MONASH University

MONASH
INFORMATION
TECHNOLOGY

FIT2004
Algorithms and Data Structures

Ian Wern Han Lim
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Referencing materials by
Nathan Companez, Aamir Cheema, Arun Konagurthu and Lloyd Allison

GROUP OF EIGHT AUSTRALIA

Faculty of Information Technology, Monash University

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Ready?

Agenda

- Lecture and Studio
- Sanity Check

- Microsoft Teams
- Consultations

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Let us begin…

Lecture and Studio
Arrangements

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- No live classes.

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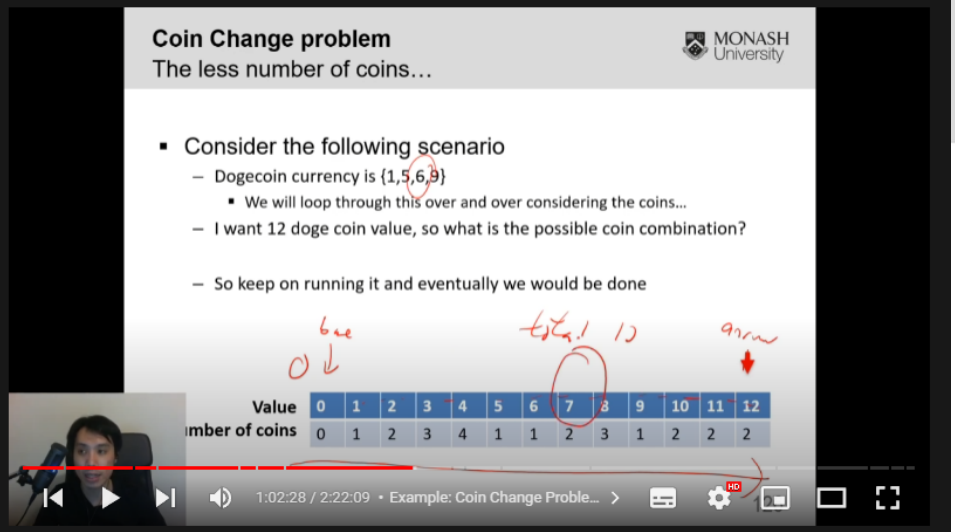


[FIT2004_2022sem01] Lecture06 DynamicProgramming

Unlisted

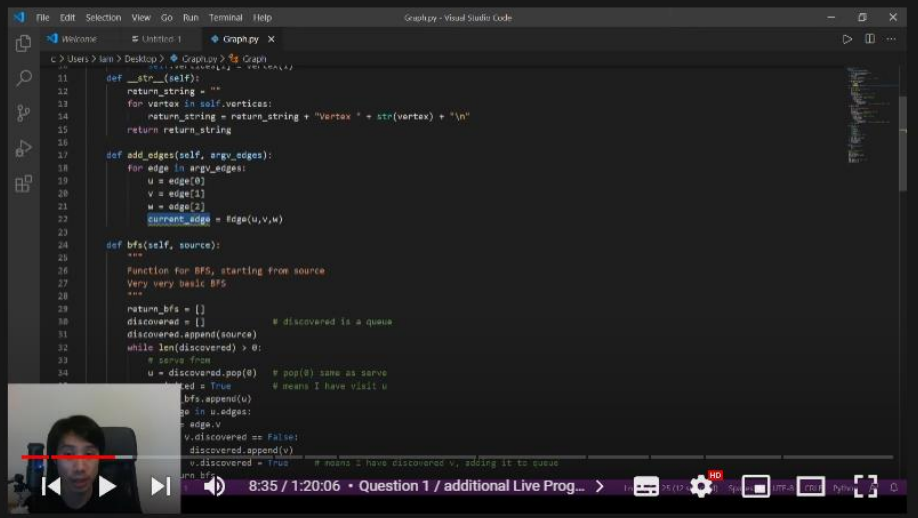
aecoian_Comp… 126 subscribers

ANALYTICS EDIT VIDEO 9 Dislike Share Clip …

1,040 views 2 Apr 2022 FIT2004 Lecture06 Dynamic Programming
Recorded from 2020 semester 01.
All context are based on the recorded semester.

00:00:00 Introduction.
00:06:48 Brute forcing solution and repetitions. This lead us to memoization for such repetitions.
00:17:58 Example: Fibonacci using DP.
00:21:25 Dynamic Programming vs Divide and Conquer. This helps us define what is a DP problem/ solution very clearly!
00:34:42 Why is DP important?
00:37:08 Why is DP hard?
00:41:20 Example: Coin Change Problem. Brute force, greedy and DP.
01:08:48 Top-down vs Bottom up. Which one to use?
01:10:35 Example: Knapsack Problem. Introduction
01:16:12 Example: Knapsack Problem (unbounded variant).
01:30:40 Example: Knapsack Problem (0/1 variant).
01:58:10 Space saving trick. Note, might not always work. This doesn't work if I want to have the combinations of item.
02:00:50 Example: Knapsack Problem (0/1 variant). Solution reconstruction using backtracking.
02:06:59 Example: Coin change. Solution reconstruction using decision array.
02:15:18 Backtracking vs Decision Array recap.
02:18:30 Example: Edit Distance. Skipped here, to be covered in the tutorial videos by linking it with another problem.
02:20:39 Summary of DP.

Comments Add a comment…



[FIT2004_2022sem01] Studio05 Q1Q2Q3Q4Q5Q6Q7 Graph BFS DFS

Unlisted

aecoian_Comp… 126 subscribers

ANALYTICS EDIT VIDEO 6 Dislike Share Clip …

815 views 29 Mar 2022 FIT2004 Studio 05 – Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q9
Recorded from 2020 semester 01.
Edited in 2022 semester 01 for updated question mapping.
All context are based on the recorded semester.

