CS2040S Semester 1 2023/2024

Data Structures and Algorithms

Tutorial+Lab 05
Midterm Quiz/First Half Review; UFDS

For Week 07

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1 Introduction and Objective

In the early part of the tutorial component of this session, we will properly discuss the solutions and a few common mistakes that were found during grading over recess week. Then, we will discuss more of the short one-off `https://visualgo.net/en/ufds` in this tutorial. We will do a (much) longer a lab component today (a small warm-up for PE on Week 11).

2 Tutorial 06 Questions

Midterm Quiz Review

Q1). See the midterm quiz solution draft file that has been uploaded at Canvas before this tutorial. TA will do one quick (re-)presentation of the solutions and highlight the common mistakes. TA will open a 5-10m AMA (Ask Me Anything) session about that Quiz to give closure to all.

UFDS Review

Q2). Using `https://visualgo.net/en/ufds`, quickly review the `findSet(i)`, `isSameSet(i, j)`, `unionSet(i, j)` operations of the Union-Find Disjoint Sets (UFDS) data structure.

Q3). The basic UFDS data structure can be *augmented* to support extra operations. The first (and easiest) augmentation is to support `numDisjointSets()` query in $O(1)$ (instead of in $O(N)$). When we create a new instance of UFDS, we create N initially disjoint sets. Show how we can carefully track these information throughout various UFDS other operations!

Q4). The second (harder, but more versatile) augmentation is to support `sizeOfSet(i)` query in $O(1)$ (instead of in $O(N)$). This query reports the size of set that currently contains item i. Think of how to do this operation quickly and especially if two previously disjoint sets were merged into one!

Hands-on 5

TA will run the second half of this session with a few to do list:

- Review of our-own custom implementation of UFDS, see `https://github.com/stevenhalim/cpbook-code/blob/master/ch2/ourown/unionfind_ds.cpp`
- Do a sample speed run of VisuAlgo online quiz that are applicable so far, e.g., `https://visualgo.net/training?diff=Medium&n=5&tl=5&module=ufds`,
- Finally, live solve TWO chosen Kattis problem involving material from the **first half** of CS2040C (please treat this as a warm-up exercise for the upcoming Practical Exam (PE) that will be harder than this; or for preparation of the application question(s) in Midterm Quiz)

Problem Set 4

We will end the tutorial with a **short algorithmic** discussion of PS4.
As we still have Week 08 before PS4 is due, then TAs are not supposed to reveal the algorithmic ideas of the near 100+100 solutions publicly (yet).