

Community Discovery in Big Data with Algorithms & Computational Thinking

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*Experience the fun of
algorithmic community discovery*

□ Course Objectives

- ❖ Community Detection in Graphs
- ❖ Experience Cloud Computing with Big Data & Data Visualization
- ❖ Creative Thinking in Algorithm Design & CT

- ❖ PROJECT: Apply Community Detection to Big Data Analytics

References

- [CLRS09] *Introduction to Algorithms*, (3nd edition) by Cormen, Leiserson, Rivest, Stein, 2009, MIT Press. (some chapters on basic and graph algorithms)
- [TL2010] “*Community Detection and Mining in Social Media*”, by Lei Tang, Huan Liu, *Morgan and Claypool Publishing*, 2010. <http://dmml.asu.edu/cdm/>
- [F10] Santo Fortunato, “*Community detection in Graphs*”, *Physics Reports*, Vol. 486, No. 3-5, (2010), 75-174.
- [http://www.cscs.umich.edu/~crshalizi/notebooks/
community-discovery.html](http://www.cscs.umich.edu/~crshalizi/notebooks/community-discovery.html)

Coding background assumed

❑ Programming Fundamentals

- ❖ Done several different programming paradigms!
- ❖ Good debugging knowledge, STRATEGIES
- ❖ Careful use of Libraries...

❑ Data Structures (with analyses)

- ❖ Arrays, Linked Lists, Sets, Dictionary
- ❖ Stacks, Queues, Trees & Binary Search Trees
- ❖ Graphs, Simple Graph Algorithms, MST

Algorithm background assumed

- Simple Algorithm Design (with Analysis)
 - ❖ Standard algorithms with arrays and lists
 - ❖ Searching and sorting algorithms
 - ❖ Maybe: Graph algorithms, DFS, BFS, MST, SP

□ Simple Analysis of Algorithms

- ❖ Knows how to use Big-*O* notations
- ❖ Has done Algorithm Analysis:

Bubblesort, Selection Sort, Searching, Binary Search

The Teaching Staff (2018)

Govind Venugopalan
(Math-CS DDP, Year 3)

Leong Hon Wai
NUS, SOC
(梁汉槐)

Vighnesh Remesh Iyer
(CS-Biz DDP, Year 2)

Kal Ng Yew Kaow*
UTAR, Malaysia

About Govind (2018)

Govind is a Year 4 student taking a double degree in Computer Science and Mathematics.

He enjoys programming puzzles, watching Superhero TV shows and playing Ultimate Frisbee.



About Vighnesh (2018)

Vighnesh is a soon-to-be Year 3 student taking a double degree in Business Administration and Computer Science.

He enjoys coding, sci-fi and reading about history and philosophy.



About Leong Hon Wai (梁汉槐)

Hon Wai enjoys teaching and research in Algorithms, Computational Thinking, Creative Problem Solving, and MatheMAGIC,

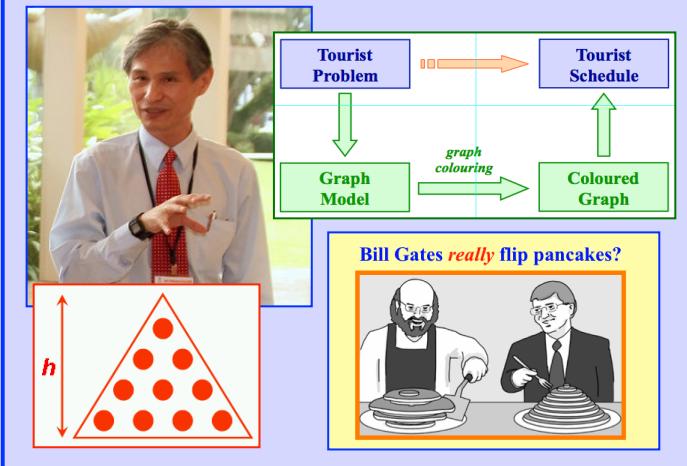
He likes to work with and develop young talent.

