

CS1010S Programming Methodology

Lecture 12

The Last Lecture

14 Nov 2018

Practical Exam

17 Apr (Sat),

12:30 – 2:30pm, 3:00 – 5:00pm

COM1 PL 1 – 6, ES 1 – 2

I³ WSL 1 – 3, AS6 ML1 – 2

Open Book (Physical)

No thumb drives or other electronic devices

Access to IDLE & Coursemology
only

No PythonTutor, no Google

No Facebook login



Test your username and
password now

Hosted on Coursemology

- Just like your Missions
- Except... Can only "Run" 5 times
- All action will be tracked. Do not share your password with your friends.

PE Questions

- 1. General Problem Solving
(Recursion/Iteration)
 - 2. Data Processing
(read + process data file)
 - 3. OOP
 - 4. ~~Bonus: mystery question?~~
- 
- Varying
level of
difficulty

Tips for PE

- Do past year papers
 - Style is very similar
- Use **IDLE** to test
 - Read the error messages
 - Test after every stage
 - Formulate corner cases
 - Save regularly in different files
- Manage your time
 - OOP might be easier for some

Final Exam

Scope – Everything!

Tue 27 Nov 9:00 am

Open-Sheet

Can bring 1 x A4 sheet of notes (both sides)

2 hours, 100 marks total

Manage time wisely

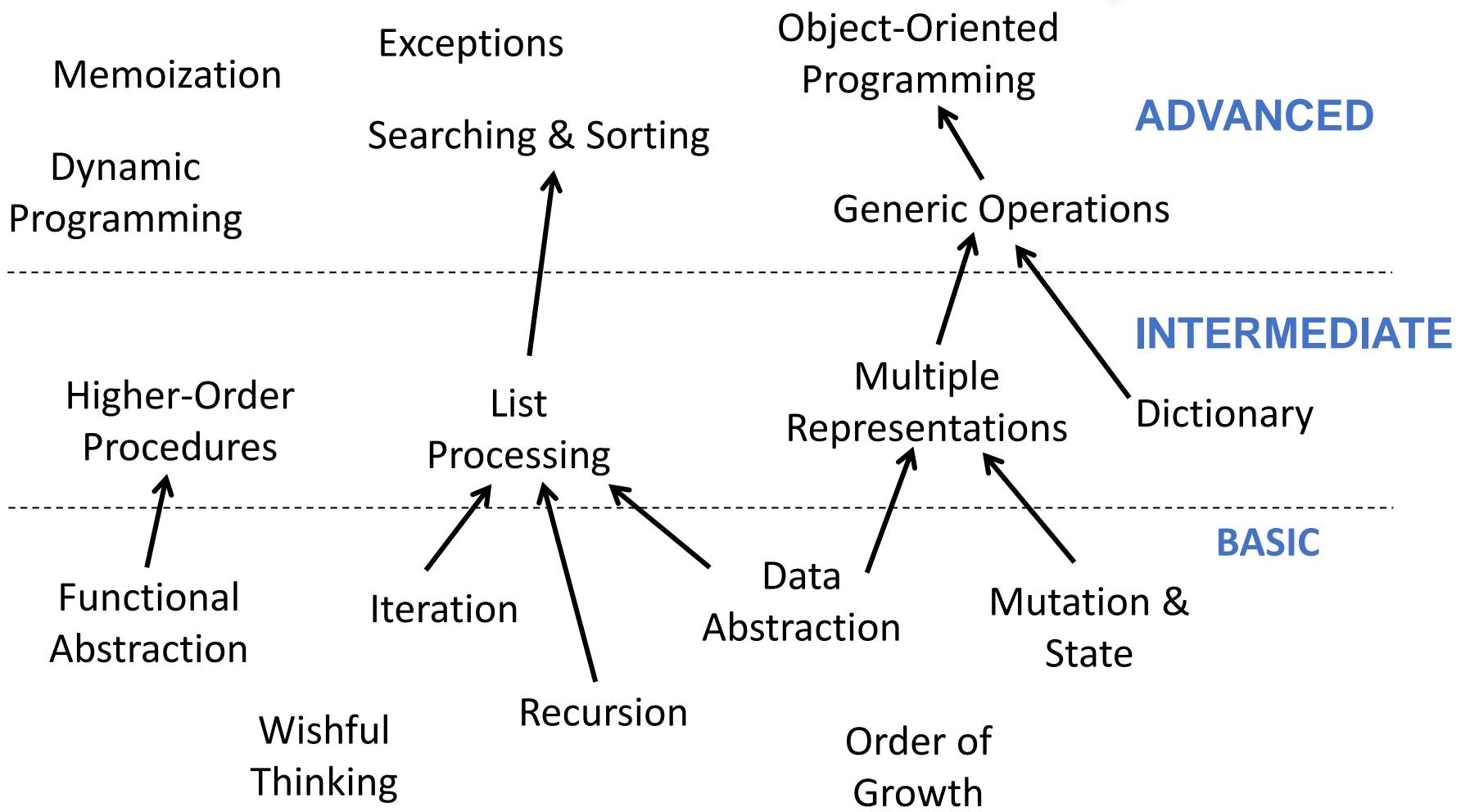
Do the easy questions first

Questions **NOT** in order of difficulty

What Did We Learn This
Semester....

... what's going to be
on the exam

CS1010S Road Map



Fundamental concepts of computer programming

Week 1

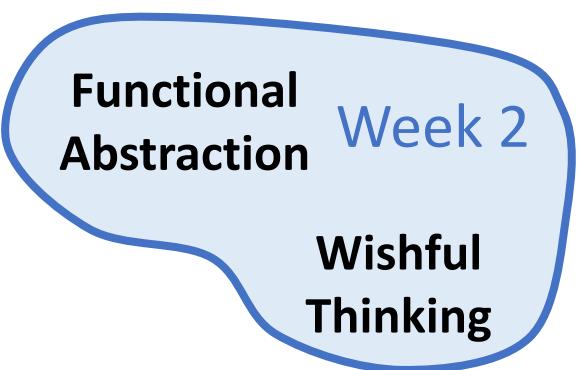
Syntax + Conditionals

CS1010S Road Map

ADVANCED

INTERMEDIATE

BASIC



Fundamental concepts of computer programming

Functional Abstraction



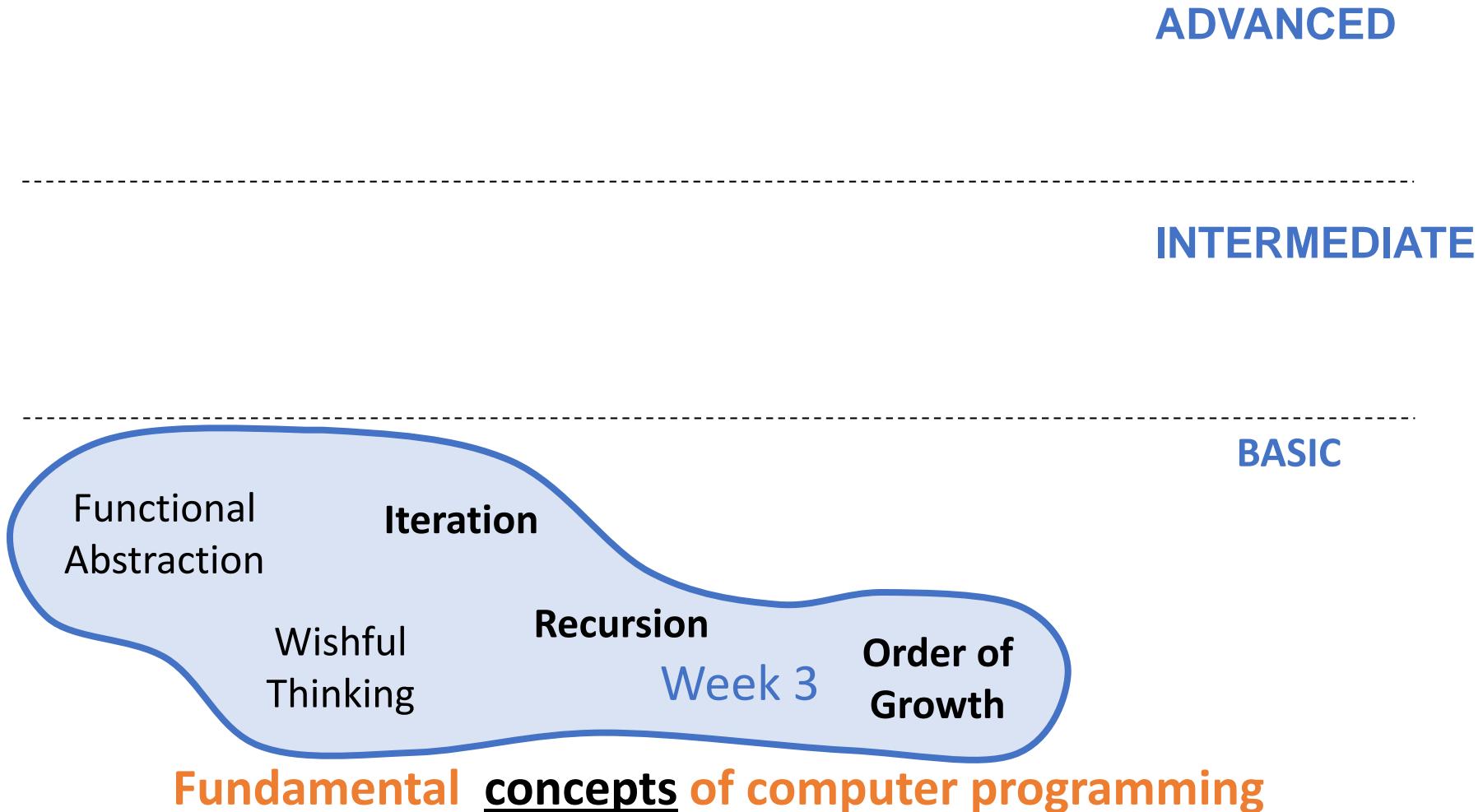
lambda

create functions

def fn(...):

lambda + variable binding

CS1010S Road Map



Factorial

$$n! = \begin{cases} n \times (n - 1)! , & n > 1 \\ 1 , & n = 1 \end{cases}$$

```
def factorial(n):  
    if n <= 1:  
        return 1  
    else:  
        return n * factorial(n - 1)
```

Recursion

1. Base Case
2. Recursive Step

Iterative Factorial

$$n! = 1 \times 2 \times 3 \cdots \times n$$

Factorial rule:

product \leftarrow product \times counter

counter \leftarrow counter + 1

```
def factorial(n):
    product = 1
    for counter in range(2, n+1):
        product = product * counter
    return product
```