00:00:00 Introduction
00:02:34 Question 1 / additional Live Programming session
00:23:27 Question 1 with undirected graph
00:26:04 Question 2
00:29:00 Linking Question 2 to Question 4 (Reachability)
00:41:56 Question 5 (Colorability/Discoverability). You can link this with Question 9 on later, mainly just counting with the equation 2^{number_of_connected_components}
00:52:00 Question 7 old question
00:57:46 Question 3 (Looking for a cycle)
01:02:43 Question 6
01:09:50 Question 7 (Shortest Cycle)

Question 8 and Question 10 we will discuss about this more in the Sanity Check next week – linking with Dijkstra as well.
But do go through it on your own first.

Comments Add a comment…

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  - Easy to access, on all devices and stable across the world.
  - Playlist will be provided after Week12 for easy viewing.

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  - Higher production quality (?)
    - Depends when I record the video as my hardware has gone through a lot of upgrade cycles >.<

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  - Higher production quality (?)
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  - Comprehensive, without time limitations.

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Questions?

Break…

Sanity Check

The Live Session

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- Not a lecture

Sanity Check
The Live Session

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- Not a lecture
  - Reinforce and expand basic concepts from recordings.
  - Application of knowledge.
  - Question-based approach:
    - How are topics examined? With respect to prior semesters.
    - How are questions formulated? We create questions and solve them!
    - Responding to students' question? Fix any doubts.

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MONASH University

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MONASH University

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    - How are topics examined? With respect to prior semesters.
    - How are questions formulated? We create questions and solve them!
    - Responding to students' question? Fix any doubts.
  - Highly interactive, in a casual environment.
  - Using tools
    - Virtual whiteboards with INFINITE SPACE
    - Live coding sessions

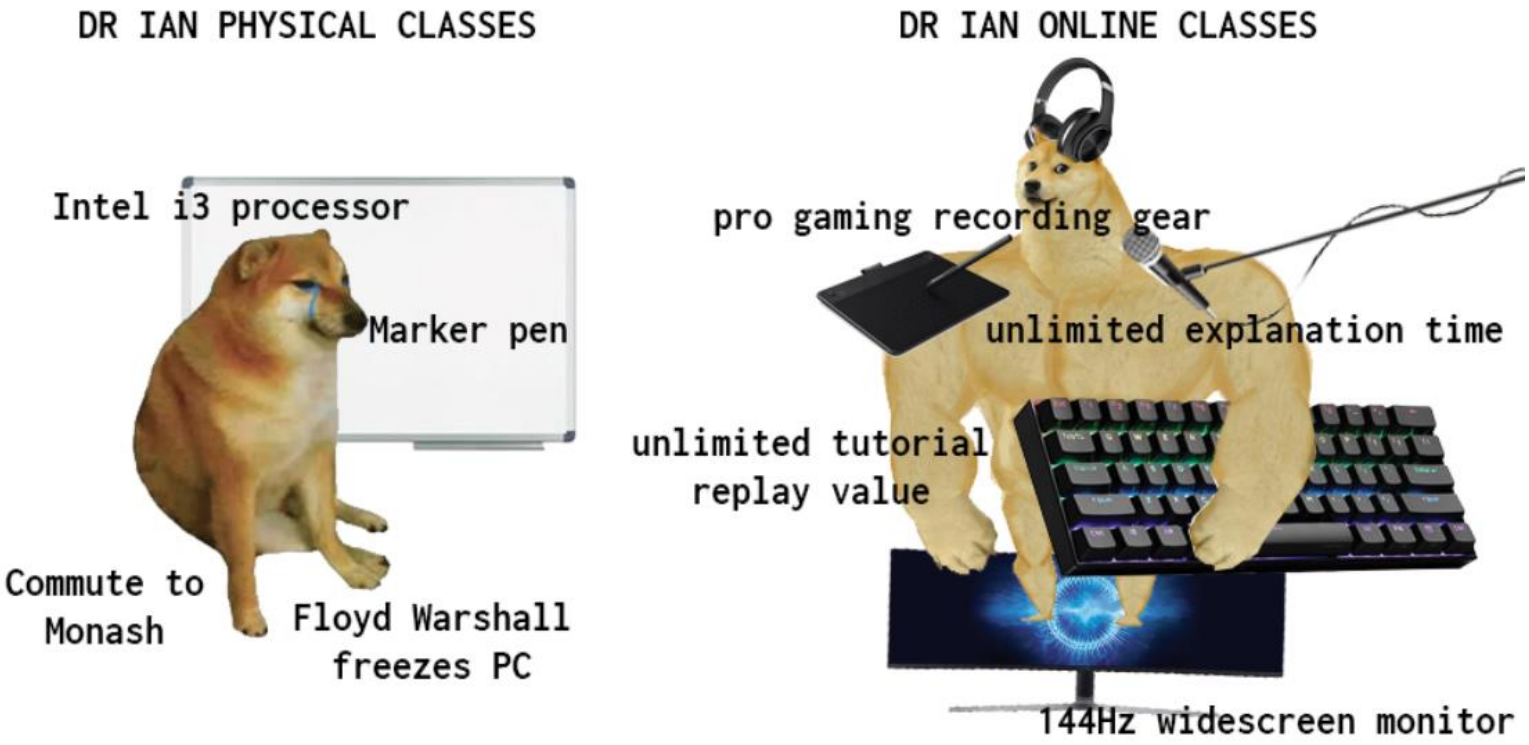
Sanity Check

The Live Session

- Zoom University?

Sanity Check
The Live Session

- Zoom University?



