Math 377 Final Group Project

Group project report due on Monday April 25
Group presentation by appointment on or before April 25

Choose **ONE** of the following suggested project.

1. Fishery: (for those who have taken or are taking Math 342) Model the interaction among the fish population and the size of fishing fleet through profitability, and discuss the dynamics, e.g., under what condition do you expect the fish population to eventually crash, or to settle down at an equilibrium?

2. Fishery: Assume that the spawning season of a fish is from the beginning of February to the end of March. Find the optimal strategy for setting the fishing season.

3. The whooping crane population in US is given in the attached CSV file. It is interesting to see that the population has a mild oscillation while growing roughly exponentially. Explain the oscillation and the exponential growth using a mathematical model (e.g., you may consider the age structure using the Leslie model, or temperature variations, or come up with other hypothesis).

   (a) Develop such a model, explain why the model may give oscillations and exponential growth, and fit the model to the data.

   (b) Use your best estimate to stochastically simulate of this population 100 times, and compare the average of the 100 simulations to the data.

   (c) Do the simulate results reflect the assumptions of your fitting method? Is there a way to improve the fitting?

4. Drug concentration. Incorporate the dissolving process into the drug concentration model that we studied on March 14. Assume that the drug may be absorbed in the intestine (for a duration of 4 hours on average). For simplicity, let us only consider the dissolving process and ignore the absorpsion process. How should we choose the pill shape and the solutibility product constant K_{sp} to maximize the average drug concentration? You may compare a few choices for the shape, and use either numerical examples or theoretical analysis to study it.