Homework 1

DS 440 Data Mining

Maximum points: 100

Due: September 28 (Wednesday), 11:59pm

Question 1: (20 points)

Fibonacci sequence (F_n), is defined as a sequence of numbers such that each number is the sum of two preceding ones starting from 0 and 1 ($F_0 = 0$ and $F_1 = 1$). Hence, we have the following value at n^{th} position

$$F_n = F_{n-1} + F_{n-2}$$

Write a python function that takes the number of elements the user wants in the generated Fibonacci sequence as a parameter. The function should return the generated Fibonacci sequence when called. Hence,

- For user input n = 0, function should return [ ]
- For user input n = 1, function should return [0]
- For user input n = 2, function should return $[0, 1]$
- For user input n = 3, function should return $[0, 1, 1]$ .. and so on

Question 2: (20 points)

Write a function in python that takes a list of numbers from the user and returns a different list which only contains those numbers from the original list that are within the range $[\mu - \sigma, \mu + \sigma]$. Here μ and σ are the mean and standard deviation of numbers in the original list.

Question 3: (30 points)

Write a function in python that takes a list (or an 1 dimension array) from the user as a parameter and

1. (**10 points**) Inserts a 0 at the second last position. For example if list was [0,1,2,3], then the modified list would be [0,1,2,0,3]

2. (**10 points**) Then checks for all the duplicates in the list and removes them. For example if the list was [0,1,2,0,3], then after removal it will become [0,1,2,3], i.e. always keeps the first instance of the number to be removed.

3. (**10 points**) Then finds the location of the 3rd smallest number in the list. For example if the list was [0,1,2,3], the location would be 2.

The function should return the final modified list and the location found in part 3.

Question 4: (30 points)

Write a python function that takes an integer (n) as an input and:

1. (**10 points**) If the integer is less than 1, the function should print an error message and return nothing.

2. for other cases:

   (a) (**10 points**) Returns a numpy array with a checkerboard pattern. For example if user provides n = 5 to the function, then it should return the 5x5 array

$$\begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$

   (b) (**10 points**) Plots the checkboard pattern as an image with grayscale colormap.