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MONASH
INFORMATION
TECHNOLOGY

FIT2004
Algorithms and Data Structures

Ian Wern Han Lim
lim.wern.han@monash.edu

Referencing materials by
Nathan Companez, Aamir Cheema, Arun Konagurthu and Lloyd Allison

GROUP OF EIGHT AUSTRALIA

Faculty of Information Technology, Monash University

Agenda

- Welcome
- Importance of ADS
- What is ADS?
- Learning Outcomes
- Topics of ADS for FIT2004
- About me…

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Let us begin…

Welcome to FIT2004

- So what brings you to FIT2004?

Welcome to FIT2004

First timers…

- So what brings you to FIT2004?

Welcome to FIT2004

Returning students…

- As promised every semester

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Questions?

Break…

- This is a very important unit

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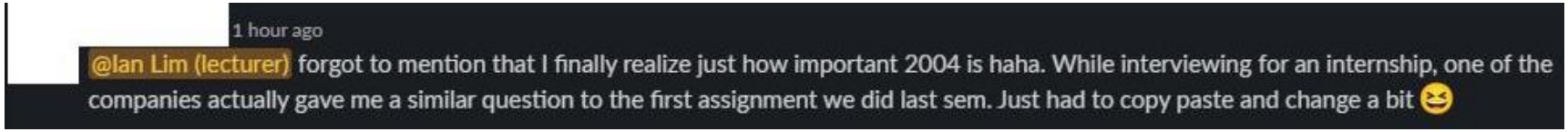

- This is a very very very important unit
  - The core unit to computer science
  - "This is the COREST of CORE unit in your degree" – A/Prof Arun
    - Ex-course coordinate of the BCS
    - Ex-CE of the unit
    - CE of FIT3155 Advance Algorithms and Data Structures

- This is a very very very important unit
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    - Expect the FANG companies to interview you on the unit…
      - Facebook
      - Amazon and Apple
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Celestine Omin
@cyberomin
Follow
I was just asked to balance a Binary Search Tree by JFK's airport immigration. Welcome to America.
12:26 AM - 27 Feb 2017 · Manhattan, NY
8,754
7,447

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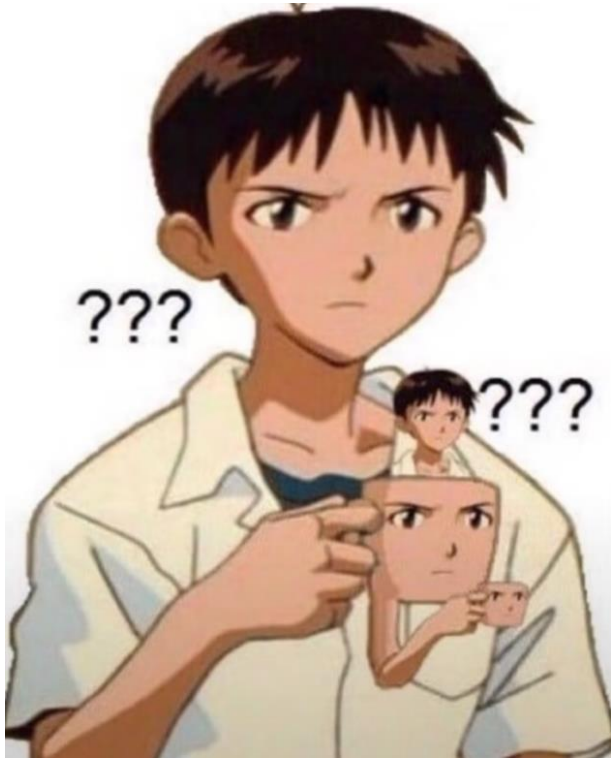
Questions?

Break…

Algorithms and Data Structures

What is it?



