Computer Science Department
CS632P – Topics Python Programming
Spring 2021

Final Exam

<Q1>
a) Create a Pandas dataframe (df1) with three (3) columns: Student-ID, Student-Name, Student-Major.
   Populate the dataframe with these lists of data:
   list1 = [1,2,3,4,5,6,7,8,9]
   list2 = ["John", "Mary", "George", "Anne", "William", "Britany", "Steve", "Kathy", "Michael"]
   list3 = ["CS", "CSIS", "Biology", "Math", "CS", "CSIS", "Math", "Biology", "CS"]
b) Write up a statement to filter (show only) students with Major 'CS' or 'CSIS'

<Q2>
a) Create an identical copy of the dataframe df1, from question Q1, call it df2. Make sure df2 has the exact copy as df1 but no data (not even NaN values).
b) Populate the df2 dataframe with these two (2) records:
   10, "Gregory", "CS"
   11, "Valerie", "Biology"
c) Create a new dataframe, call it df, by merging df1 and df2.

<Q3>
   a) Create a 6x6 matrix of zeros (0) and then frame it with a border of ones (1).
   b) Create a 6x6 matrix with its left diagonal of ones (1) and its right diagonal of minus ones (-1).

<Q4>
   a) Write a function that generates an nxn array (assume elements of the array are numbers only) with (i,j)-entry equal to i+j
   b) Device a function that takes as input an mxn array (assume elements of the array are numbers only) and returns 3 numbers:
      1- Sum of all numbers in the array
      2- Sum of numbers in all rows
      3- Sum of numbers in all columns

<Q5>
Create a list (l_all) of one million entries (range(1,000000)). Then create 2 lists as follows:
l_even: all even numbers from list l_all powered to 2
l_odd: all odd numbers from list l_all powered to 2
Then add the l_even and l_odd list element-wise to create the l_even_odd list.
Provide the total compute time, from start to end, in order to create the l_even_odd list.

Create the same l_even_odd list by using Python's multiprocessing module.
Provide the total compute time in order to create the l_even_odd list, respectively.

Pace University   Seidenberg School of Computer Science   Prof. Sarbanes

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