Sanity Check
The Live Session

- Classes are sent out as calendar invites:
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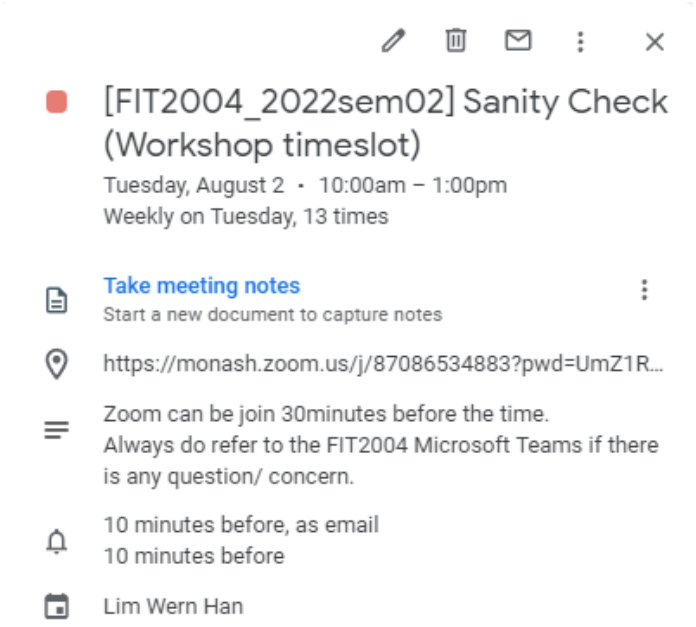
  - With ZOOM link, 1 quick click and you are in!
  - Know when classes are scheduled, rescheduled or cancelled easily.



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- Attendance is important!

The lecturer organises a "Sanity Check" every week that discusses the tutorials and assignments. It helps a lot for the overall understanding.

Sanity checks and recordings for every week's topic, tutorials

Weekly sanity checks and the way Ian explains the material

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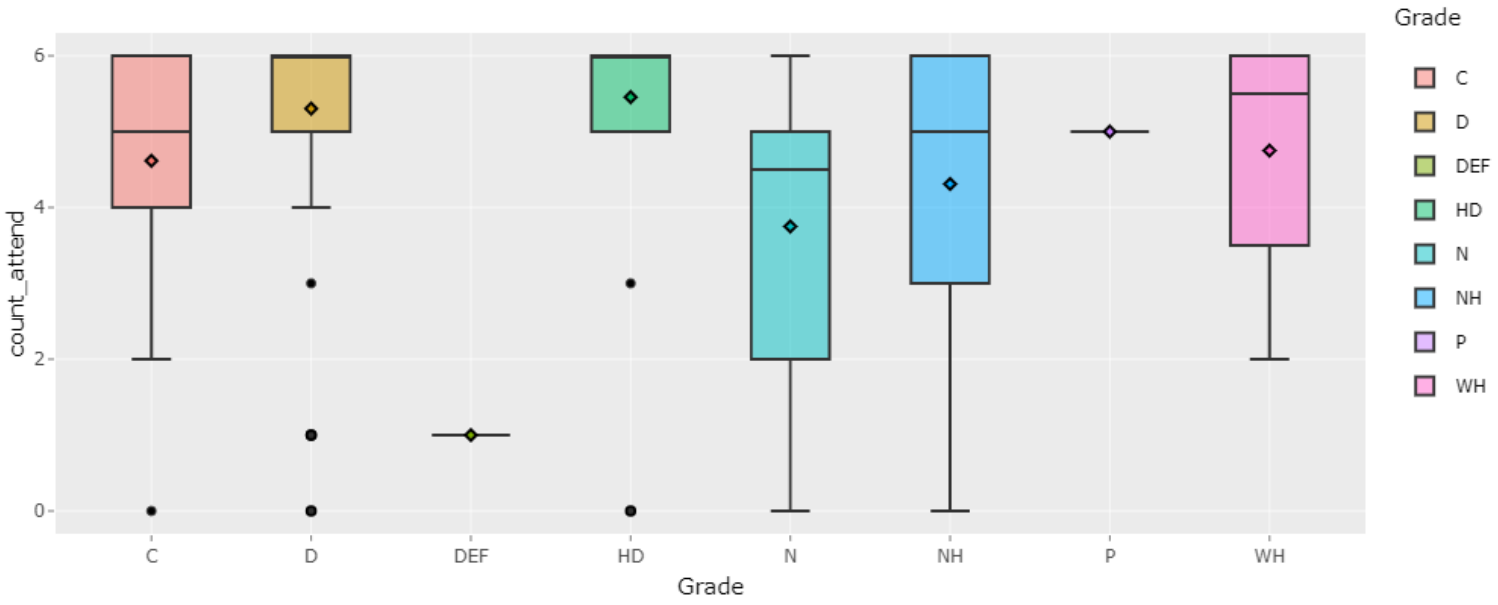

Sanity Check

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- Attendance is important!
- … and it WILL NOT BE RECORDED

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Questions?