*Fun and Creative
Problem Solving
in Computing*

Prof Leong Hon Wai

NUS-SOC

leonghw@comp.nus.edu.sg
(Email, FB)



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About Prof. Kal Ng Yew Kaow

Kal enjoys working on
All sorts of data,
Hacking things together
and (of course)
Algorithms

He likes to read math, physics,
and philosophy on Quora.



How the Course is run...

Lectures:

- ❖ Introduces the *What* and the *Why*,
- ❖ Get the *key ideas*
- ❖ Learn the *How*

Team Project:

- ❖ Apply them in solving problems...
- ❖ Apply them to *develop programs / software*

Course Schedule (2018)

Lectures:

- ❖ 13-14 July: 2-Day Introduction
(HW, Quiz, Prog-Asgmt)
- ❖ 21 July: Selection of Students
- ❖ 23-27 July: Mini Lectures

Prog Assignment and Project:

- ❖ Apply them to *develop programs / software*

Project Milestones (2018)

Team Project: (Milestones)

M1: Project proposal

M2: Interim Poster Report

M3: Poster Showcase



MindSet and Learning Attitude

Computational Thinking & Creative PS

- ❖ Important for *all* areas/domains
- ❖ Can be *mastered* with practice

Healthy Learning Attitude:

- ❖ “*Cattywampus*”
- ❖ Positive Learning Attitude,
- ❖ Questioning Attitude,
- ❖ Being independent, taking initiative
- ❖ Good Sense of Humor

Just “Do Good” (no reason *not to*)

Today, I told my class, “If you constantly do good, not because of money or fame or other reasons, then good things will eventually come to you.”.

Later that day, my high-school classmate, Soo Thong Phor posted...



Soo Thongphor ▶ Soo Thong Phor

4 hrs ·

How I entered the Bachelor Degree in Civil Engineering at UTM (then called ITK) was serendipity or almost by accident!

Initially, I only applied for the 3 years diploma course in civil engineering, fearing that I might not have enough financial resources or confidence to complete the 5 years degree course. I felt lack of CONFIDENCE!

One lucky day, one of my Menglembu friends came and visited me out of the blue. He offered his application form for UTM free of charge for me, as he has unfortunately failed his Bahasa Malaysia and not qualified to apply.

At that time, I have already submitted my application for the diploma course. Since I got a free form, I submitted a second application for the degree course. He was the ANGEL!!

Eventually, I received 2 offers, one for the diploma and the other for the degree course. In those days, without computer, it is possible to get 2 offers. I promptly rejected the diploma offer and accepted the degree offer. My path might have been different if not because of this!

UTM in those days was a wonderful place for poor guy like me, who could not afford to pay the fees and the living expenses. For the whole year, I did not pay a single cent to UTM. IT WAS FREE FOOD AND LODGING!

Eventually towards the end of the year, I was offered a JPA (Public Service Department) scholarship, just like almost 90% of the students there.

The next hurdle, after receiving the scholarship offer, was to look for a guarantor. None of my ex-school teachers or headmasters was willing to be my guarantor and none of my relatives or friends were qualified to be the guarantor as they did not have sufficient regular income.

Then lo and behold, one day, while helping my father at his vegetable stall at the Ipoh Central market during the term holiday, one of my father's customers met me and enquired what was I doing. My father promptly told him about my predicament. The gentleman immediately agreed to be my scholarship guarantor, without any further questions or no strings attached. He is the second ANGEL sent by the invisible and omnipotent, to open the PATH for me!



Love



Comment



Hon Wai Leong @Thong Phor: Super kudos!!!

Today, in my class to a group of 45 students from PRC, I just told them, "If you constantly do good, not because of money or fame or other reasons, then good things will eventually come to you."

And you just given me proof of what I told the students.

Can I have your permission to use this story with my students?

-hon-wai

Like · Reply · 6 mins



Soo Thong Phor Sure, Hon Wai. Thanks for your positive words!

Like · Reply · 4 mins

Key insights...