Iteration

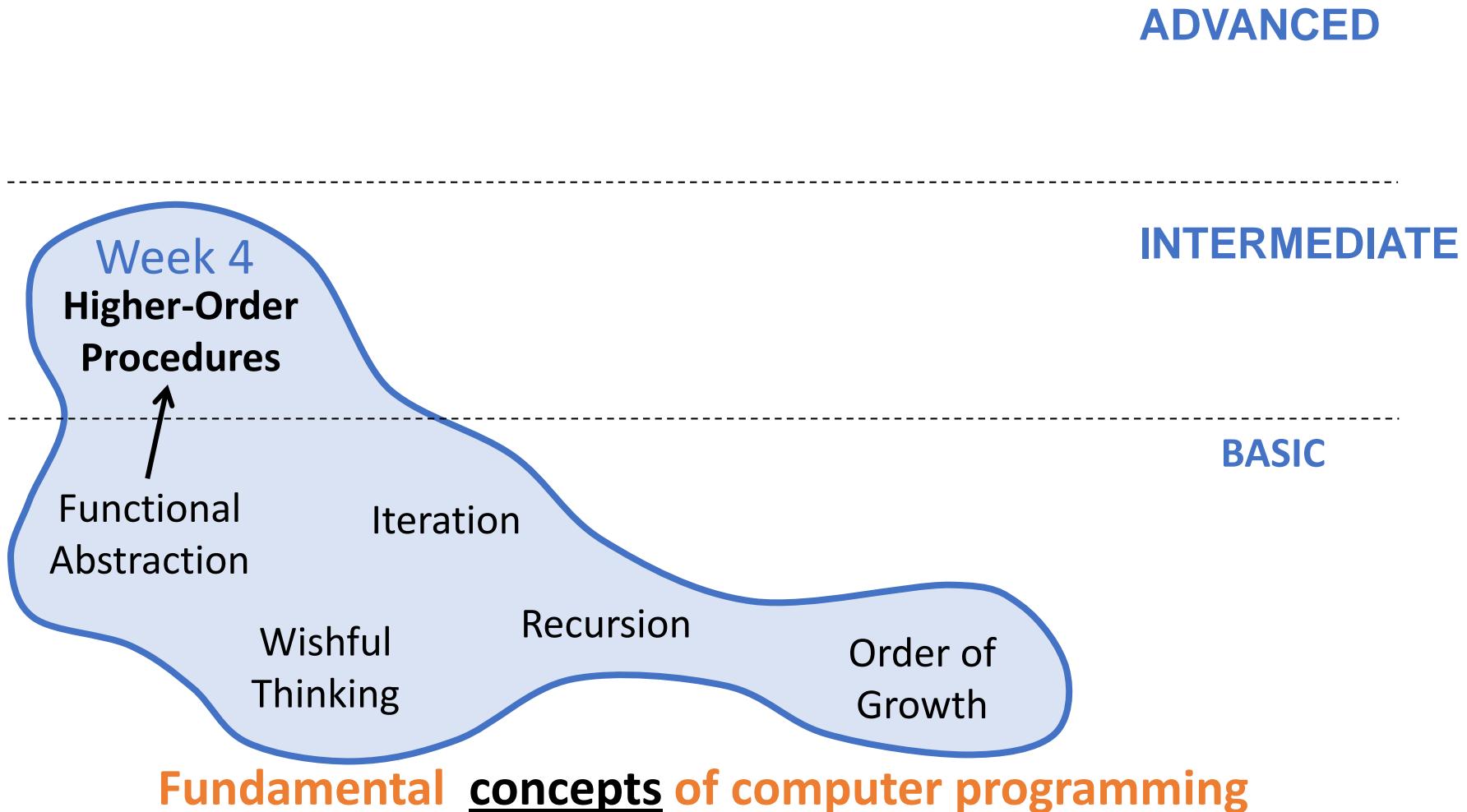
for loop

```
for i in range(start, stop, step):  
    # do stuff  
  
for item in seq:  
    # do stuff
```

while loop

```
while cond:  
    # update cond
```

CS1010S Road Map



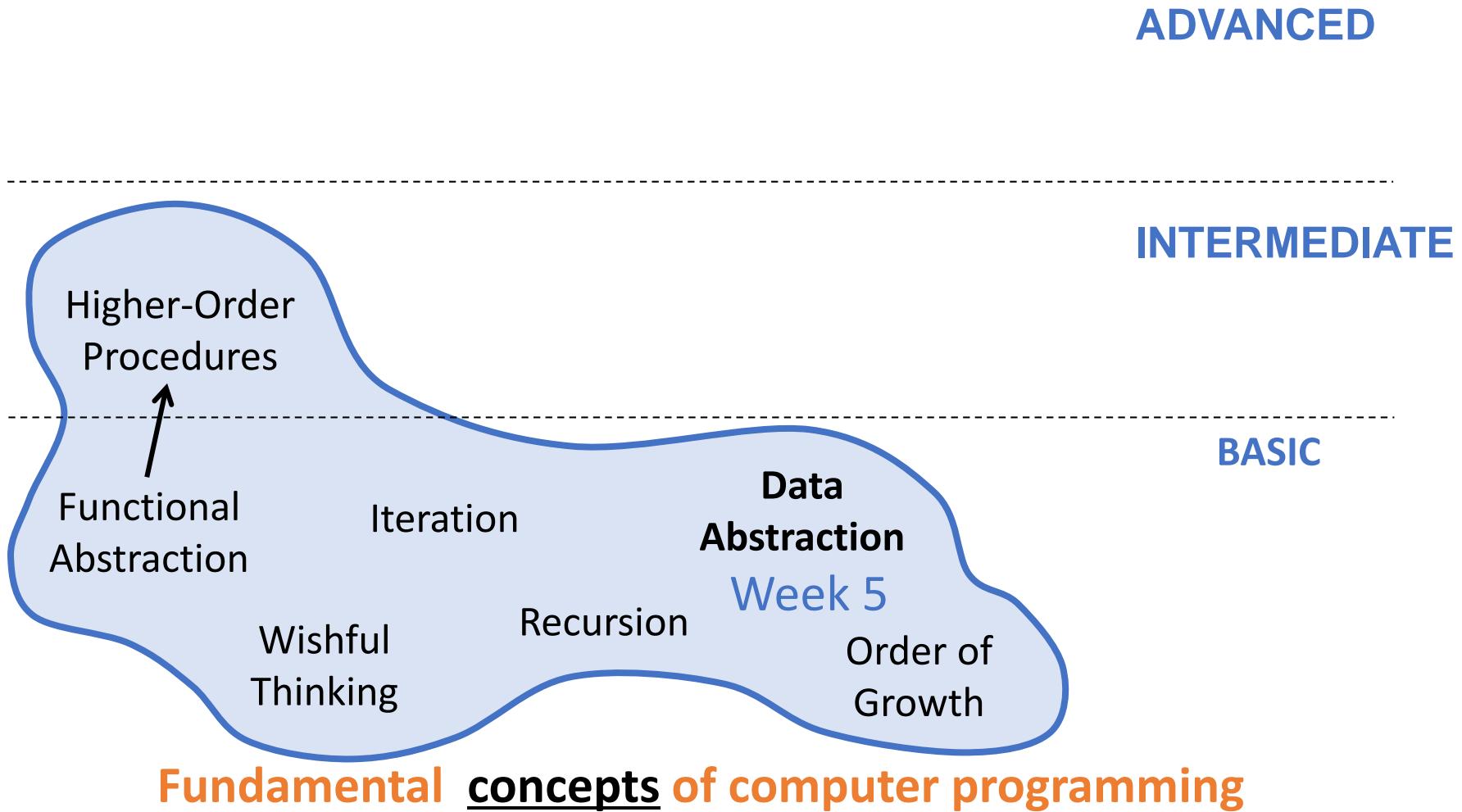
Higher-Order Functions

Functions can be

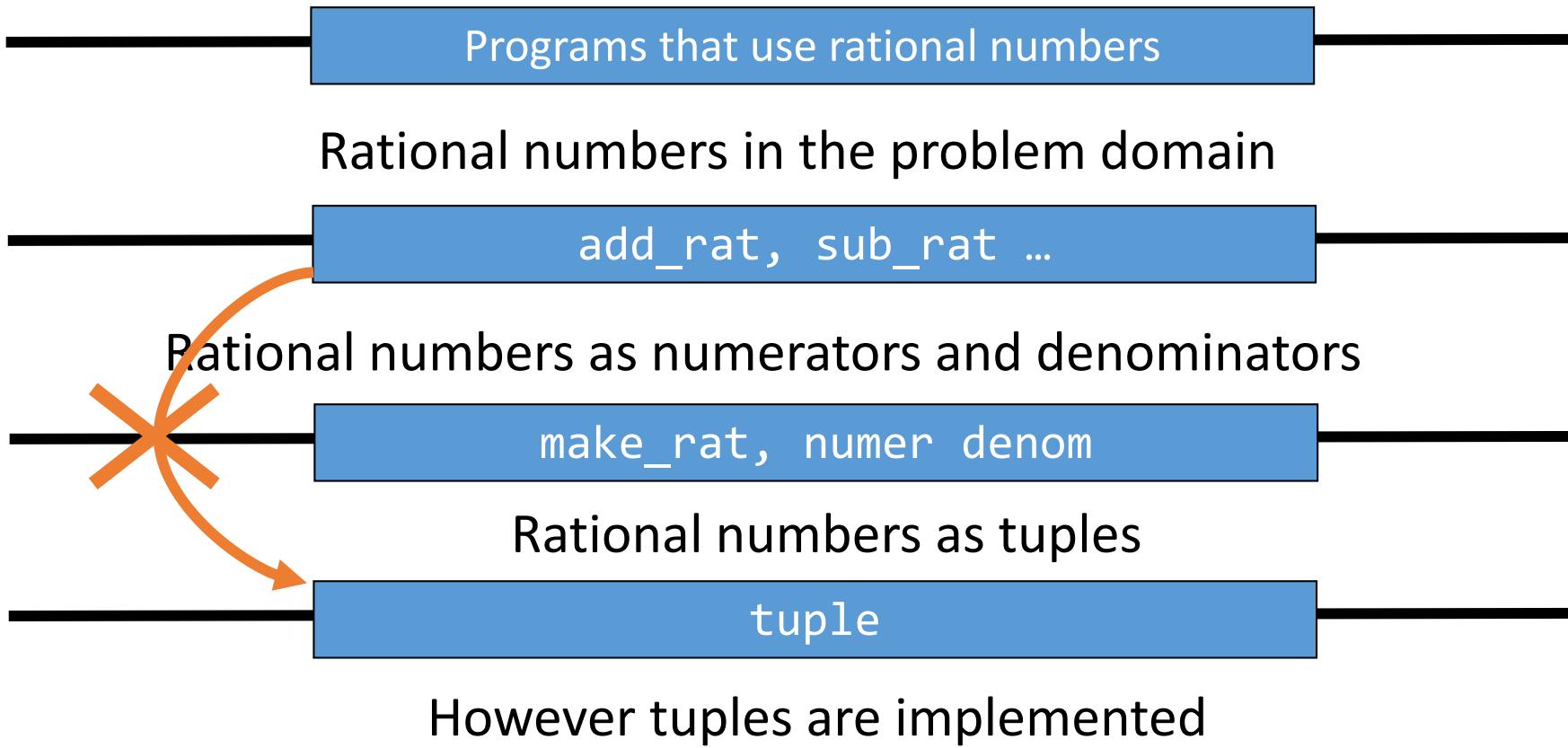
- inputs to functions
- return values from functions

Capturing common patterns

CS1010S Road Map



Abstraction Barrier



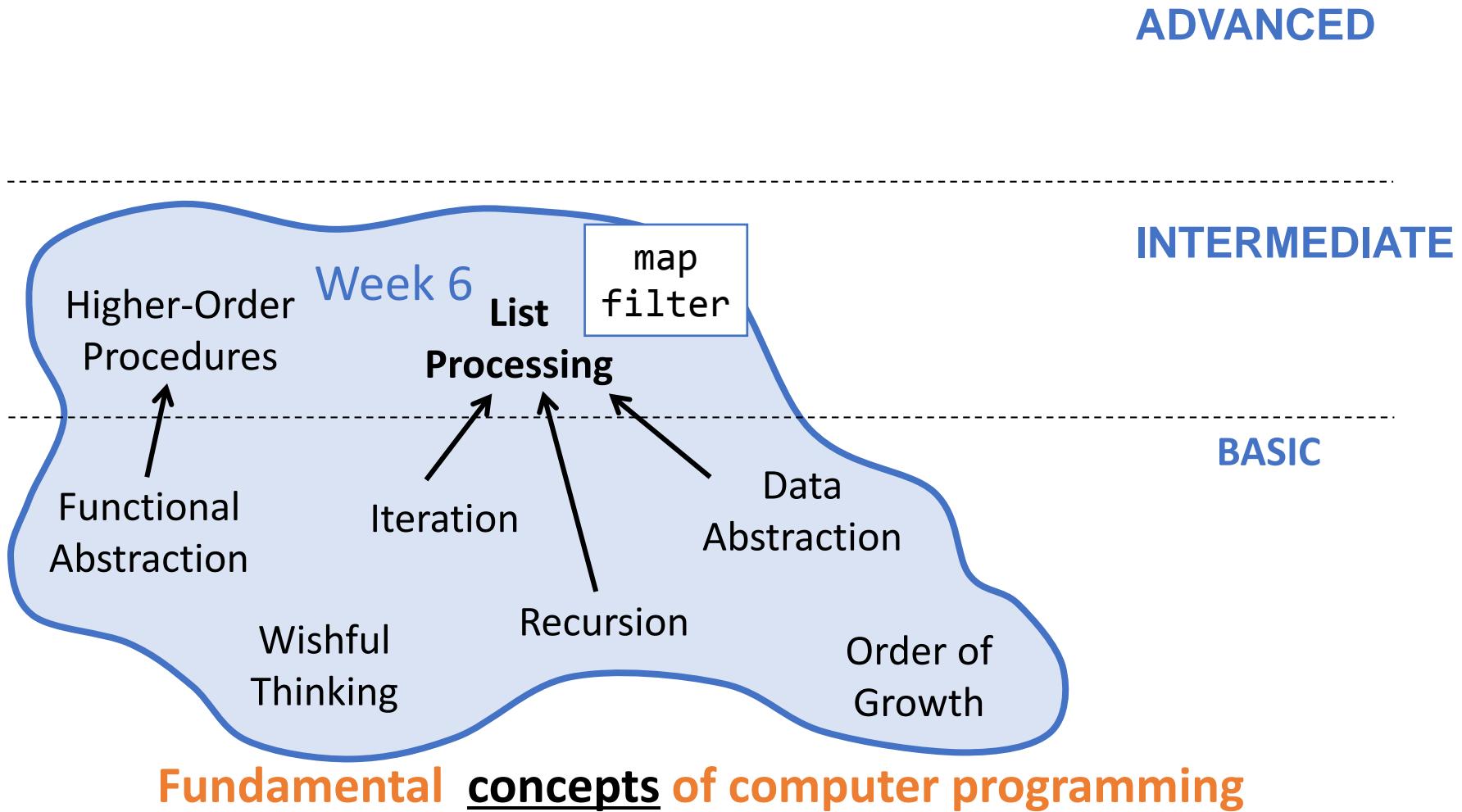
At each level, use only functions available at that interface, not below it.

