

CS2040S Semester 1 2023/2024
Data Structures and Algorithms

Tutorial+Lab 10
Shortest Paths
For Week 12

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1 Introduction and Objective

In this tutorial, we will discuss the (second) last examinable topic for this course: Single-Source Shortest Paths (SSSP) problem and continue talking about the ‘graph modeling’ soft skill, i.e., ability to model a seemingly random (non-explicit-graph) problem into a graph problem (specifically the SSSP problem for this tutorial).

We will use <https://visualgo.net/en/sssp> during our discussion in this tutorial.

SSSP problem is quite easily found in many real life applications and it is the source of many interesting Computer Science problems, as you can see in this tutorial. Again, we recommend that you put some thoughts on them before discussing the potential solutions with your tutor.

Standard Stuffs

During week 11 and also during your self-study via VisuAlgo /sssp e-Lecture/exploration mode (and a bit more later during week 12b as we need to use week 11b time for Practical Examination), you were presented with these SSSP algorithms: BFS (only for unweighted graph) and Dijkstra’s algorithm (only the original version first).

First, the tutor will (re-)demonstrate the executions of BFS and/or Dijkstra’s algorithms on a small directed weighted graph using <https://visualgo.net/en/sssp> from a certain source vertex s . The tutor will re-explain when a certain algorithm can be used and when the same algorithm cannot be used. The tutor may invite some students to do this live demonstration using different source vertex s and/or using different graph.

Graph Modeling Exercises, via Past Paper Discussions

There are a few graph questions in recent final assessment papers. Let's discuss two of them (considering that SSSP has not yet been examined in our recent Practical Exam, you can bet that there will be SSSP question(s) in the Final Assessment):

1. <https://www.comp.nus.edu.sg/~stevenha/cs2040/tests/CS2010-2013-14-S1-final.pdf>, Question 4.1, Facebook Privacy Setting
2. <https://www.comp.nus.edu.sg/~stevenha/cs2040/tests/CS2040-2017-18-S4-final.pdf>, Question C.1, SSSP in a Special "SLL"

Hands-on 10

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

- One last speedrun most of VisuAlgo Online Quiz3 topics (on Medium Setting, as student's VisuAlgo account cannot do this on Hard setting):
<https://visualgo.net/training?diff=Medium&n=4&t1=4&module=ufds,graphds,dfsdfs,sssp>
- Share any last minute tips for VA OQ preparation based on TA's experiences
- Hands-on: One task about SSSP.

Problem Set 6

We will end the tutorial with **high-level** discussion of PS6.

We can now discuss more ideas of PS6 A+B (not necessarily until the final subtask).