Break…

Microsoft Teams

All the Resources

- Moodle
- Ed
- Microsoft Teams

Microsoft Teams

All the Resources

- Moodle
  - Clayton lecture
  - Clayton lecture recording
  - Tutorial materials
  - Assignment materials
  - Assignment submission
  - Quiz
- Ed
- Microsoft Teams

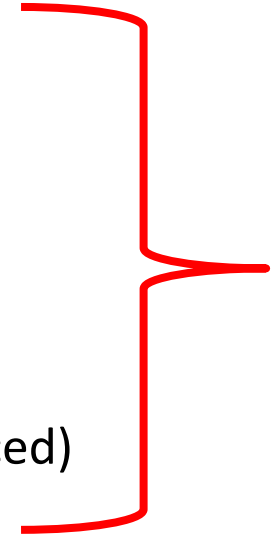
Microsoft Teams

All the Resources

- Moodle
- Ed
  - Forum for both campus.
  - Clayton announcements.
- Microsoft Teams

Microsoft Teams
All the Resources

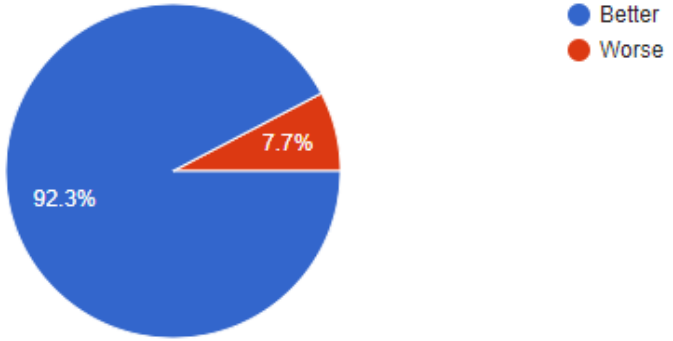
- Moodle
- Ed
- Microsoft Teams
  - Malaysia announcements
  - Malaysia lecture
  - Malaysia lecture recording (Youtube links)
  - Malaysia studio recording (Youtube links)
  - Extra assignment resources
  - Sharing of assignment test cases (crowdsourced)



They are pinned for quick access

Microsoft Teams
All the Resources

- Moodle
- Ed
- Microsoft Teams
  - Malaysia announcements
  - Malaysia lecture
  - Malaysia lecture recording (Youtube links)
  - Malaysia studio recording (Youtube links)
  - Extra assignment resources
  - Sharing of assignment test cases (crowdsourced)
  - You can react!
  - You can vote!
  - Proper code formatting for easy reading!
  - Notification control!



Lim Wern Han 03-19 01:38

Week04 and Week05 Lecture Materials

For this semester, Week04 and Week05 starts off with the Graph data structures and algorithms. This is usually done in Week08 but is now brought forward. Personally I do think that it is too early, but it is also good to get you interested on one of the most powerful data structures today.

In Clayton, the materials ordering is a little messy. Thus I am combining Week04 and Week05 together... Reason is that the flow of content is much better especially how learning BFS/DFS and then slowly modifying them for Dijkstra, Khan etc. In general, these algorithms are a combination of traversal (BFS DFS) with greediness.

Do note that these materials are recorded in the earlier semesters (when they were in Week08, Week10 and Week12). So do not be confused by that and read the Youtube descriptions always.

[FIT2004 2022sem01] Lecture04 P1 Graph BFS DFS; Lecture05 P1 Dijkstra
https://youtu.be/4zWk8kvVnlA
00:00:00 Introduction. What is a graph? Why it is important?00:24:49 Graph representation.
00:38:45 Live coding for graph ADT.
00:48:57 Graph traversal with breadth first search (BFS) and depth first search (DFS).
01:02:57 Live coding for BFS and DFS.
01:15:09 Shortest distance traversal, unweighted with BFS. We do a quick update in live coding to update BFS to find shortest distance.
01:27:25 Shortest distance traversal, weighted with Dijkstra. What is Dijkstra? How does it work? What is the preconditions? What is the complexity? Can we terminate earlier? An emphasis here is how to convert a regular BFS into Dijkstra with just a few lines.
01:53:40 Proof of correctness why Dijkstra work?
02:01:02 Conclusion, recap and moving forward.

[FIT2004 2022sem01] Lecture04 P2 DirectedAcyclicGraph
https://youtu.be/XNhLYJRz7E4
00:00:00 Introduction.
00:00:55 What is DAG? What are DAG in real life, and some of the applications for topological sort?
00:21:15 Topological sort with Kahn's algorithm and how it is implemented.
00:33:04 Live programming session concerting BFS to Kahn's.
00:38:37 Topological sort with DFS.

[FIT2004 2022sem01] Lecture05 P2 MinimumSpanningTree PrimKruskal
https://youtu.be/ZhP4GmMQN_o

[FIT2004 2022sem01] Lecture05 P2 MinimumSpanningTree PrimKruskal
https://youtu.be/ZhP4GmMQN_o
00:00:00 Introduction.
00:15:18 Prim's algorithm.
00:21:20 Kruskal's algorithm. Here we include a new data structure known as the Disjoint-Set data structure that is used for Union-Find operation. You can recognize this data structure by the use of a parent array.
01:02:00 Proving the greediness of Prim's and Kruskal's to be working. This is done via proof by contradiction.
01:28:28 Prim's and Kruskal with negative edges.

See less

Lecture04_p1_Graph_Tra... ⋯ Lecture04_p2_DirectedA... ⋯ Lecture05_p2_Minimum... ⋯

Collapse all

03-19 16:43
Hi sir, does that mean Week 5's forum session will be covering everything above?