Concepts of Equality:

Equivalence (`==`)

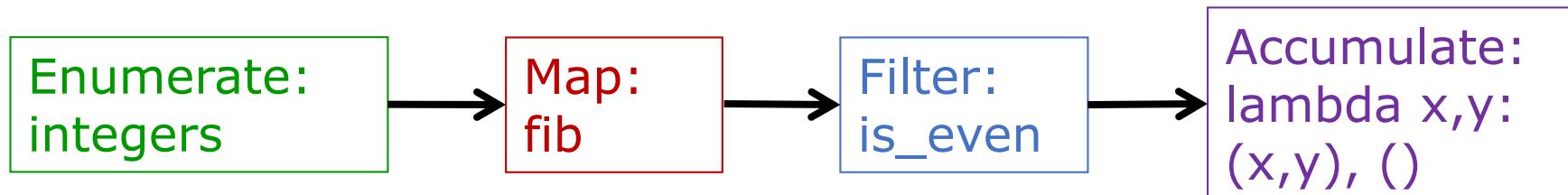
Identity (`is`)

CS1010S Road Map

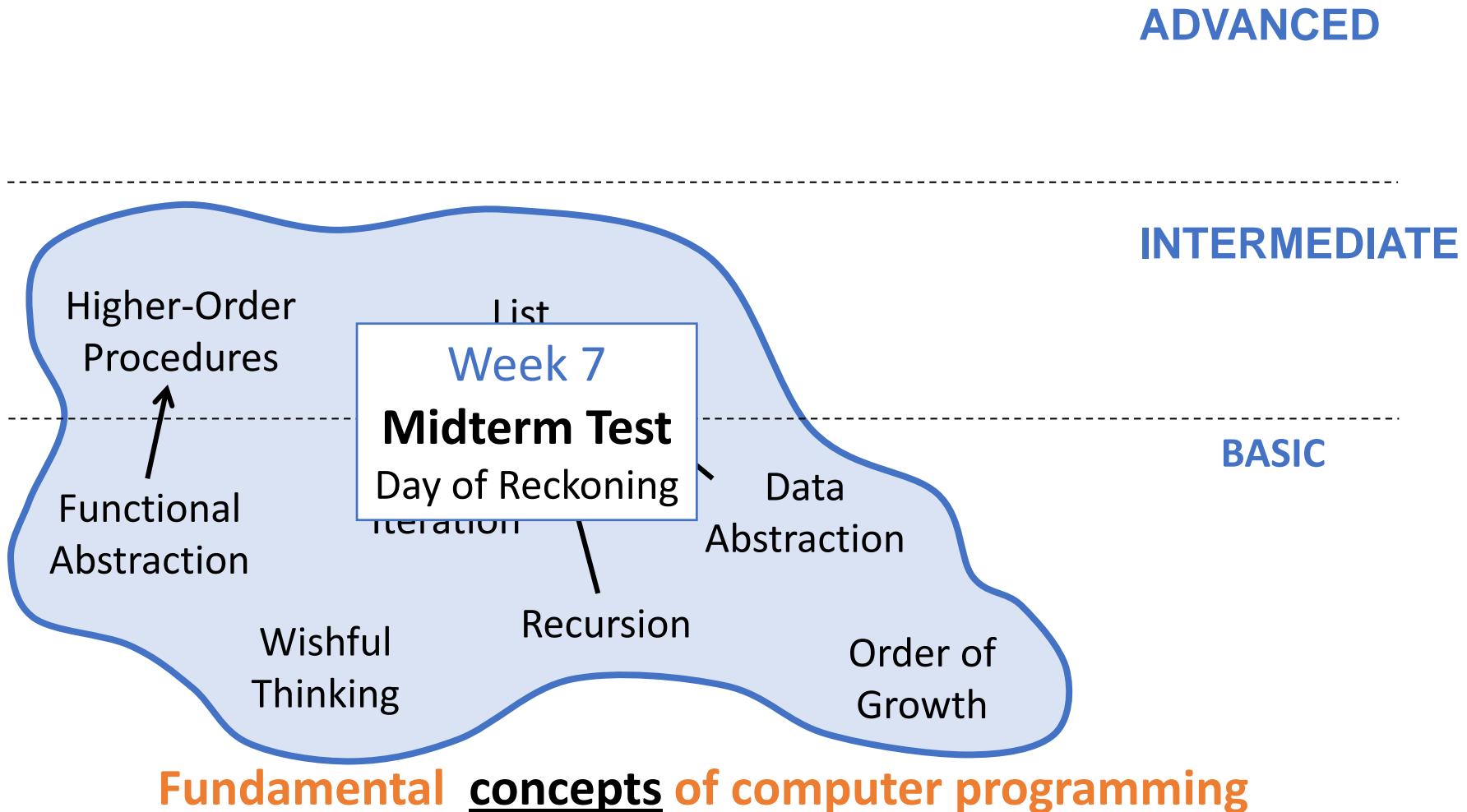


List and Sequences

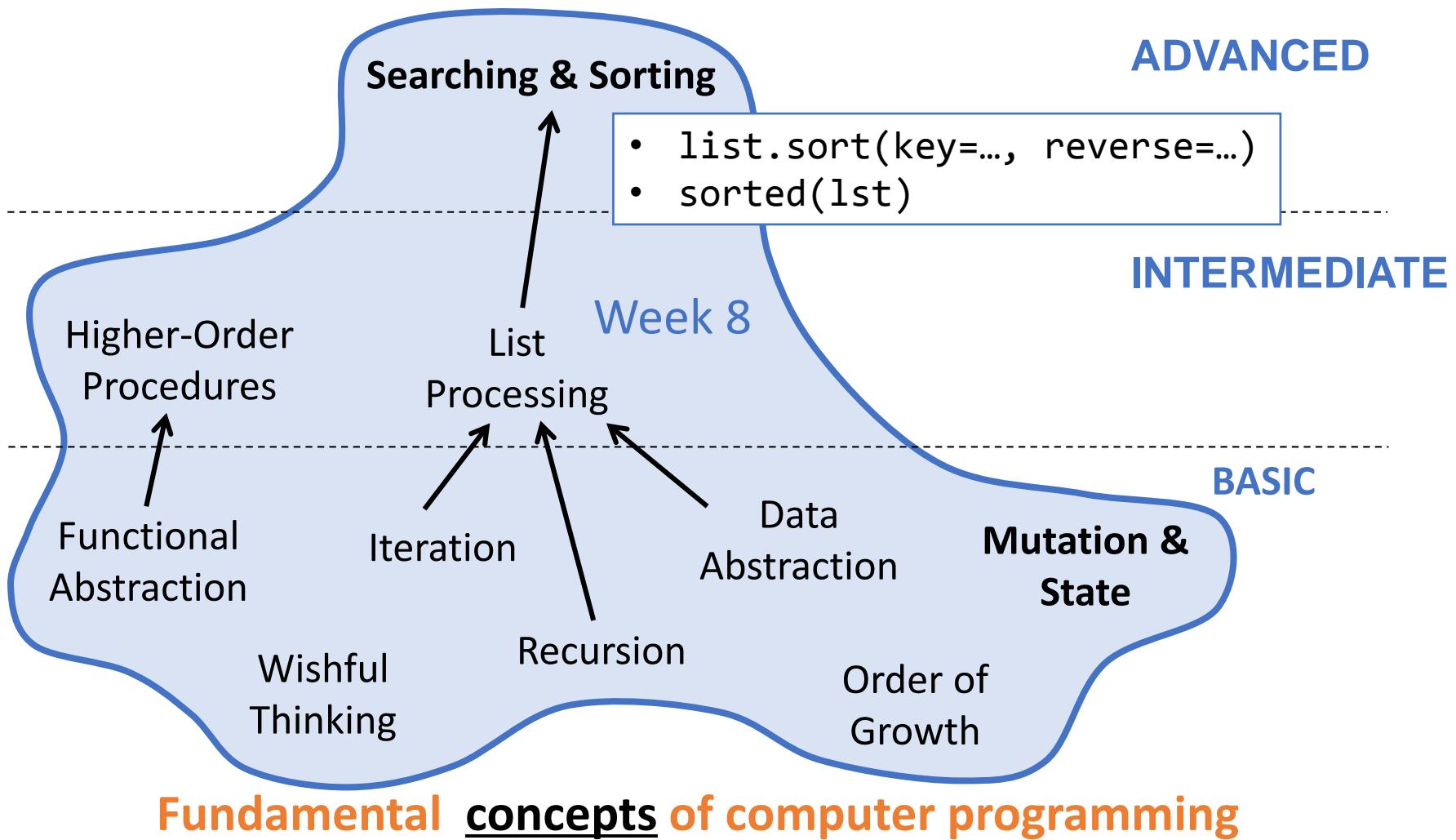
- map and filter
- Signal processing view
 - even_fibs



