

CS2040S Semester 1 2024/2025
Data Structures and Algorithms

Tutorial+Lab 11
Minimum Spanning Tree and Finale
For Week 13

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1 Introduction and Objective

In this tutorial, we will discuss the last examinable topic for CS2040S: Minimum Spanning Tree (this topic, including its pre-requisite UFDS for Kruskal's algorithm, is not included in IT5003).

We will use <https://visualgo.net/en/mst> (and indirectly <https://visualgo.net/en/ufds>) during our discussion in this tutorial.

This session also serves as another open slot for past paper discussions.

We will also do a quick class photo taking session.

Attendance/participation marks will be finalized after this session.

2 Discussion

MST Review

In this segment, we spend some time discussing MST problem and its associated algorithms: Prim's and Kruskal's. Here are some possible discussion pointers:

1. What are the differences between (Single-Source) Shortest Paths and Minimum Spanning Tree?
Follow up: What are the similarities between the two (that sometime caused the mix-up)?
2. Discuss two important properties of a generic MST algorithm:
 - (a) Cycle property: A max-edge in any cycle in the graph can never be part of any MST.
 - (b) Cut property: No matter how you cut the vertices of your graph, the minimum-weight edge that goes across the cut must be part of the MST.
3. Revise on how Prim's/Kruskal's apply the ideas of those generic MST algorithm.

Past Paper Discussions, Open Ended

Here is the list of final paper questions that Prof Halim found ‘interesting’ and ‘suitable’ for preparation of CS2040S final paper this semester. However, since they have been asked in the past, obviously none of them will appear in the real final paper this semester. Perhaps TA can just throw a vote and discuss the most voted question first, and then repeat this process until either time (maximum 1 hour, as we need the 2nd hour for one last hands-on exercise on MST) runs out (more likely) or all proposed problems below have been discussed (less likely).

1. <https://www.comp.nus.edu.sg/~stevenha/cs2040/tests/CS2010-2015-16-S1-WQ2-medium.pdf>, Question C.1, Graph Traversal
2. <https://www.comp.nus.edu.sg/~stevenha/cs2040/tests/CS1020E-2016-17-S1-final.pdf>, Question B.1, Printing Integers
3. <https://www.comp.nus.edu.sg/~stevenha/cs2040/tests/CS2040C-2018-19-S2-final.pdf>, Question B.2, Interesting Variants
4. <https://www.comp.nus.edu.sg/~stevenha/cs2040/tests/CS2040S-2023-24-S1-final-no-MCQs.pdf>, Question B.3., Alternative Shortest Path

Hands-on 11

TA will run the second half of this session with just two to do list (as there is no more PS):

- Although the last VA OQ 3 has been conducted last week, we can still do this:
<https://visualgo.net/training?diff=Medium&n=5&t1=5&module=mst>
- Hands-on: One task about MST.

Class Photo

Let’s take a class photo with your tutor as momento (and post the photos in Discord).

All the best for your final assessment of this course and of your other courses.