*Week 5 and 6's forum session

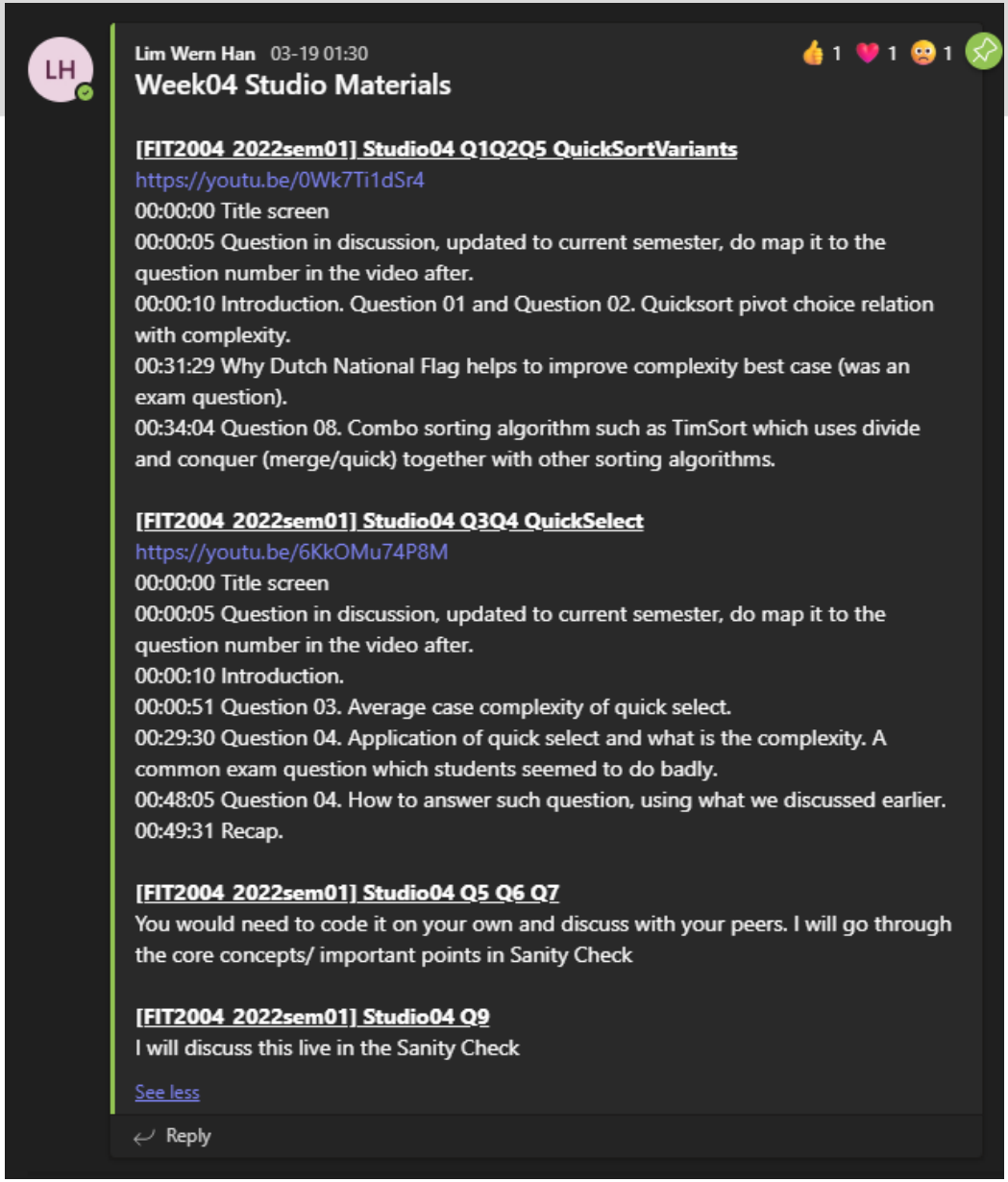
Lim Wern Han 03-19 16:44
Week05 Sanity check sitll covers Week04 materials. But I am releasing it so if you have time to go through them you do see the connections/ links clearer