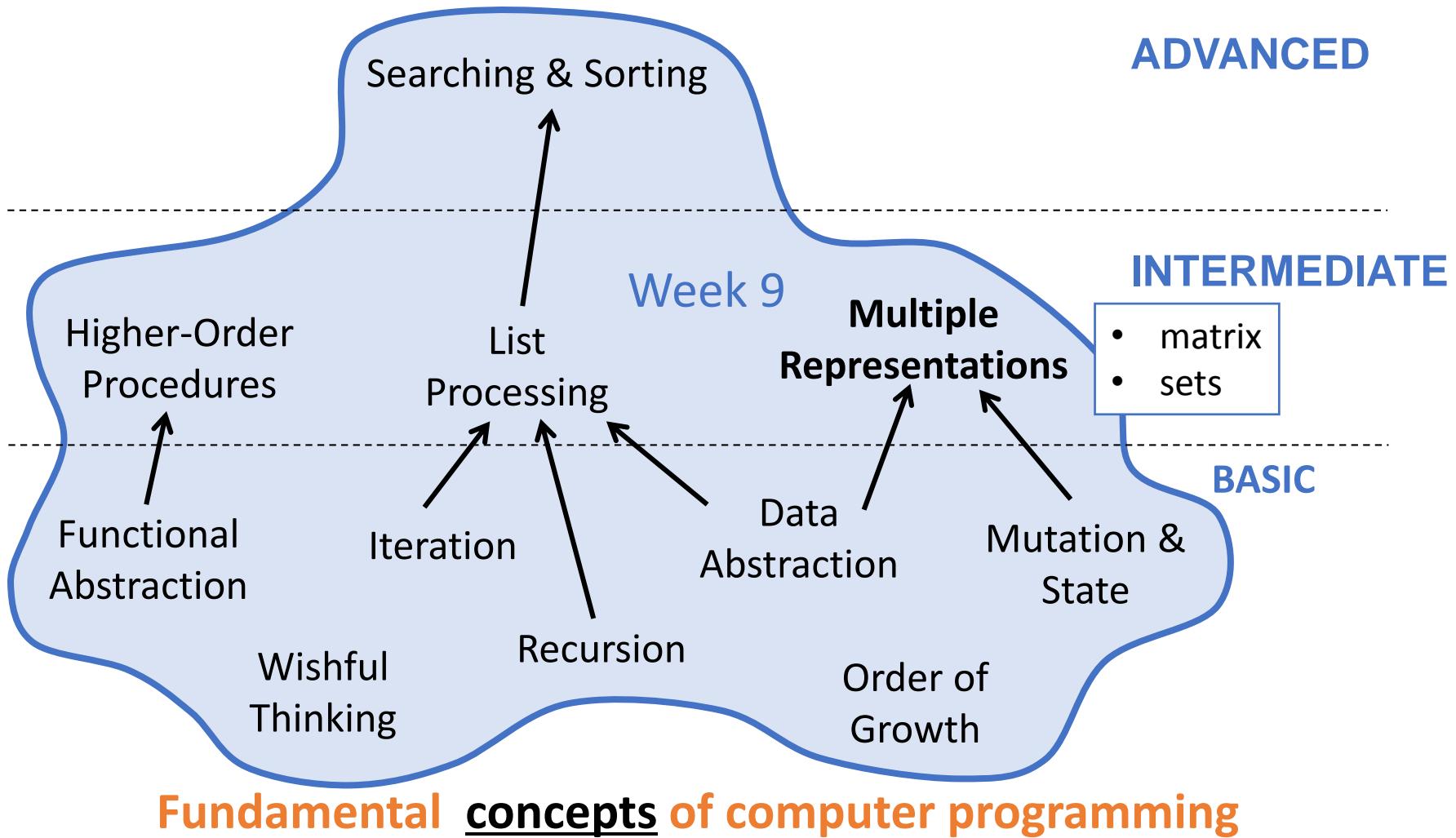
CS1010S Road Map



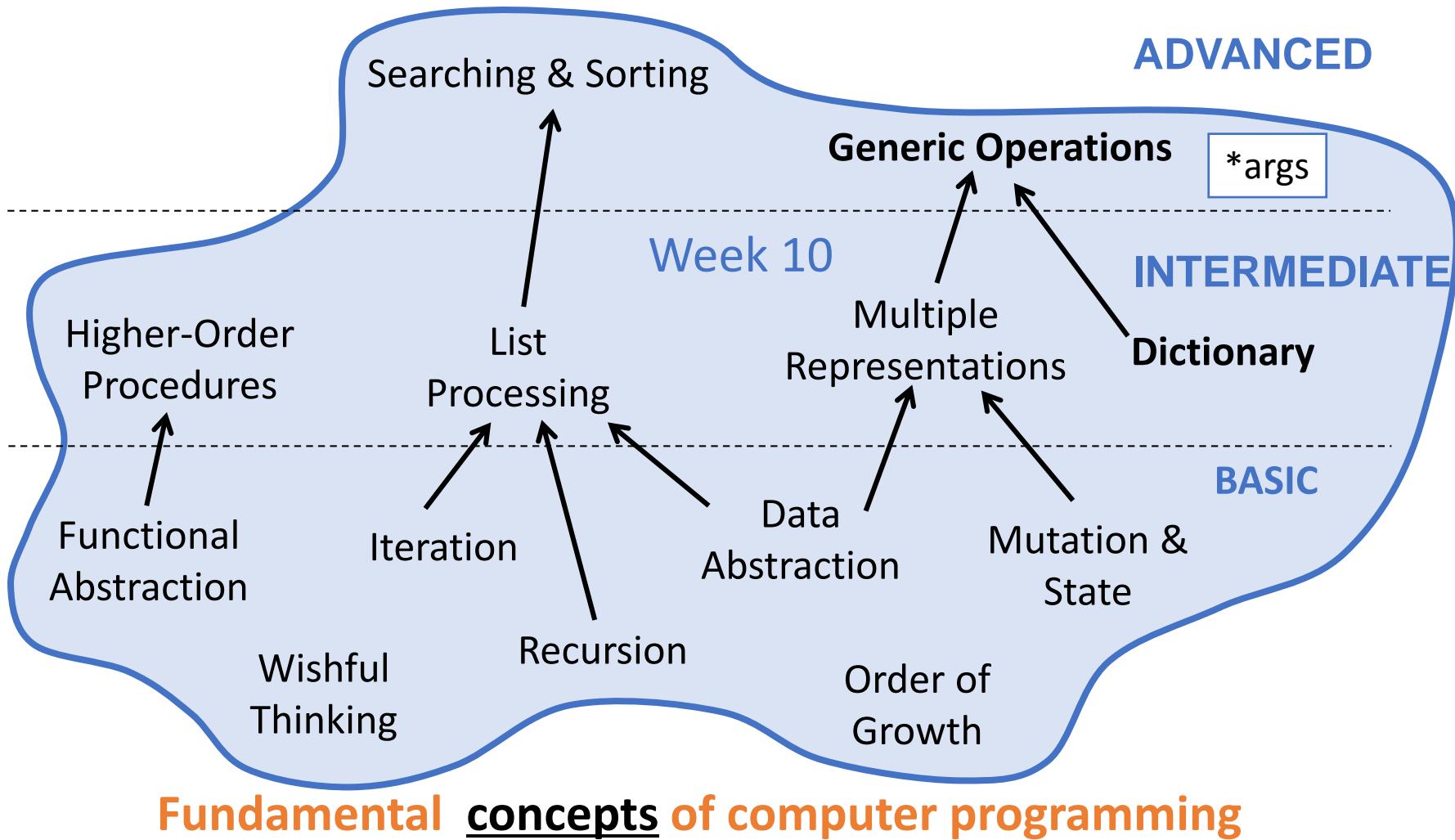
CS1010S Road Map



CS1010S Road Map



CS1010S Road Map



Rect version:

```
make_from_real_imag(x, y)  
real_part(z)  
imag_part(z)  
magnitude(z)  
angle(z)  
make_from_mag_ang(r, a)
```

Polar version:

```
make_from_real_imag(x, y)  
real_part(z)  
imag_part(z)  
magnitude(z)  
angle(z)  
make_from_mag_ang(r, a)
```

(2, 2)
Rect

(4, 9)
Rect

(2, 3)
Polar

(4, 1)
Polar

(1, 3)
Rect

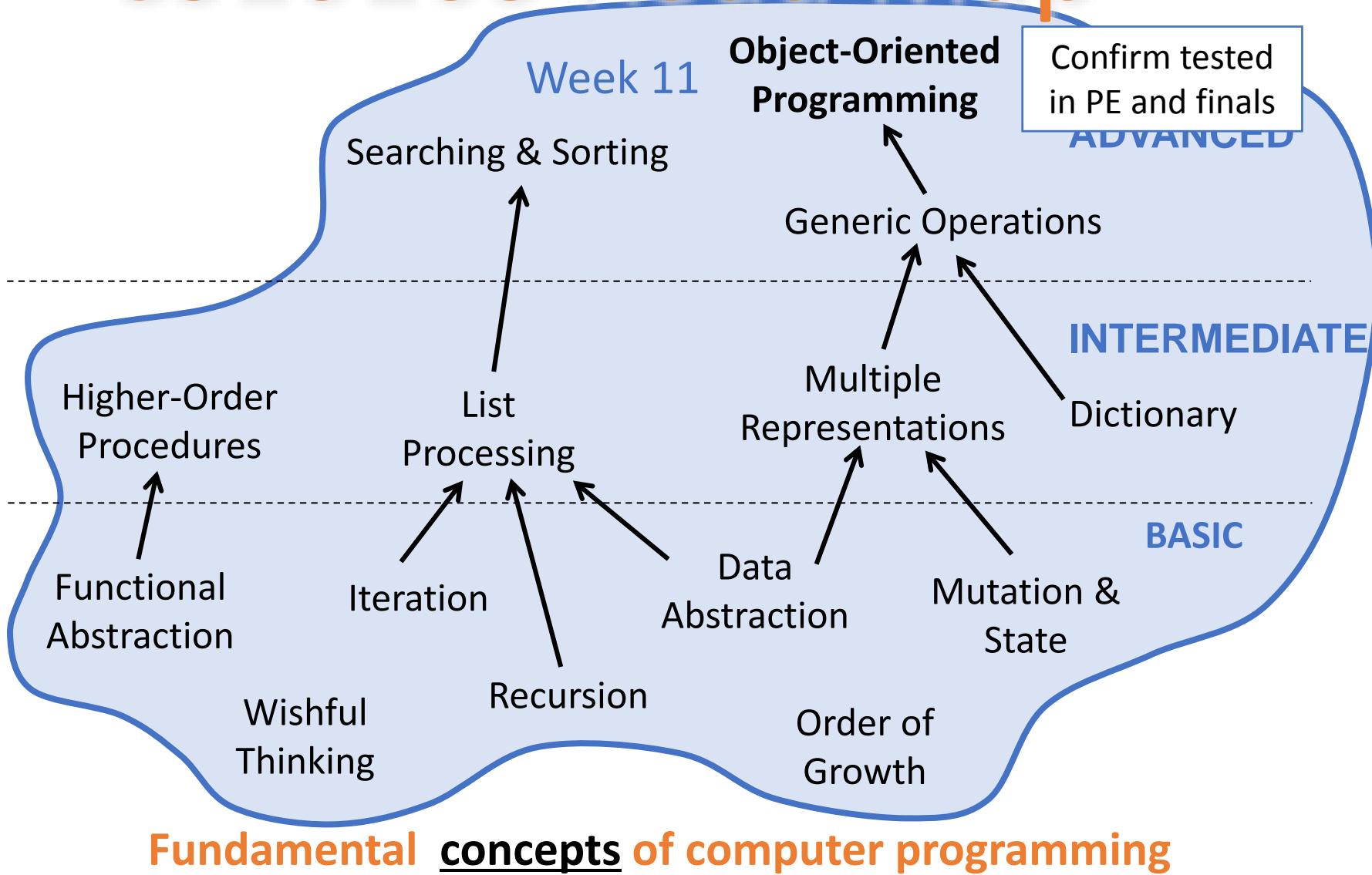
(7, 3)
Rect

3 Strategies

- Dispatch on Type
 - if-else
- Data Directed Programming
 - Store in table
- Message Passing
 - Put function in the data!

Won't be tested in PE or Finals
Why?