Algorithms and Data Structures

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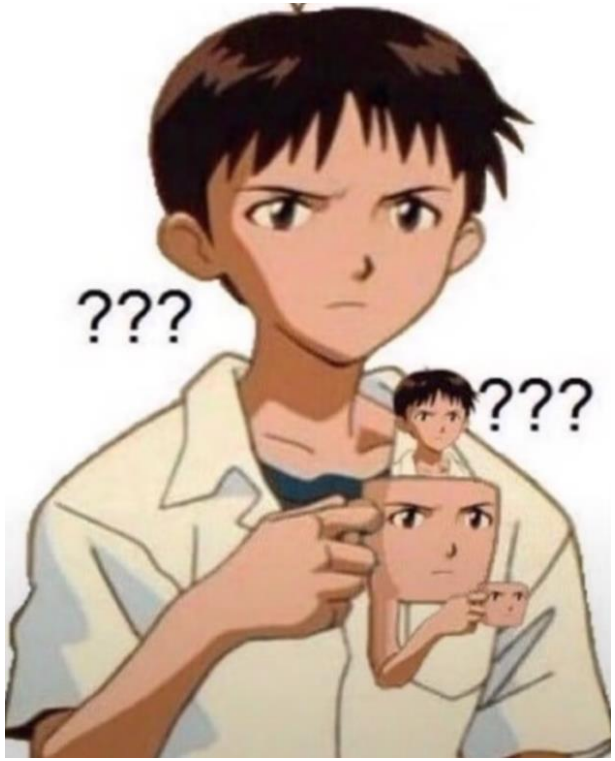

Algorithms and Data Structures
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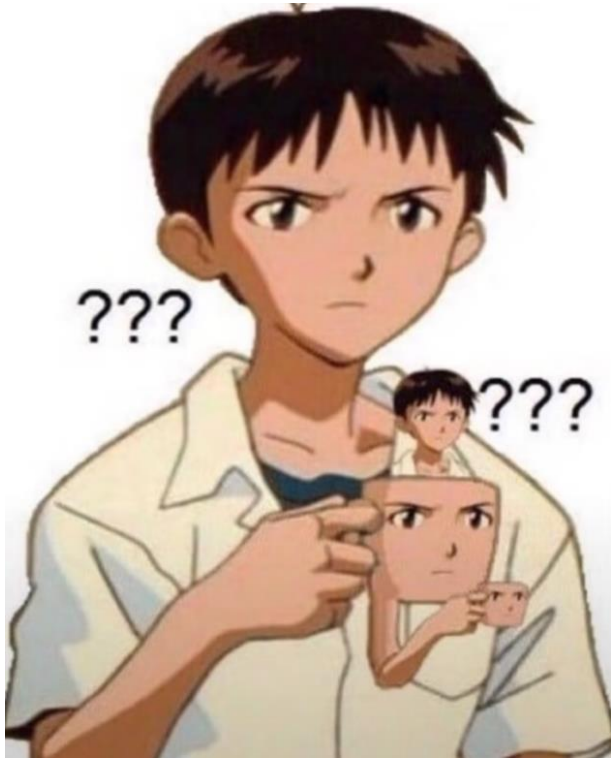

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Algorithms and Data Structures
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    - Step-by-step