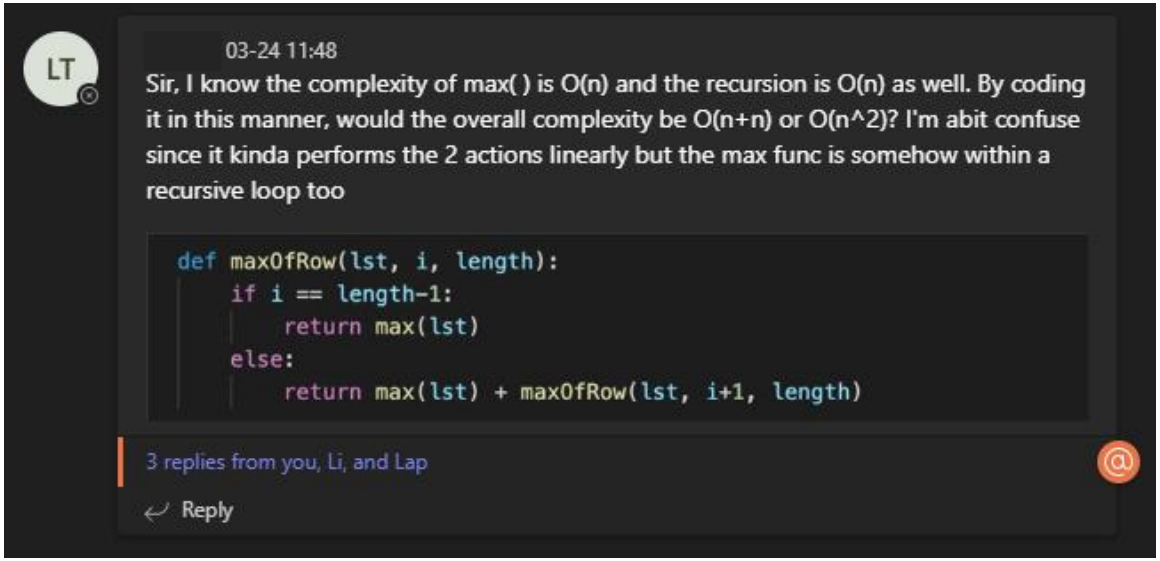
03-19 16:45 👍 1
Okay, got it 👍

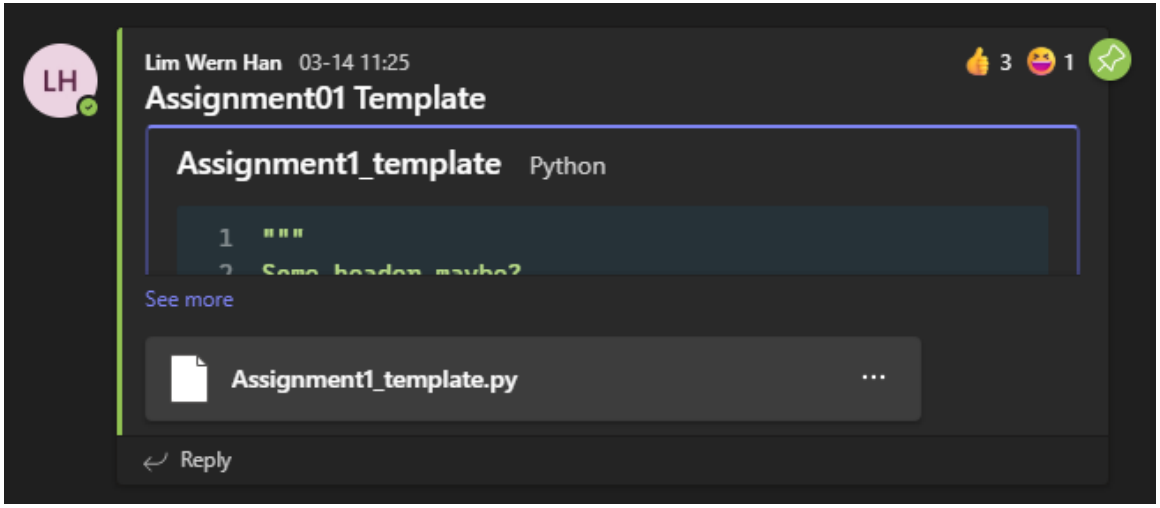
03-31 17:09
Sir just to be sure, implementing topological sort using BFS but changing only the process list from queue to stack does not make it a DFS right? I must do recursion for DFS right?

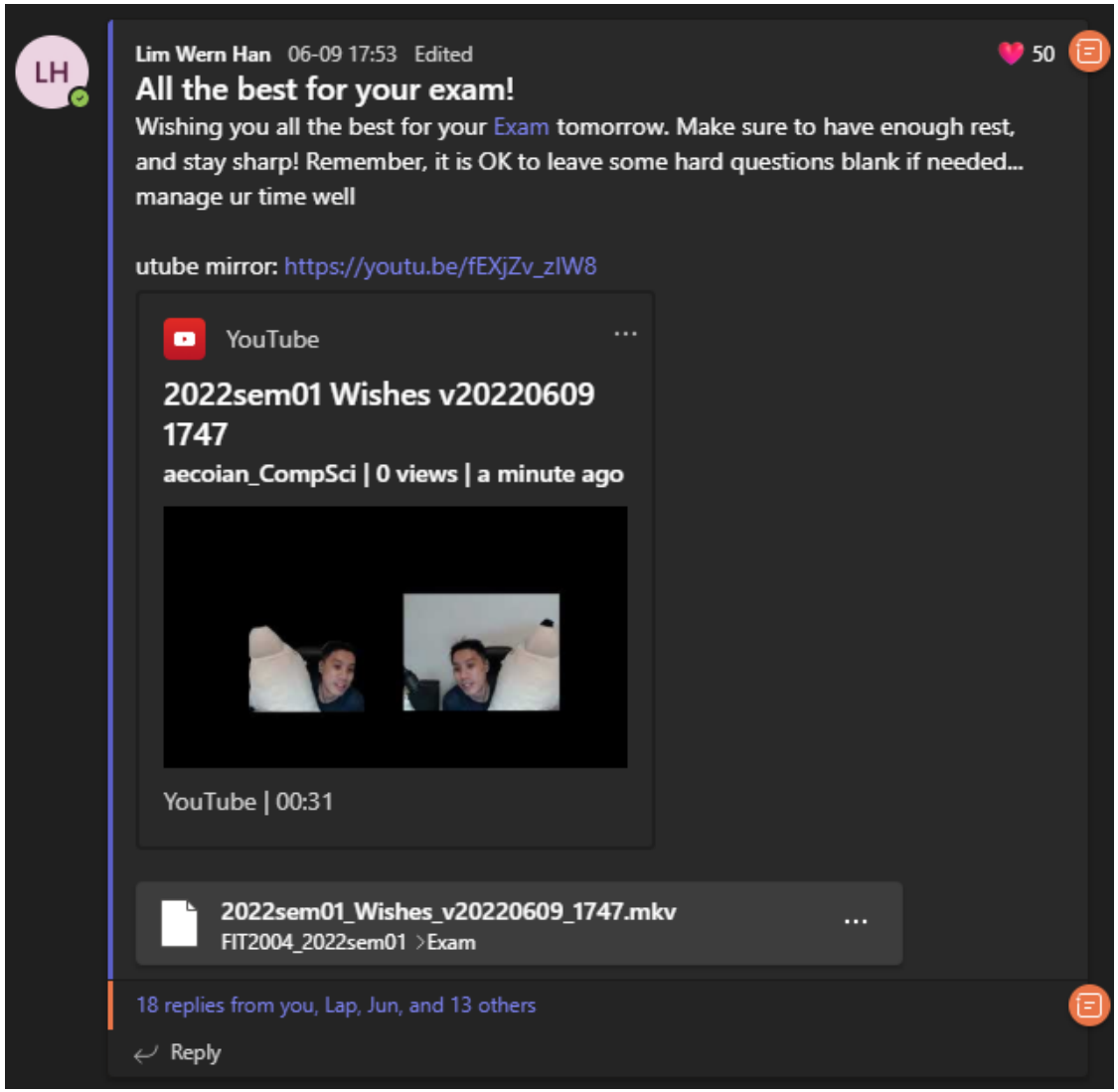
Lim Wern Han 03-31 17:10
› queue -> stack do give you a DFS actually. you don't need recursion