CS1010S Road Map



OOP =
Message Passing + Data
Abstraction

Major concepts

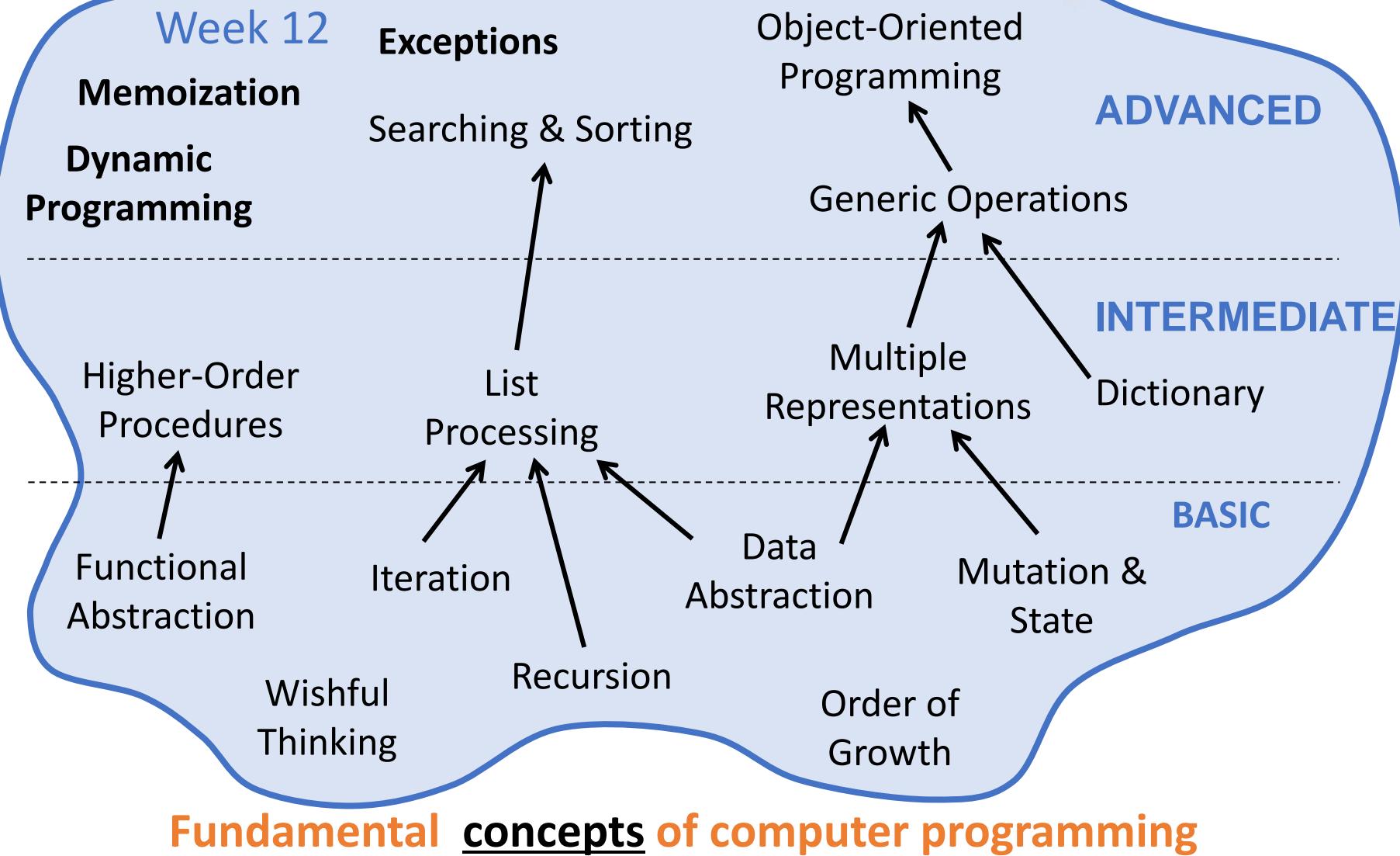
- Classes and instances
- Properties (state)
- Methods
- Inheritance
- Polymorphism
(overriding)

Focus on syntax

self

super()

CS1010S Road Map



Won't come out on
PE/Finals

Memoization

Redundant
Computations!

Dynamic Programming

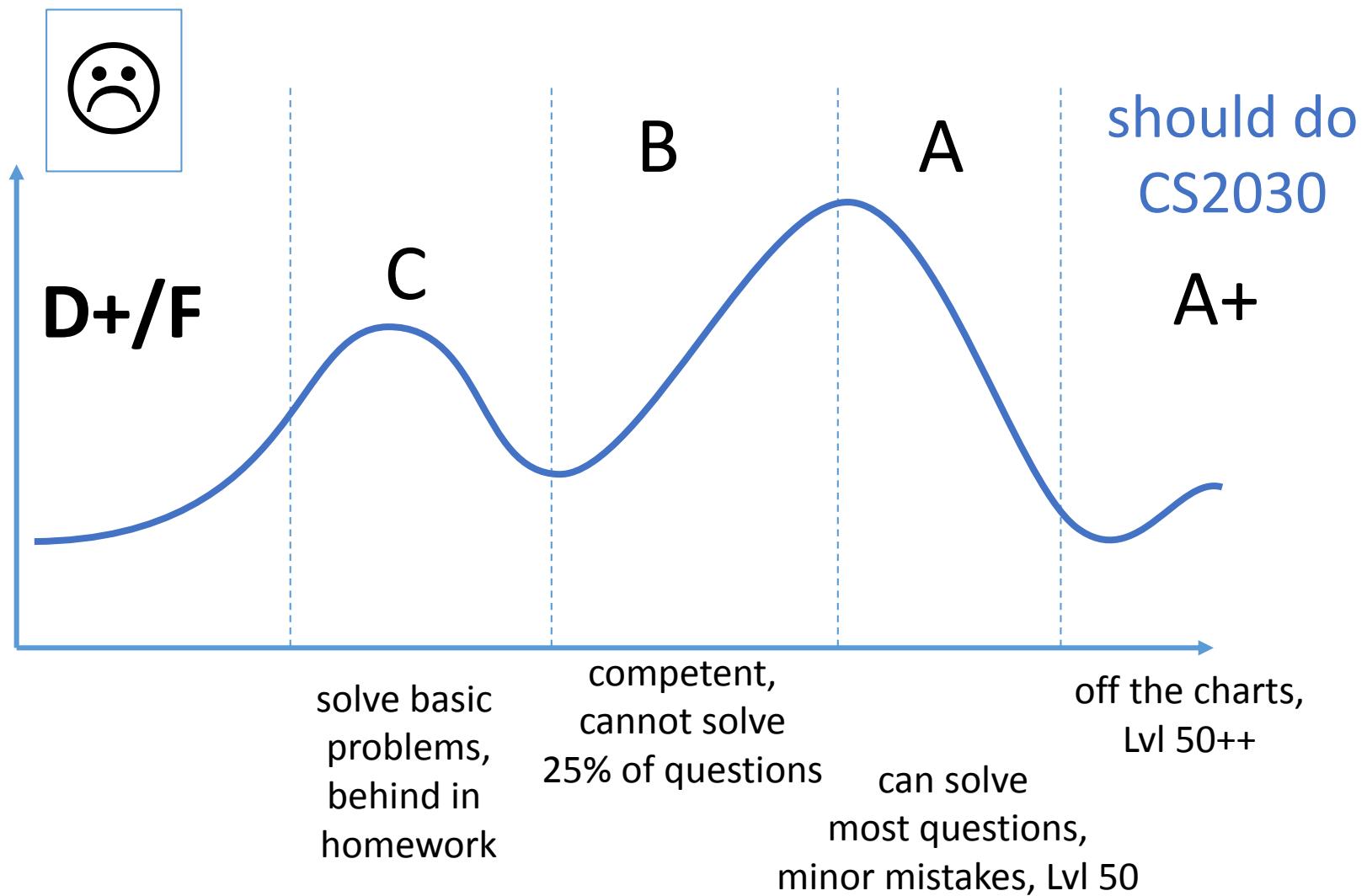
remember
what you
computed
before in
table!

fill the
table
directly!

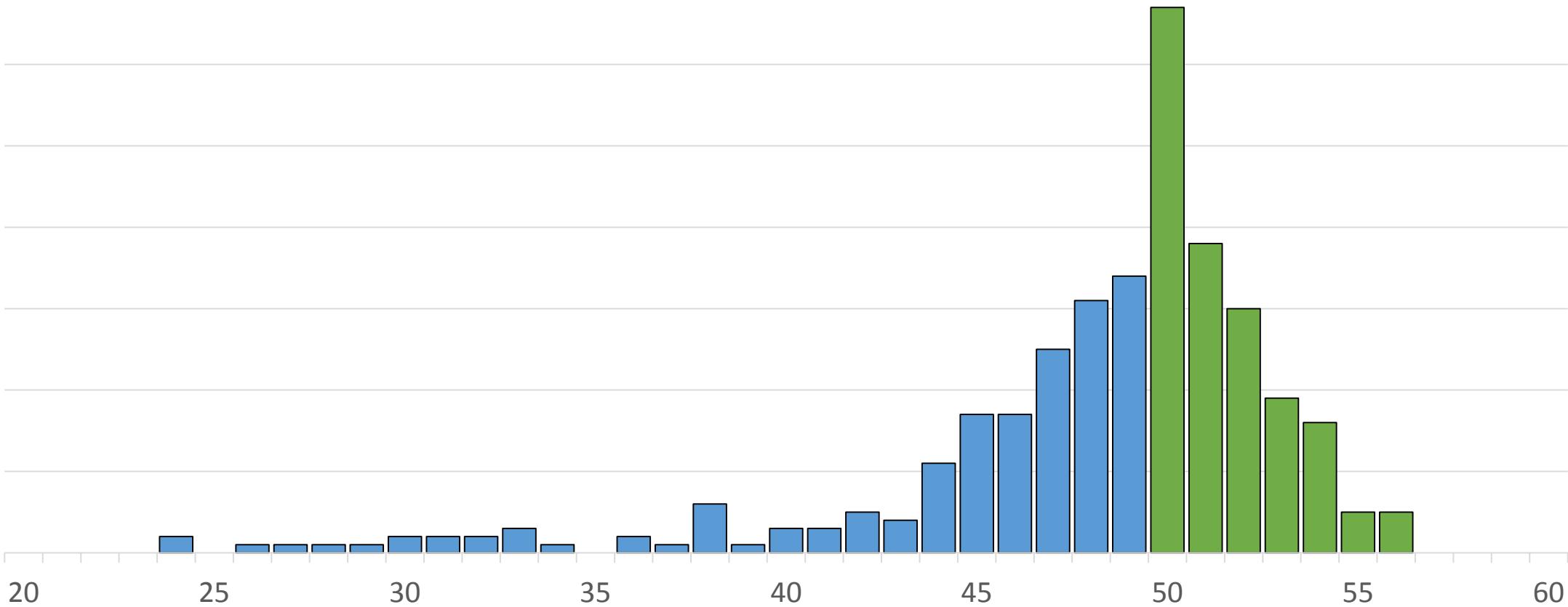
3 Types of Data Structures

- Tuple ()
 immutable
 indexed by int
- List []
 mutable
 indexed by int
- Dictionary {}
 mutable
 indexed by key

How You Will Be Graded



Coursemology EXP

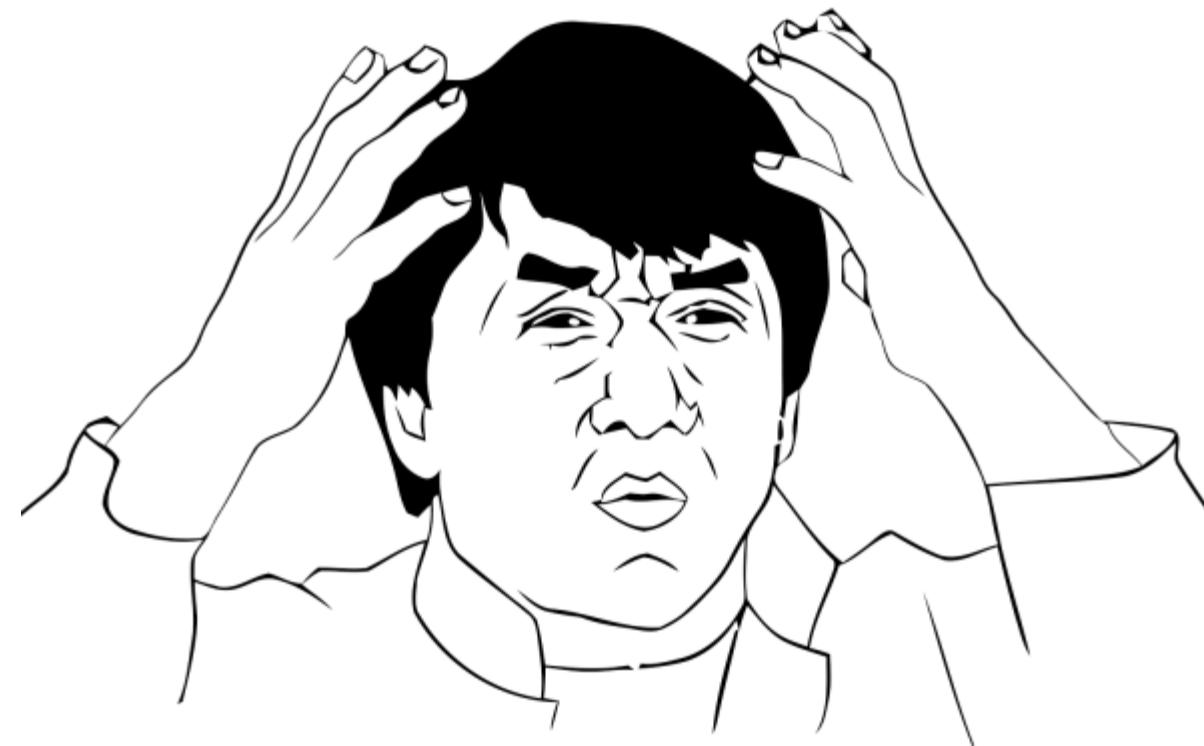


Deadline for Coursemology EXP
Day of Finals

Now...

