Welcome to Data Structures & Algorithms

Or, how to pass technical interviews given by programmers

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Course contents

https://github.com/parrt/msds689

- A formula for problem-solving simple algorithm problems
- How to read code
- Core data structures, a unifying perspective
- Algorithm complexity analysis
- "*So much recursion!*" – MSDS2019 student comment
- Walking and searching data structures
- Sorting (with all of my dirty tricks)
- Graphs and graph algorithms

Course projects

- Convert htable project to object-oriented version (8%)
  - With some extensions
  - …and using somebody else's code from two years ago!
  - hint: it's kinda stinky code. ha!
- kmeans clustering, kmeans++ initial point selection (20%)
  - Spectral clustering using Breiman's unsupervised learning trick for RFs
  - Image compression applications
- Feature importance and selection (22%)
  - Permutation and drop column
  - Automatic feature selection
- Work as hard or as little as you want (I give no unit tests)
  - grader will assign check -, check, check+ based upon your reports

https://github.com/parrt/msds689/blob/master/projects/oohtable/oohtable.md
https://github.com/parrt/msds689/blob/master/projects/kmeans/kmeans.md
https://github.com/parrt/msds689/blob/master/projects/featimp/featimp.md

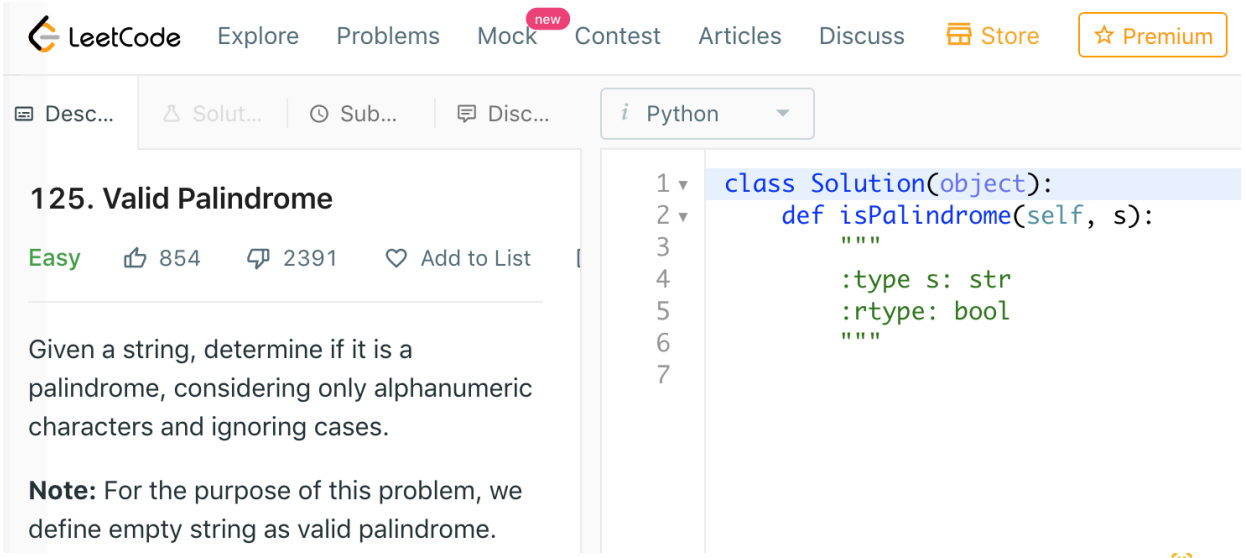
Student evaluation

Please note grader will take at least a week to grade projects, but I'll grade exams quickly

Artifact	Grade Weight	Due date
OO hashtable	8%	Fri, Jan 31 11:59pm
Clustering	20%	Sun, Feb 16 11:59pm
Feature selection and importance	22%	Wed, Mar 4 11:59pm
Exam 1	20%	3:15PM-4:15PM Thur Feb 13
Exam 2	30%	10AM-11:00AM Fri Mar 6

Extra things you can do

- Lots of little practice quizzes; e.g., https://github.com/parrt/msds689/blob/master/labs/quiz-oo.ipynb
- LeetCode algorithm and data structures challenges. e.g., https://leetcode.com/problems/valid-palindrome/



Resources

- A great free book on algorithms by Jeff Erickson
- Kleinberg and Tardos, *Algorithm Design*
  - Please see compressed pdf kleinberg-common-running-times.7z in Canvas course files area (do not post material publicly please)
- A very useful set of programming-concepts-for-data-science and data science coding questions by former USF MSDS student Shikhar Gupta
- 10 steps to solving a programming problem
- A review OO notebook and Operator overloading notebook

Administrivia

- The usual academic honesty rules will be enforced; in projects, reports, exams or any other artifact; Honor Code
  - Do not represent another person's work as your own
  - Don't leave your laptop unattended/unlocked; others can take a picture of your code or simply use a USB key quickly
- Students with Disabilities
  - If you are a student with a disability or disabling condition, or if you think you may have a disability, please contact USF Student Disability Services (SDS) for information about accommodations.
  - More details on the course syllabus: https://github.com/parrt/msds689

Why this course, why now?

- At least for the moment, many of the people interviewing you will be programmers, pretending to be data scientists
- What do they know? Programming, data structures, and algorithms
- Being able to organize data within a machine or cross machines is a key skill for a data scientist
- The larger the data, the more critical it is to understand how to measure algorithm performance and how to design efficient solutions
- Optimally, this course would be much earlier, but the timing is good for your interviewing and was only spot we could jam this course in