Problem Modeling is important skillset

learn how to model algorithmic problems

Algorithms is A&E (anywhere & everywhere)

learn how to find them

Big-Data is A&E (anywhere & everywhere)

use them, gain new insights with CD

It helps you get *jobs* in top companies

The End is really the *Beginning*...



IBM Watson vs Jeopardy Champions, Feb 2011

Watson by IBM



(9:56--10:02)

"I had thought this is
the end. We get there,
we're done.
And I'm realizing that
this is just the
beginning."

IBM Watson: Final Jeopardy! and the Future of Watson

When you *finish* solving the problem,
that's when you *begin* to really know it. ~LeongHW

Thank you!

If you want to contact me,
email, FB: leonghw@comp.nus.edu.sg

Weixin ID: leonghw

Or

Google “Leong Hon Wai”



Why is SWS3001 FUN?

HW0:

Find out who all
these celebrities are.

- “Meet” many CS celebrities



(1972)



(1974)



(1978)



(1980)



(1986)



(1986)



(2000)



(2002)

Why is SWS3001 FUN?

HW0:

Find out who all
these people are.

□ What about this one?



(1975)



(1985)



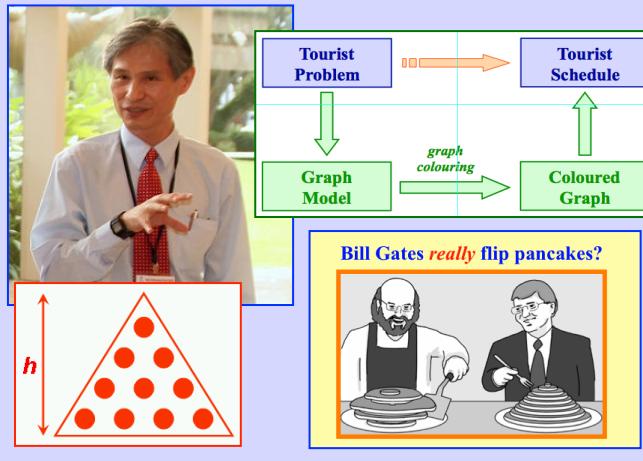
(1990)

Fun and Creative Problem Solving in Computing

Prof Leong Hon Wai

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About Leong Hon Wai...

Research:

Design and analysis of algorithms
[算法设计与分析]

Transportation Logistics

Computational Biology
[生物信息学]

Teaching:

Algorithms Design and Analysis

Discrete Mathematics

Graph Theory and Algorithms

Problem Solving in Computing

Invitation to Computer Science

Selected Hobbies:

Mentor / Develop Talents
[SMP, SRP, UROP, etc]

National Olympiad in Informatics
[新加波信息学奥林匹克竞赛]

International Olympiad in Informatics
[国际信息学奥林匹克竞赛]



[编程序::极端应用软件::]
[24小时不间断编程大赛]

About Oh Shunhao (2015,2016)

Shunhao enjoys mathematical problems & algorithms, & loves talking about them!

He also spends his time making games, and has interest in game AI.

Update on Shunhao:
Shunhao graduated Dec-2017
(2 degrees, Math, CS, both 1st Class)



About Leong Xuan Li (2016)

Xuan Li is a sophomore in CS in UIUC,
Univ. of Illinois, Urbana-Champaign.

She's back home
for summer vacation.

She finds generative design, video
games and natural language
processing fascinating.

When she's not in class, she's busy
with theatre.

Update on Xuan Li:
Just finished Y3.
(6mo internship HubSpot)



About Xing Kai

Xing Kai is a Year 2 student taking a double degree in Computer Science and Mathematics.

He enjoys math puzzles, reading Japanese novels and playing League of Legends.

**Update on Xing Kai:
(on internship now)**



About Wei Liang

Wei Liang is currently studying computer science in NUS

He loves algorithmic problems and logic puzzles. His favourite puzzles are from nikoli and he never fails to buy a nikoli puzzle book every year.

He also enjoys teaching very much and TAs multiple

**Update on Wei Liang:
(on internship now)**