5 years after you graduate
(9 years from now), when people ask you what you
learnt in college....

MANAGING COMPLEXITY



What did you learn in CS1010s?

Computational Thinking

Computational Thinking

Decomposition

- Divide and Conquer
- Breaking problem into smaller parts

Abstraction

- Functional Abstraction
- Data Abstraction
- Object Oriented Prog

Pattern Recognition

- Higher-order Function

Algorithm

- Searching & Sorting
- Almost every problem

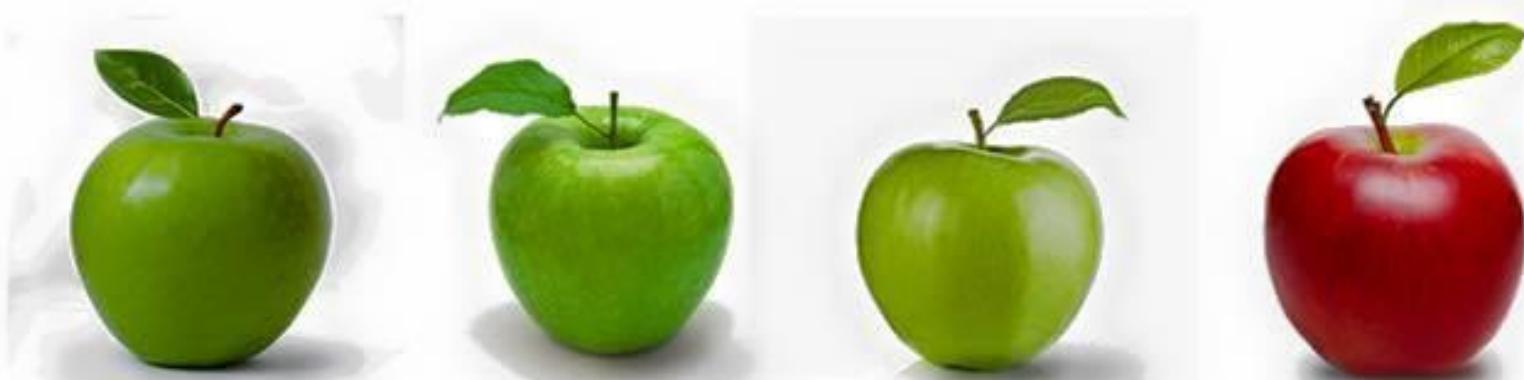
THIS IS IT



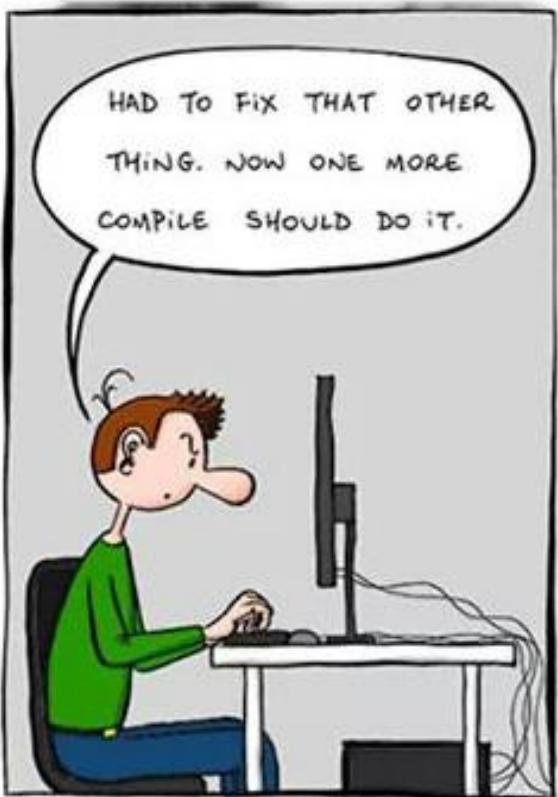
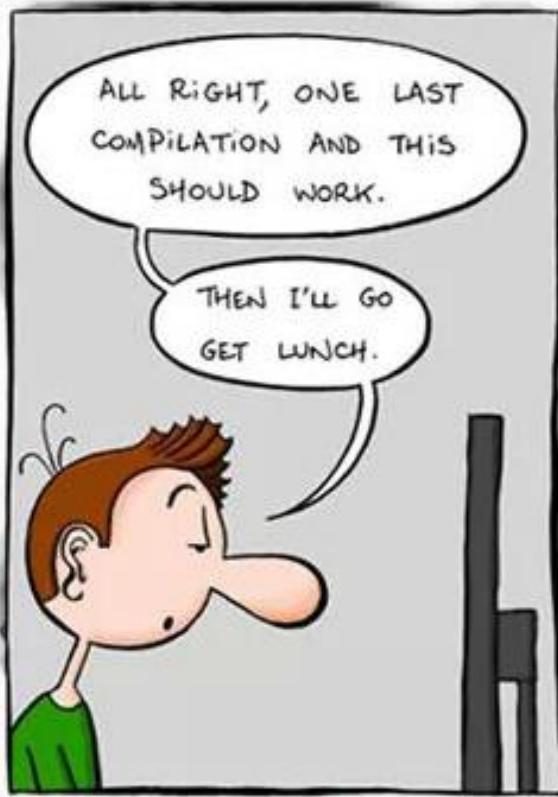
Are you a
programmer?

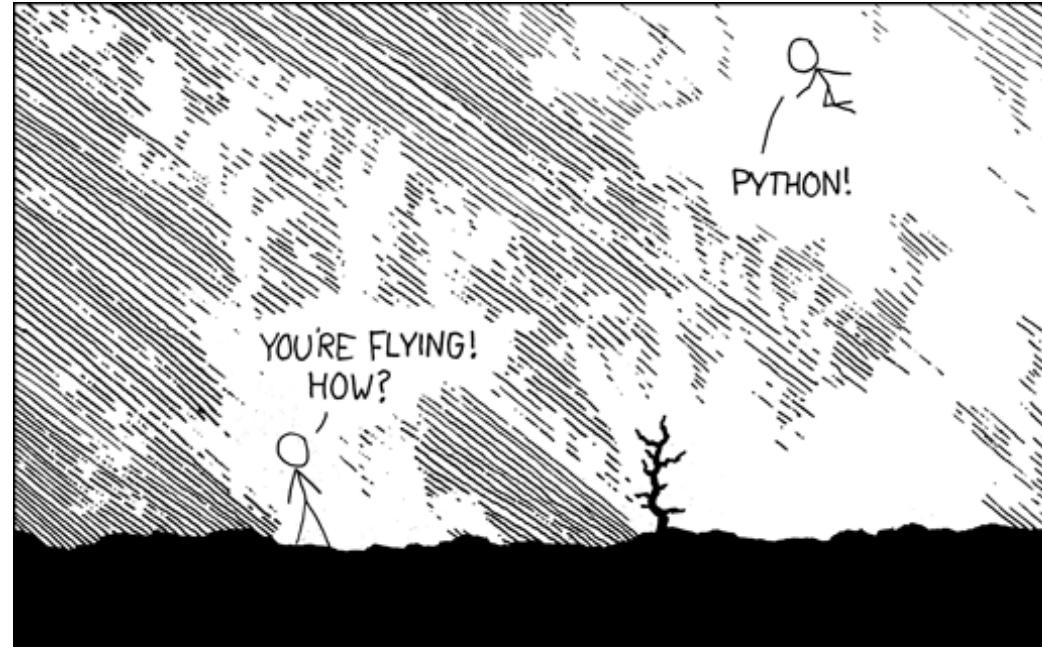
It depends

YOU KNOW YOU'RE A PROGRAMMER WHEN...



red apple is number 3





I LEARNED IT LAST
NIGHT! EVERYTHING
IS SO SIMPLE!
/ HELLO WORLD IS JUST
print "Hello, world!"

I DUNNO...
DYNAMIC TYPING?
WHITESPACE?
/ COME JOIN US!
PROGRAMMING
IS FUN AGAIN!
IT'S A WHOLE
NEW WORLD
UP HERE!
BUT HOW ARE
YOU FLYING?

I JUST TYPED
import antigravity
THAT'S IT? /
... I ALSO SAMPLED
EVERYTHING IN THE
MEDICINE CABINET
FOR COMPARISON.
/ BUT I THINK THIS
IS THE PYTHON.

webs



NOVICE PROGRAMMER



EXPERIENCED PROGRAMMER



I DON'T GET
YOUR CODE.
WHAT ARE
THESE LINES
FOR?

great & polite

I HAVE NO IDEA.
BUT IT DOES NOT
WORK WITHOUT
THEM

THE ART OF PROGRAMMING - PART 2: KISS

Jokes aside...

What did you get out of
this course?



Mastery in Python

МАСТЕРСТВО В ПИТАОН

5

Transfer to Computer Science



<http://www.nus.edu.sg/oam/apply-to-nus/transfer-applicants.html>

Double Degree

Computer Science &

Math/Applied Math

<http://www.comp.nus.edu.sg/programmes/sp/ddp/cmam/>

Second Major in CS

12 courses

of which 4 can be double counted

<http://www.comp.nus.edu.sg/programmes/ug/major/structure/>

Minor in CS

6 courses

of which 2 can be double counted
with major

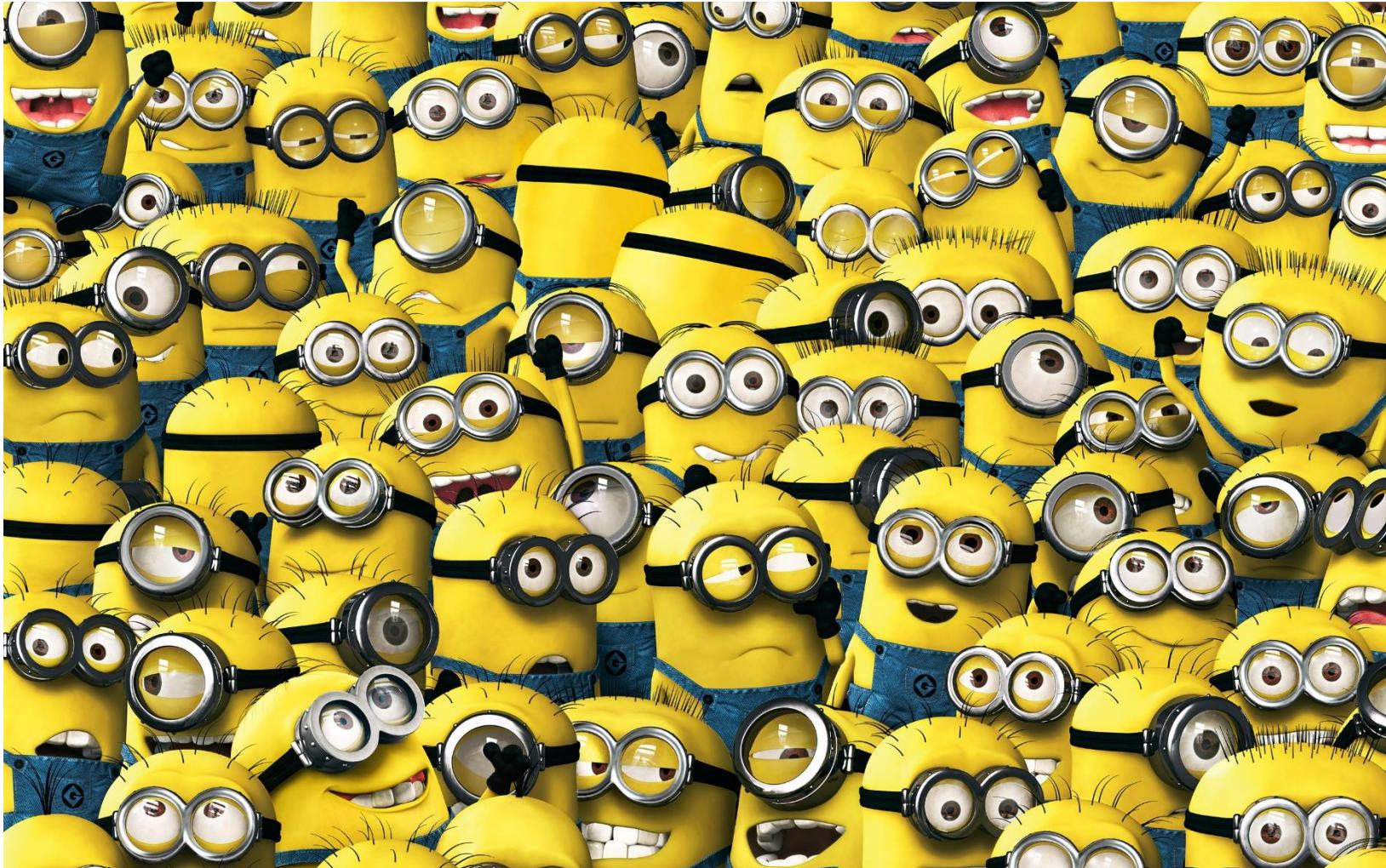
<http://www.comp.nus.edu.sg/programmes/ug/minor/>

Continue with...