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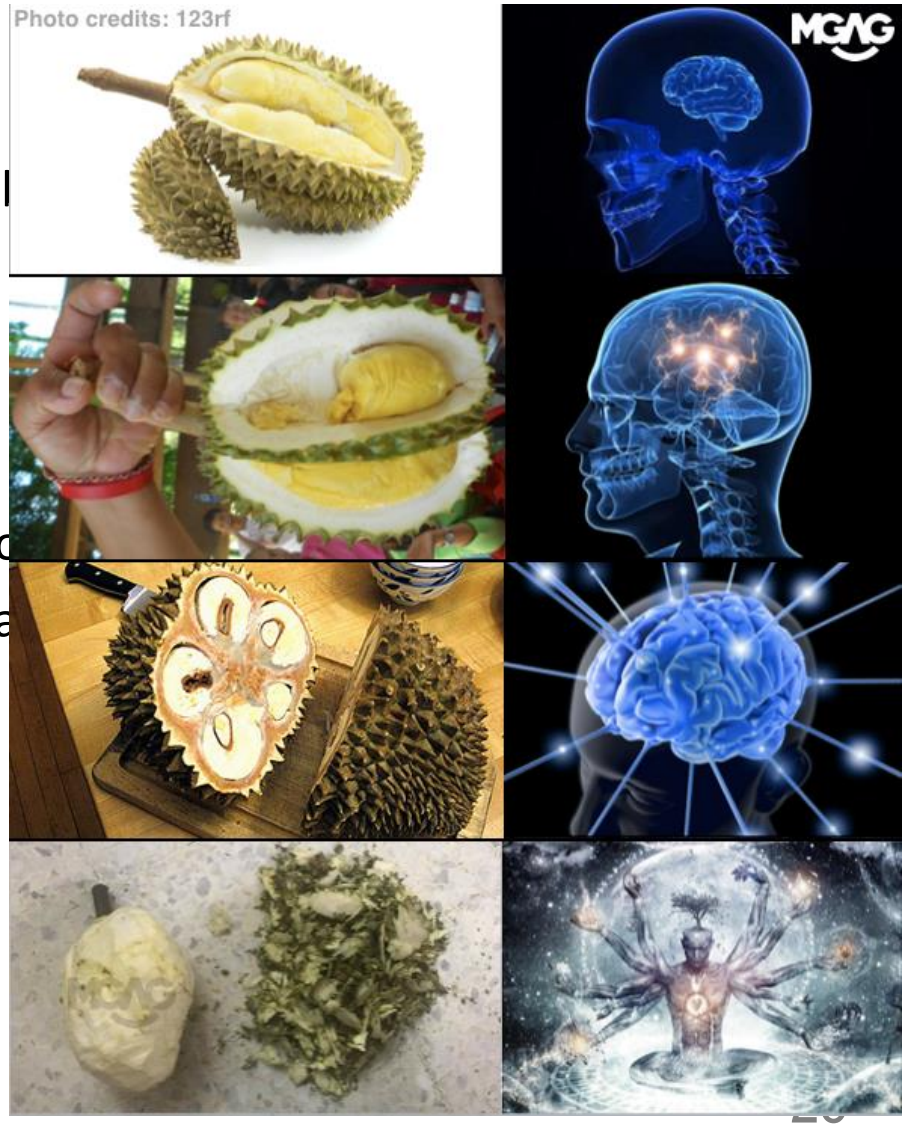

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Algorithms and Data Structures
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    - Or even come up with your own recipe if you are good enough…
    - Or to know what not to ever try…

Algorithms and Data Structures

What is it?

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Why should I hire a software engineer if I can just copy and paste code from Stack Overflow?

Jessica Su, CS PhD student at Stanford

Answered Dec 28 · Upvoted by Rupak Hattikudur, Software Engineer @ L&T Infotech and Terry Lambert, Senior Software Engineer: Novell, Artisoft, IBM, Array Netw...

It's still worth the money. The breakdown is

- Copying code from StackOverflow: $1
- Knowing which code to copy from StackOverflow: $100000/year

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Because now you know what recipe to look for and make sense

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Questions?

Break…

Learning Outcomes

At the end of the unit…

Learning Outcomes

At the end of the unit…

1. Analyze general problem-solving strategies and algorithmic paradigms, and apply them to solving new problems;
2. Prove correctness of programs, analyze their space and time complexities;
3. Compare and contrast various abstract data types and use them appropriately;
4. Develop and implement algorithms to solve computational problems.

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Learning Outcomes

At the end of the unit…

- Materials are designed to achieve the learning outcome
- Measured in and mapped to all your assessment
  - Assignment
  - Exam