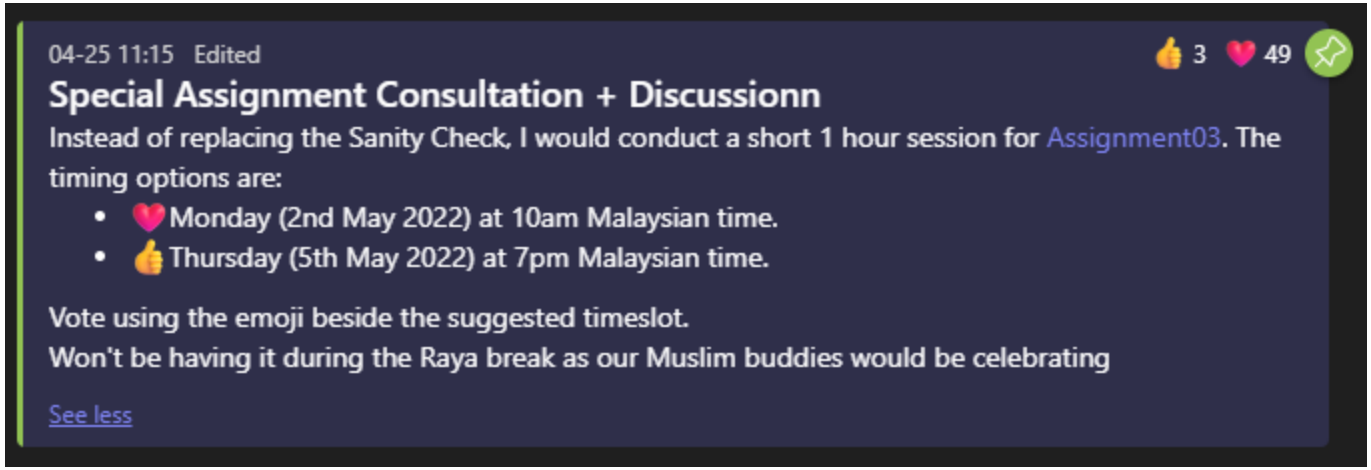
03-31 17:12
So just change one line?

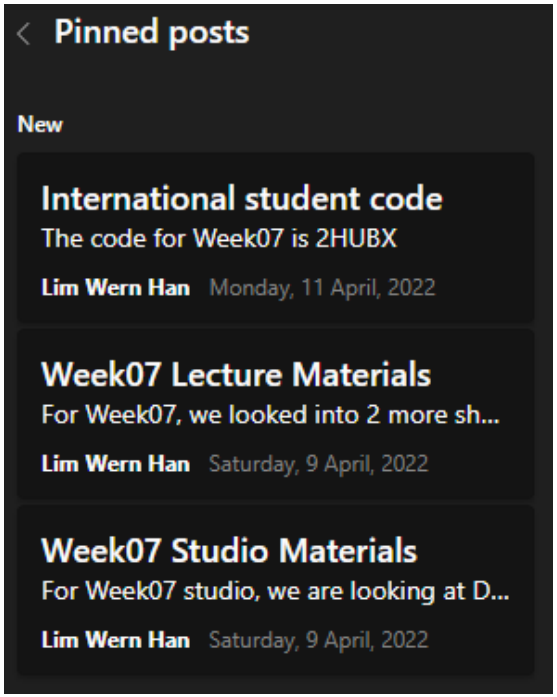

LH
Lim Wern Han 03-19 01:30
1 1 1
Week04 Studio Materials
[FIT2004_2022sem01] Studio04 Q1Q2Q5 QuickSortVariants
https://youtu.be/0Wk7Ti1dSr4
00:00:00 Title screen
00:00:05 Question in discussion, updated to current semester, do map it to the question number in the video after.
00:00:10 Introduction. Question 01 and Question 02. Quicksort pivot choice relation with complexity.
00:31:29 Why Dutch National Flag helps to improve complexity best case (was an exam question).
00:34:04 Question 08. Combo sorting algorithm such as TimSort which uses divide and conquer (merge/quick) together with other sorting algorithms.
[FIT2004_2022sem01] Studio04 Q3Q4 QuickSelect
https://youtu.be/6KkOMu74P8M
00:00:00 Title screen
00:00:05 Question in discussion, updated to current semester, do map it to the question number in the video after.
00:00:10 Introduction.
00:00:51 Question 03. Average case complexity of quick select.
00:29:30 Question 04. Application of quick select and what is the complexity. A common exam question which students seemed to do badly.
00:48:05 Question 04. How to answer such question, using what we discussed earlier.
00:49:31 Recap.
[FIT2004_2022sem01] Studio04 Q5 Q6 Q7
You would need to code it on your own and discuss with your peers. I will go through the core concepts/ important points in Sanity Check
[FIT2004_2022sem01] Studio04 Q9
I will discuss this live in the Sanity Check
See less
Reply