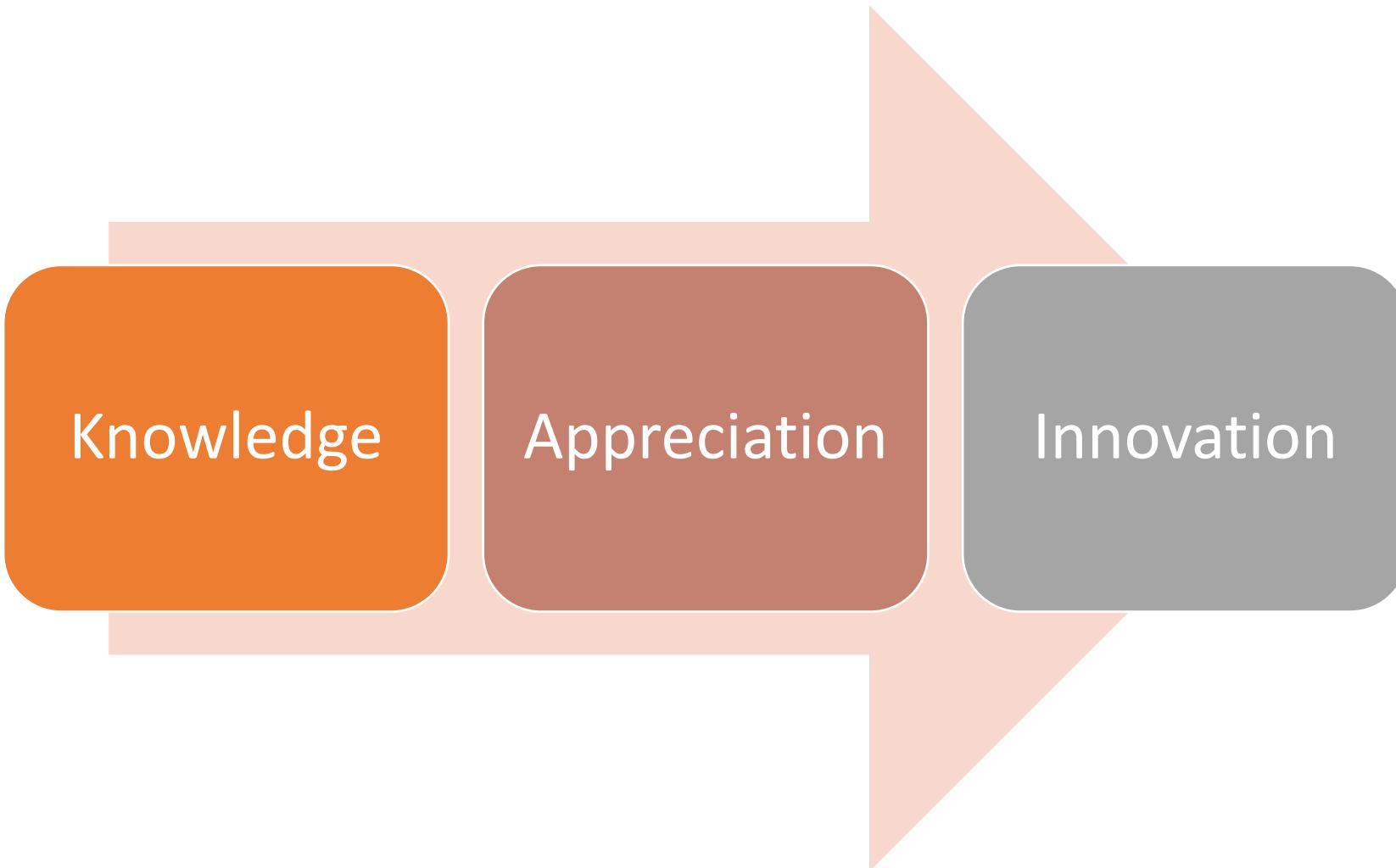
CS2030



What about us mortals?



Path to Mastery



What do you want to get from university?



Most graduates do not
work in a related field
to their degree

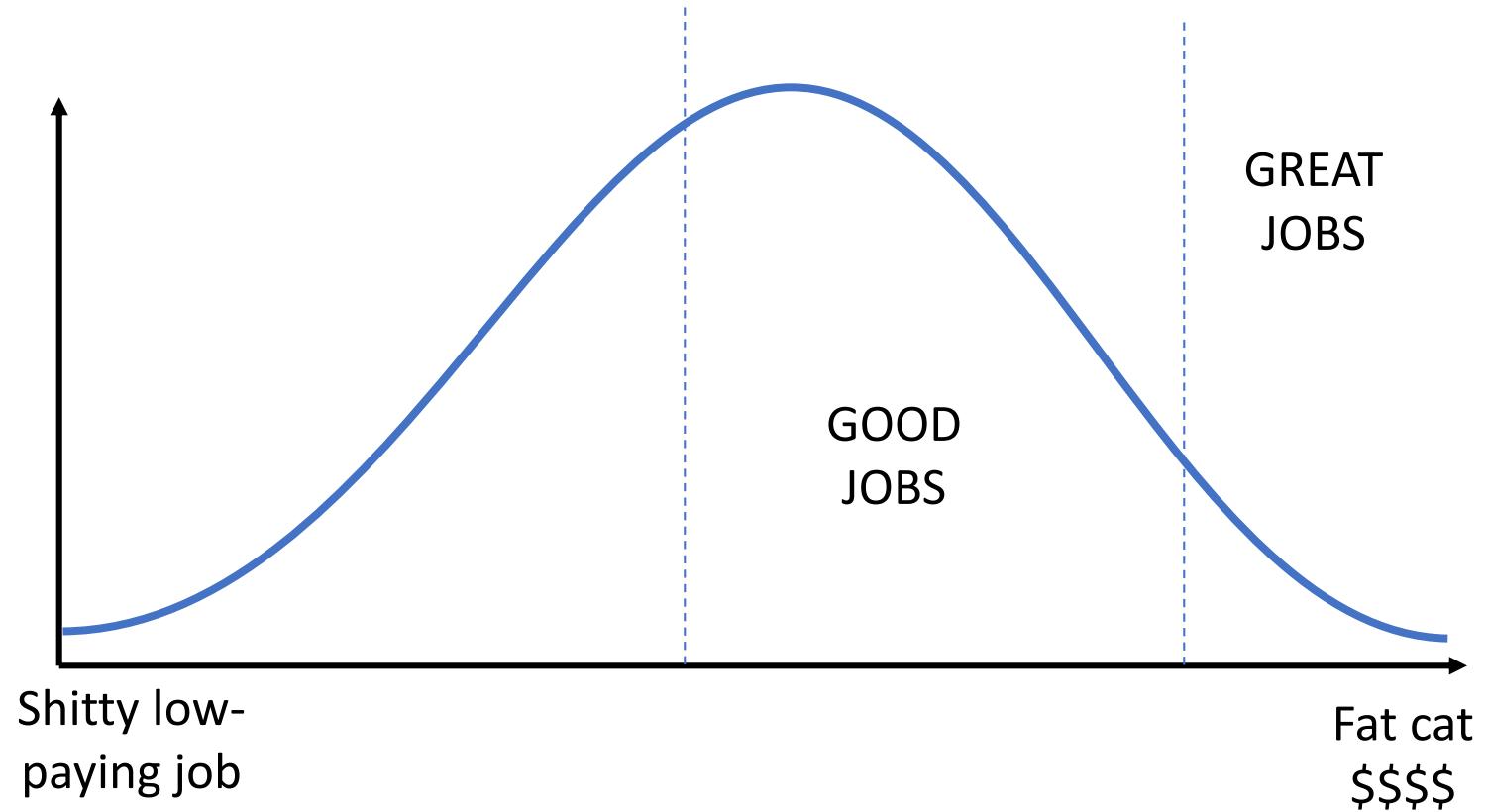
So have you wasted
your time here?

It depends



Are grades
important?

What it used to be

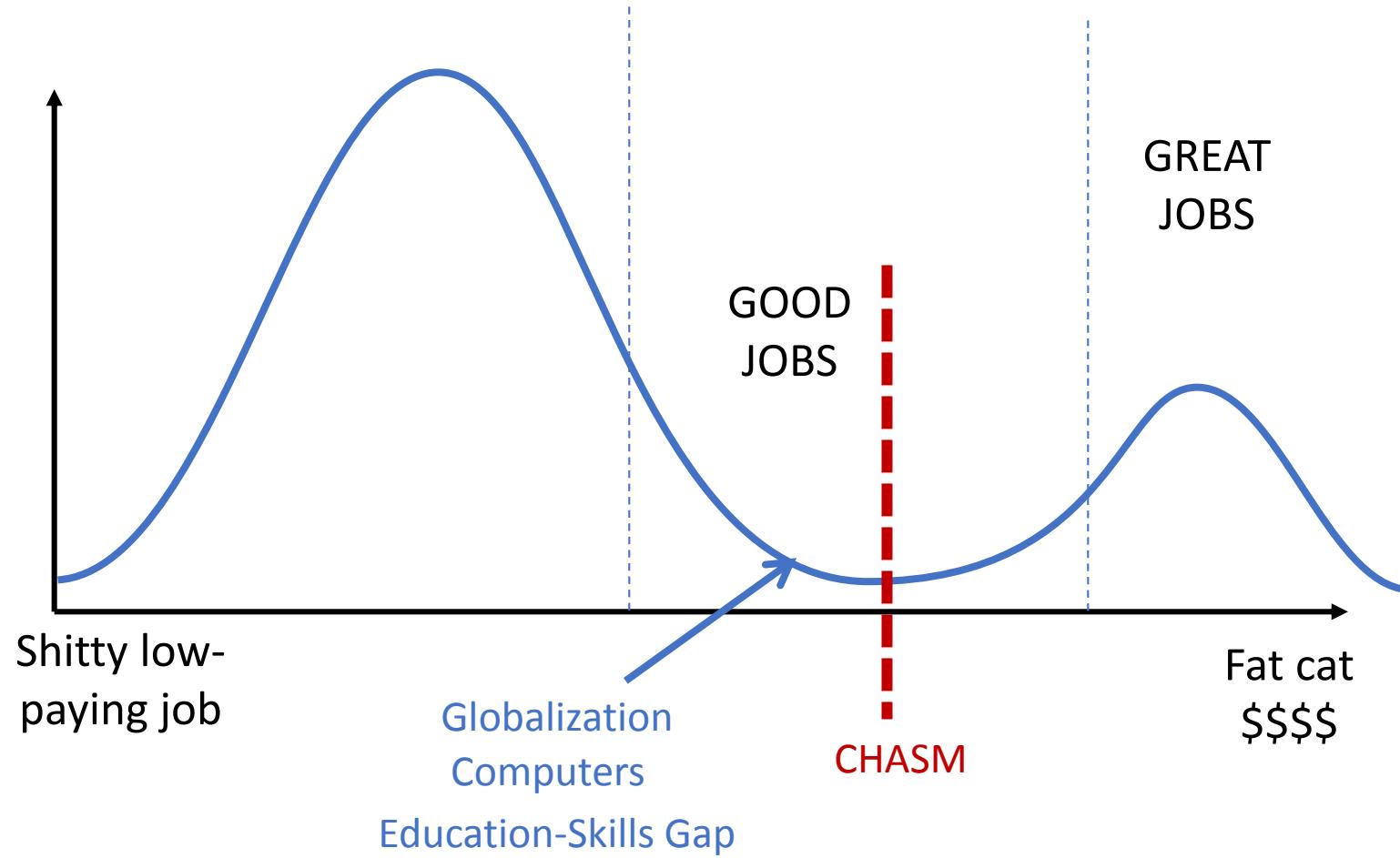


“Good jobs are now disappearing. There are great jobs and great careers, and then there are the high workload, high stress, blood-sucking, soul-destroying kinds of jobs and practically nothing in between, so the people looking for good jobs are going to fail.”