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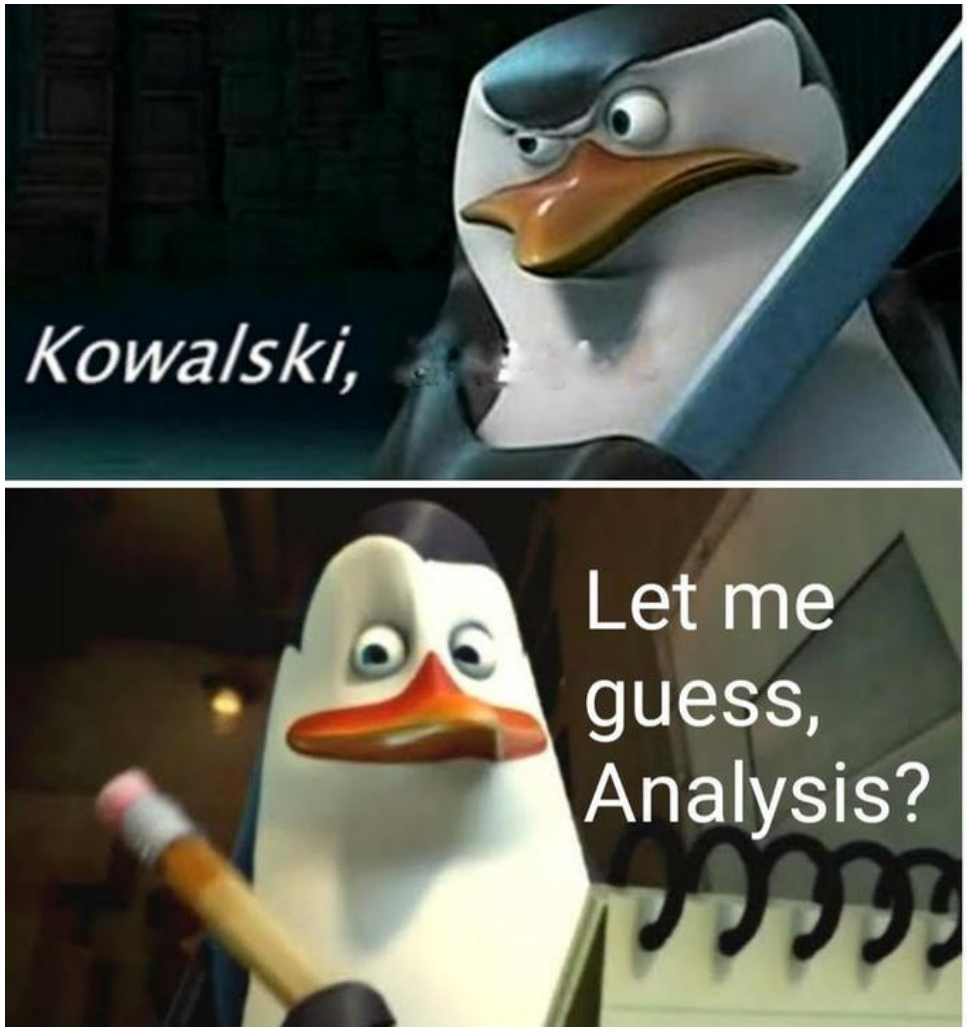
Questions?

- Now let us go through the topic one by one

Introduction
The Topics

- Analysis of algorithms
  - Correctness
  - Complexity
    - Finding
    - Proving



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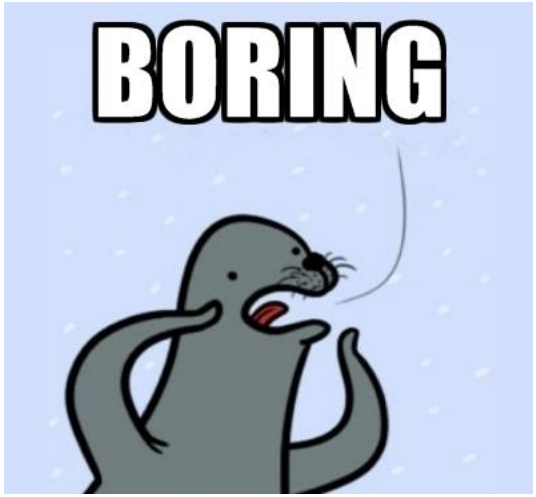