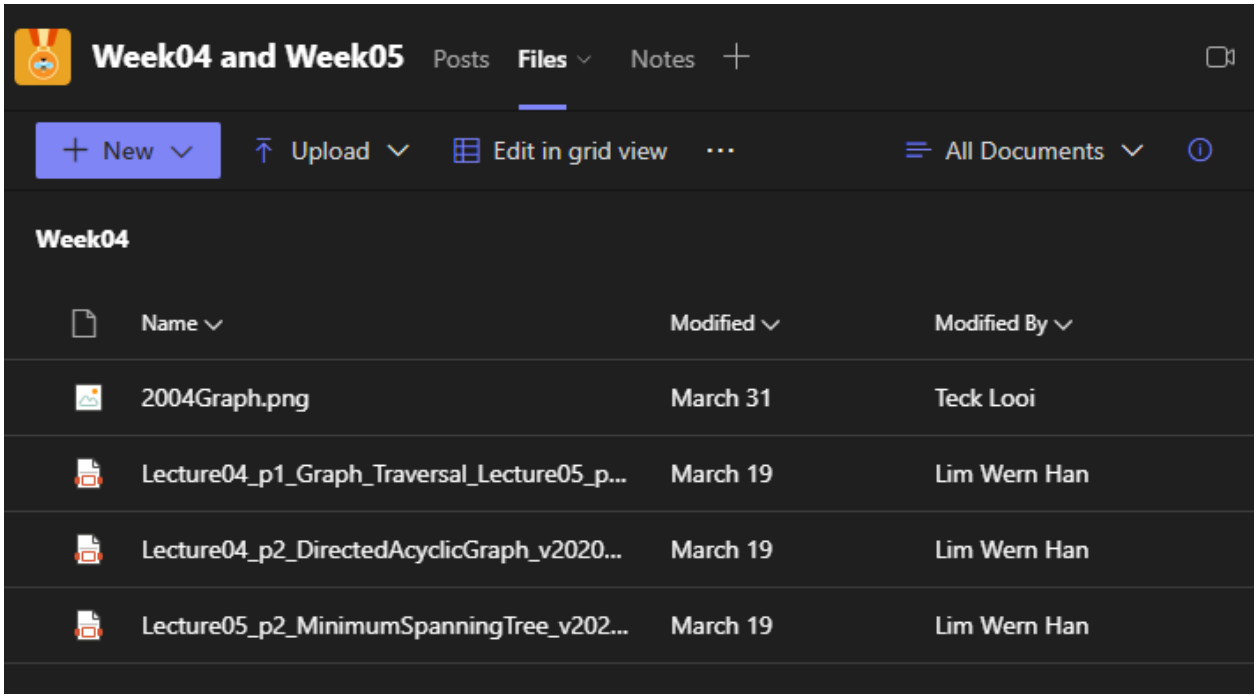

LT
03-24 11:48
Sir, I know the complexity of max( ) is O(n) and the recursion is O(n) as well. By coding it in this manner, would the overall complexity be O(n+n) or O(n^2)? I'm abit confuse since it kinda performs the 2 actions linearly but the max func is somehow within a recursive loop too
def maxOfRow(lst, i, length):
if i == length-1:
return max(lst)
else:
return max(lst) + maxOfRow(lst, i+1, length)
3 replies from you, Li, and Lap
Reply


LH
Lim Wern Han 03-14 11:25
3 1
Assignment01 Template
Assignment1_template Python
1 """
See more
Assignment1_template.py
Reply


LH
Lim Wern Han 06-09 17:53 Edited
50
All the best for your exam!
Wishing you all the best for your Exam tomorrow. Make sure to have enough rest, and stay sharp! Remember, it is OK to leave some hard questions blank if needed... manage ur time well
utube mirror: https://youtu.be/fEXjZv_zIW8
YouTube
2022sem01 Wishes v20220609 1747
aecoian_CompSci | 0 views | a minute ago
YouTube | 00:31
2022sem01_Wishes_v20220609_1747.mkv
FIT2004_2022sem01 > Exam
18 replies from you, Lap, Jun, and 13 others
Reply


04-25 11:15 Edited
3
49
Special Assignment Consultation + Discussionn
Instead of replacing the Sanity Check, I would conduct a short 1 hour session for Assignment03. The timing options are:
Monday (2nd May 2022) at 10am Malaysian time.
Thursday (5th May 2022) at 7pm Malaysian time.
Vote using the emoji beside the suggested timeslot.
Won't be having it during the Raya break as our Muslim buddies would be celebrating
See less


Pinned posts
New
International student code
The code for Week07 is 2HUBX
Lim Wern Han Monday, 11 April, 2022
Week07 Lecture Materials
For Week07, we looked into 2 more sh...
Lim Wern Han Saturday, 9 April, 2022
Week07 Studio Materials
For Week07 studio, we are looking at D...
Lim Wern Han Saturday, 9 April, 2022


Week04 and Week05
Posts
Files
Notes
New
Upload
Edit in grid view
All Documents
Week04
Name
Modified
Modified By
2004Graph.png
March 31
Teck Looi
Lecture04_p1_Graph_Traversal_Lecture05_p...
March 19
Lim Wern Han
Lecture04_p2_DirectedAcyclicGraph_v2020...
March 19
Lim Wern Han
Lecture05_p2_MinimumSpanningTree_v202...
March 19
Lim Wern Han

- But what about consultation?

Microsoft Teams
All the Resources

- But what about consultation?
- Ask on MS Teams!
  - Use the channels in MS Teams for each week/ topic/ assignment
  - Direct Message me
  - PS: Your PASS tutor will be in as well

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All the Resources

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Microsoft Teams
All the Resources

- But what about consultation?
  - I will be on campus some days,
    I will announce on MS Teams when I will be.
- Ask on MS Teams!
  - Use the channels in MS Teams for each week/ topic/ assignment
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Questions?

Break…

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Thank You