Due data: 5/13/2020, end of the day. **Please submit the following 2 files via Canvas:**

1) For question 1, please submit in a word file or a PDF file;
2) For question 2, please submit a **.ipynb** file (Python jupiter notebook file).

Question 1 (30 points):

1) Please explain the pros and cons of Instance-Based Learning and Model-Based Learning respectively. (7 points)
2) Explain what is Distance Weighted kNN. (5 points)
3) Please draw the diagram of Convolutional Neural Networks (CNN). Then explain the functionality of each layer of CNN. Name several latest algorithms of CNN (e.g., AlexNet). (10 points)
4) When training deep networks using Backpropagation, one difficulty is so-called "diffusion of gradient", i.e., the error will attenuate as it propagates to early layers. Please explain how to address this problem. (8 points)

Question 2 – Programming (30 points):

Design a genetic algorithm to solve the polynomial fitting problem that we did in Homework #1.

Lecture 10 page 35 gives the pseudo-code for a **mutation**-only algorithm. You can simply implement this algorithm. Plot the original noisy data, the polynomial you obtained in Homework #1, and the polynomial you obtained from the genetic algorithm in the same figure for comparison.

[Bonus: 5 points] Implement the genetic algorithm with BOTH **mutation** and **crossover** operations (you decide the mutation rate and crossover rate). Plot the original noisy data, the polynomial obtained from this implementation, and the polynomial from the mutation-only genetic algorithm for comparison.

[Hint: Please refer to Lecture 10 page 33 – 36 and Mitchell textbook section 9.2]