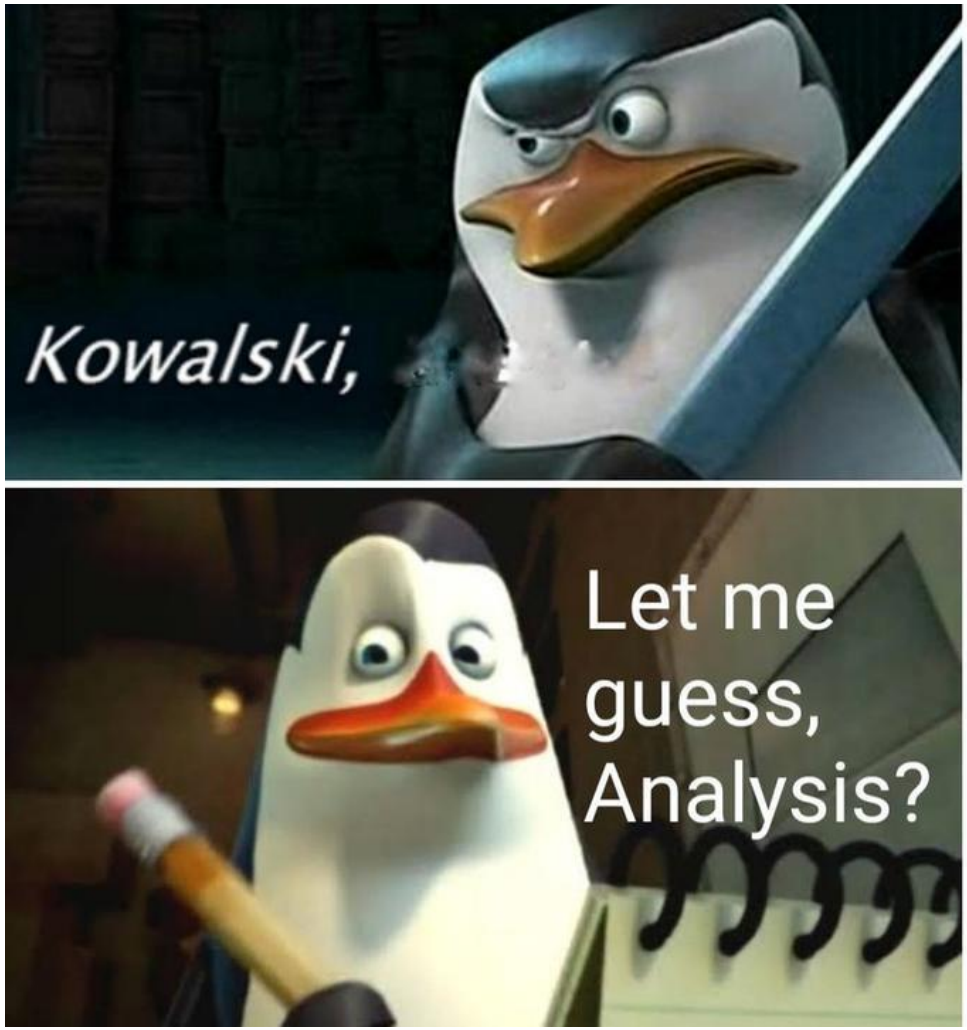

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- Analysis of algorithms
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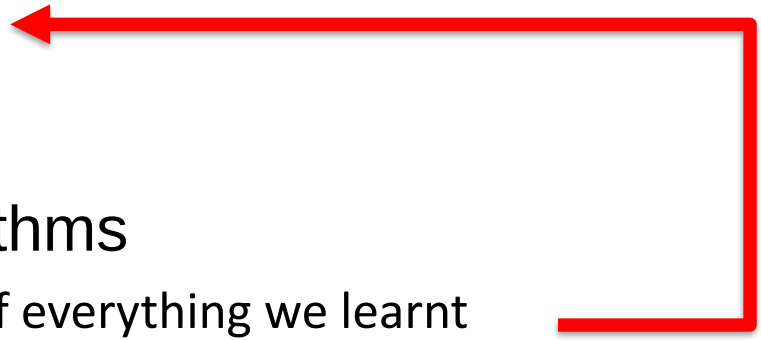
- Sorting algorithms
  - Quick recap of everything we learnt



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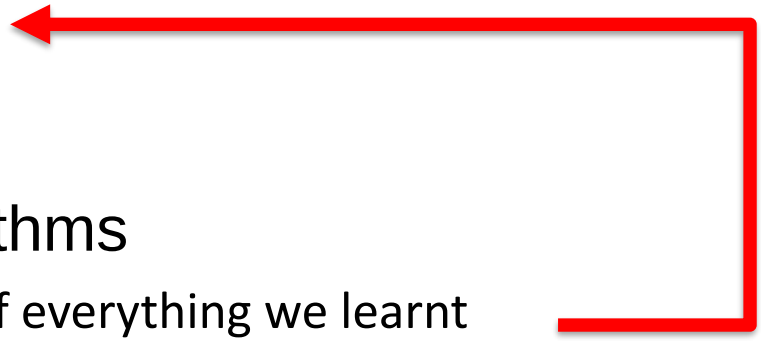

