers to Question 2.

**Question 2. Problem formulation exercise (5 points)**

Part Tiger Electronics Co. has three factories that must produce at least 30 circuit boards and 6 smart phones for sale over the next 3 days.

Factory 1 can produce at most 50 circuit boards per day at a cost of $5 per board.

Factory 2 can produce 10 processor units per day at a cost of $10 per processor.

Factory 3 can produce 2 smart phones per day at a cost of $50 per phone and must consume 5 circuit boards and 1 processor to produce smart phone.

Circuit boards sell for $6 per board, processor units sell for $15 per unit, and smart phones sell for $200 per phone.

Tiger Electronics has 150 silicon wafers in inventory for the next three days (assume it cannot get another shipment until day 4) and it takes 2 silicon wafers to produce a circuit board and 1 silicon wafer to produce a processor.

Assume for simplicity that Tiger Electronics can produce fractions of a product but cannot produce a negative quantity (e.g. the quantities for all products can take any continuous non-negative values). Also assume that circuit boards and processors can be shipped and consumed in the smart phone factory immediately during the same day they are produced at the other factories and that the required shipments to customers are not made until after the end of Day 3.

Tiger Electronics Co. wants to maximize revenue over the following 3 days. What quantities should it produce at each factory?

1. What are the **decision variables** in the above problem? Describe them (textually) and then assign them to shorthand variables of your choice (write the variables). Are these decision variables indexed across any **sets**? If so, describe how you define the sets.
2. Write down a set of linear constraints that define the feasible region for this problem, over the domain of the decision variables. Feel free to make use of set and sum notations to write the constraints compactly.

1. What is the **objective function** of this problem? Write it algebraically as a linear function of the decision variables described above (please simplify terms as much as possible, although this will not impact your grade for this part).