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Quiz

Introduction
The Topics

- Traversal and shortest distance

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- Traversal and shortest distance
  - The Graph data structure

Introduction
The Topics

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  - The Graph data structure
  - A lot of algorithms here…

Introduction
The Topics

- Traversal and shortest distance
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Assignment

Introduction
The Topics

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  - The Graph data structure
  - A lot of algorithms here…
  - And somehow, we can make trees from graph!
    called Minimum Spanning Tree (MST)

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- … all of the algorithms above uses all sort of techniques
  - Greedy
  - Dynamic programming
  - … and many more

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- Traversal and shortest distance
  - The Graph data structure and networks
  - A lot of algorithms here…
  - And somehow, we can make trees from graph!
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- Dynamic programming
  - Analyzing it from time/ space complexity

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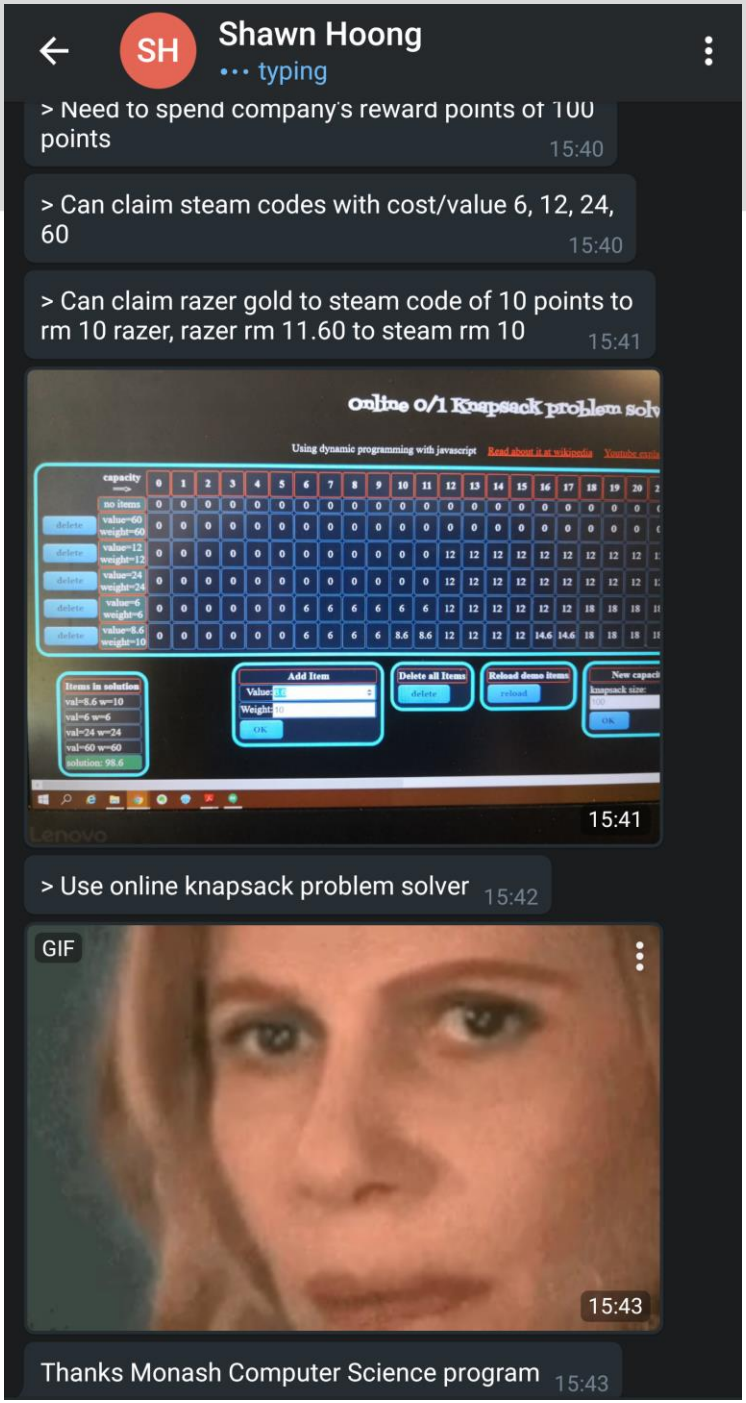
- Dynamic programming
  - Analyzing it from time/ space complexity
  - This is your Assignment as well

Introduction

The Topics

- Dynamic programming
  - Analyzing it from time/ space complexity
  - This is your Assignment as well
  - Also useful in the future…



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- Efficient lookup structure
  - How to search for item quickly (via key)

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- Efficient lookup structure
  - How to search for item quickly (via key)
  - Hash tables
  - Binary Search Tree (BST)

Introduction
The Topics

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- Efficient lookup structure
  - How to search for item quickly (via key)
  - Hash tables
    - Making good hash function
    - Cuckoo hashing
  - Binary Search Tree (BST)
    - AVL tree

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- Efficient lookup structure
  - How to search for item quickly (via key)
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Real world focus

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- Efficient lookup structure
  - How to search for item quickly (via key)
  - Hash tables
    - Making good hash function
    - Cuckoo hashing
  - Binary Search Tree (BST)
    - AVL tree
- Pattern matching

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- Efficient lookup structure
  - How to search for item quickly (via key)
  - Hash tables
    - Making good hash function
    - Cuckoo hashing
  - Binary Search Tree (BST)
    - AVL tree

- Pattern matching
  - Tries
  - Suffix Arrays

Assignment
(popular in exam)

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- Every topic is important
- Every topic is examined
  - Quiz
  - Assignment
  - Exam

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Questions?

Break…

Introduction
About me?

- Wern Han LIM, just call me Ian

- lim.wern.han@monash.edu
- Room 2-4-21

- BCS graduate 2009

- Gone through this before
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Introduction

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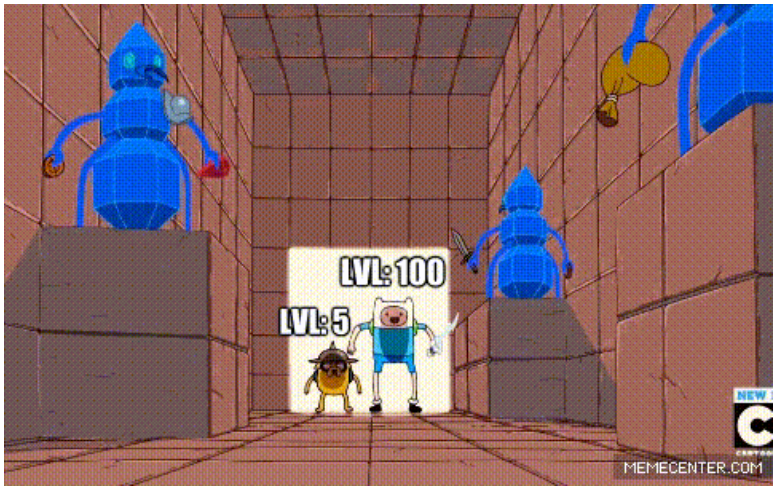

Introduction

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- Feel free to contact me
  (more on that later)

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Introduction
About me?

- Tutor for the unit since 2014 when it was redeveloped
- Lecturer for the unit since 2018
- Been packaged to MUA k-times for marking

- Also had experienced in algo units
  - FIT 1008 Introduction to Computer Science
  - FIT 3155 Advanced Algorithms and Data Structures
- … and other units
  - FIT 2014 Theory of Computation
  - FIT 3140 Advanced Programming
  - FIT 3152 Data Analytics

Introduction

About me?

- Do have speech impairment, so please do interrupt me
  - Ask me to repeat
  - Ask me to spell
  - Ask me to write

- Faculty teaching award 2017
- Monash Student Association (MSA in MUA) 2018 teaching award (Faculty of IT)
- Faculty teaching excellence 2019
- PVC teaching excellence 2020

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Questions?

Break…

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Thank You