- Larry Smith

What it's gonna be



Robots to Steal 10 Million Low Paid UK Jobs by 2034

IBT

By Lianna Brinded | IB Times – Mon, Nov 10, 2014

f Share

1

Tweet

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Pinit

Recommended for you



Asimo makes its UK debut at the Wired Conference in London

Britons earning less than £30,000 a year are likely to have their jobs taken by robots over the next two decades as 10 million UK positions are said to be eliminated in favour of automation.

According to a joint report by big four accountancy firm Deloitte and the University of Oxford, the lower paid are five times more likely to have their jobs taken over by robots, compared with those earning around £100,000 (€127,245, \$159,032).

According to Office for National Statistics data, 30.76 million people are employed in the UK, meaning that the jobs being potentially lost to robots account for 35% of the British workforce.

"Technological advances are likely to cause a major shift in the UK labour market in the coming decades. Unless these changes are fully understood and anticipated, there will be a risk of avoidable unemployment and under-employment," said Angus Knowles-Cutler, London senior partner at Deloitte.

"A widening gap between the 'haves' and 'have nots' is also a risk as lower skill jobs continue to disappear."

The report falls neatly in line with previous estimates that millions of jobs around the world will be lost to robots as the world becomes more digitised and automated.

1.8 million American truck drivers could lose their jobs to robots. What then?

One of the last well-paying working-class jobs is basically doomed.

Updated by David Roberts | @drvox | david@vox.com | Aug 3, 2016, 8:40am EDT

 TWEET

 SHARE



60% of students are chasing jobs that may be rendered obsolete by technology, report finds

Many of the jobs that young people are training for could vanish completely in 10 to 15 years

Doug Bolton | @DougieBolton | Tuesday 25 August 2015 | 0 comments





Lawyers could be the next profession to be replaced by computers

Dan Mangan | @_DanMangan | Friday, 17 Feb 2017 | 1:55 PM ET



16K
SHARES

Technology is often blamed for destroying traditional working-class jobs in sectors like manufacturing and retail.

But blue collar jobs aren't the only ones at risk.

The legal profession — tradition-bound and labor-heavy — is on the



Lawyers, accountants join list of workers who could lose their jobs to AI, warns report

PM | By Zoe Ferguson

Updated 5 Apr 2017, 9:45am

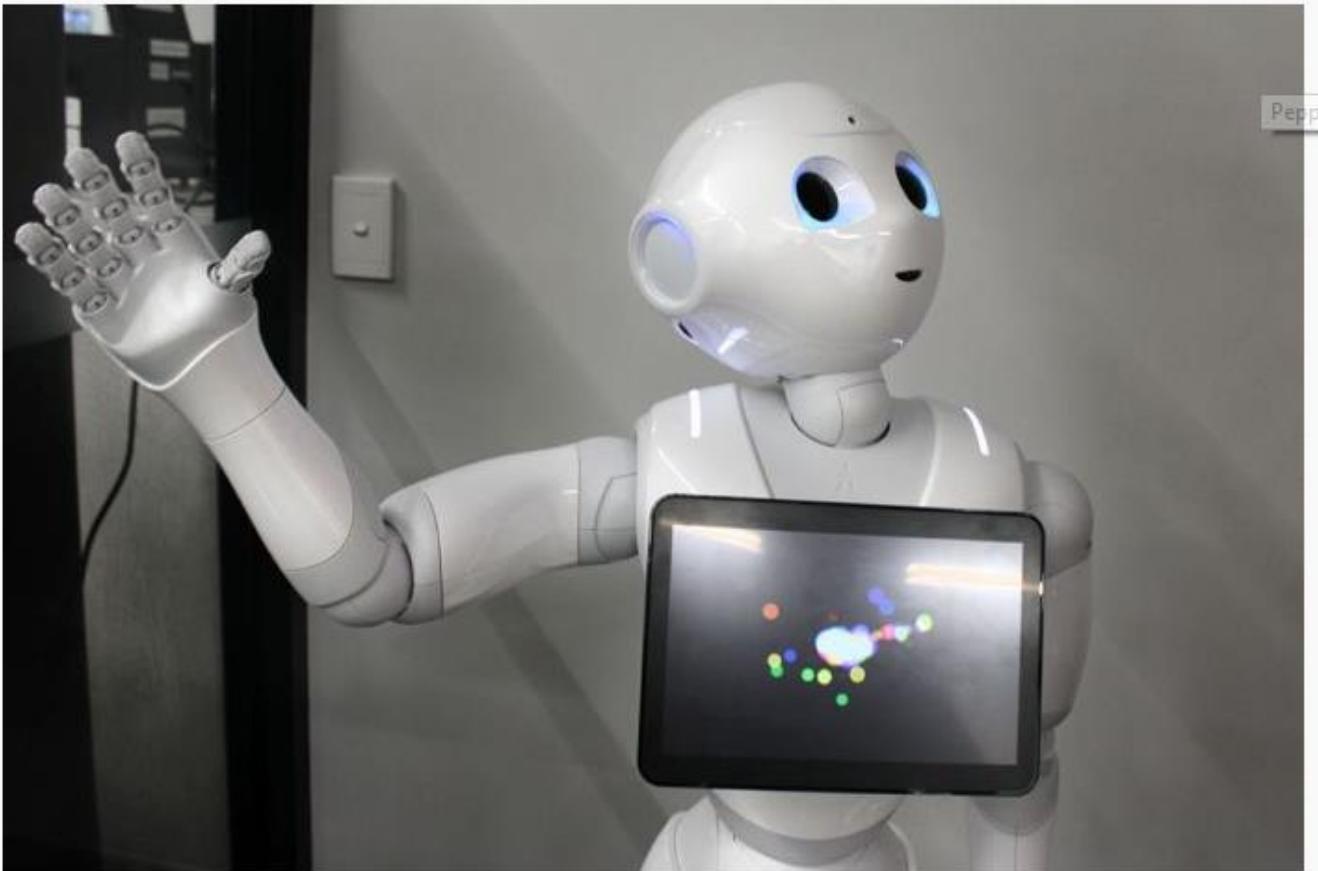


PHOTO: Pepper is the humanoid robot who has the capacity to understand people's moods and emotions.
(ABC Tropical North: Harriet Tatham)

If you're an accountant, lawyer or data analyst, a robot may soon take over your job.

A new report from the International Bar Association

RELATED STORY: Artificial intelligence beats humans in poker for first time

RELATED STORY: AI replacing human staff at Japanese insurance company

No more
“safe” options

No more
guarantees

AI rules the world

A wide-angle, low-light photograph of a city skyline, likely Los Angeles, at night. The city is mostly obscured by deep shadows, with only streetlights and building windows providing sparse illumination. In the upper portion of the image, there is a large, semi-transparent rectangular area filled with a solid orange color. Overlaid on this orange area is the text "AI rules the world" in a large, white, sans-serif font.

So how?

Tip:

Become

DAMN GOOD

at what you do

Tip:

Passion

**It's over-rated and gets you
nowhere (mostly)**



FEATURING
MIKE ROWE

Don't Follow Your Passion

Are grades important?

What do you want to get from university?



On grit



Grit /grɪt/ noun.

Mirriam-Webster: firmness of mind or spirit

Oxford: Courage and resolve; strength of character

CS1010S: Ability to take sh*t



Building Resilience: 5 Ways to a Better Life

In CS1010S, you faced a lot of
hardship



It is deliberate
by design



**Structure and
Interpretation
of Computer
Programs**

Second Edition



**Harold Abelson and
Gerald Jay Sussman
with Julie Sussman**

Congratulations on surviving



Have you reached
your potential?

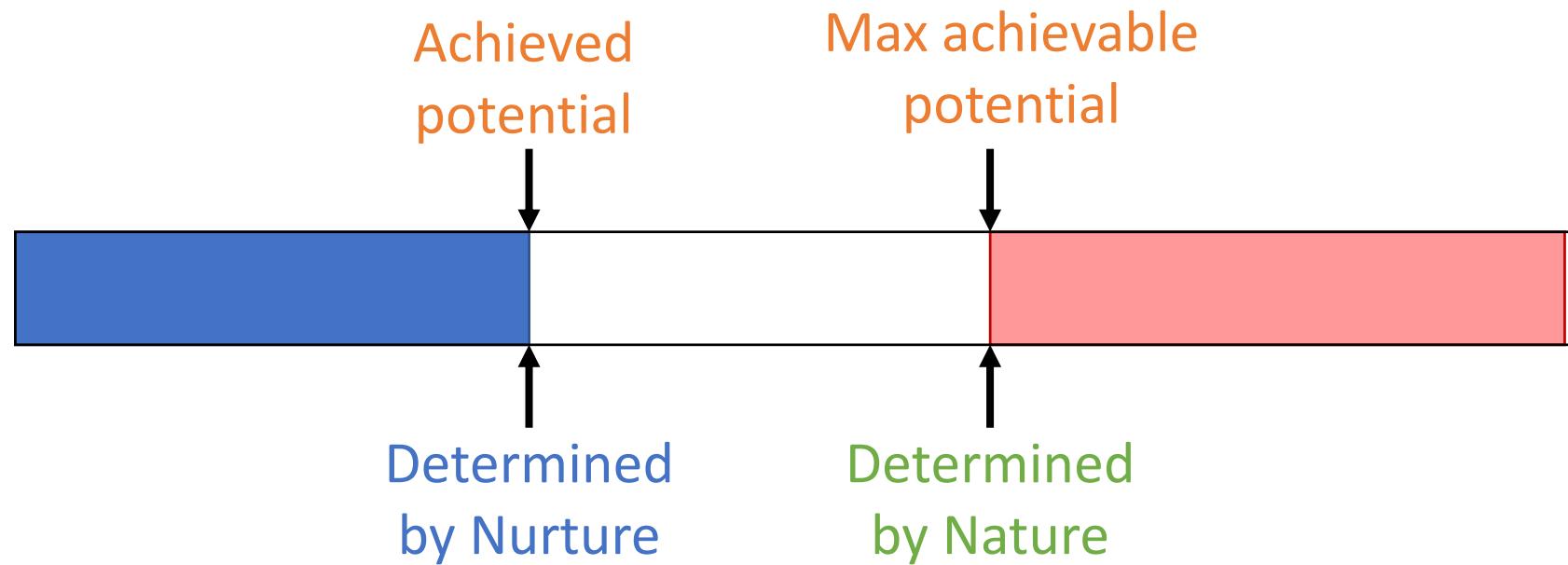
Nature

vs

Nurture

Model

Potential Meter



Model

Good news: most people are probably less than 50%



How far along are you?

How do you get to your full potential?

Model

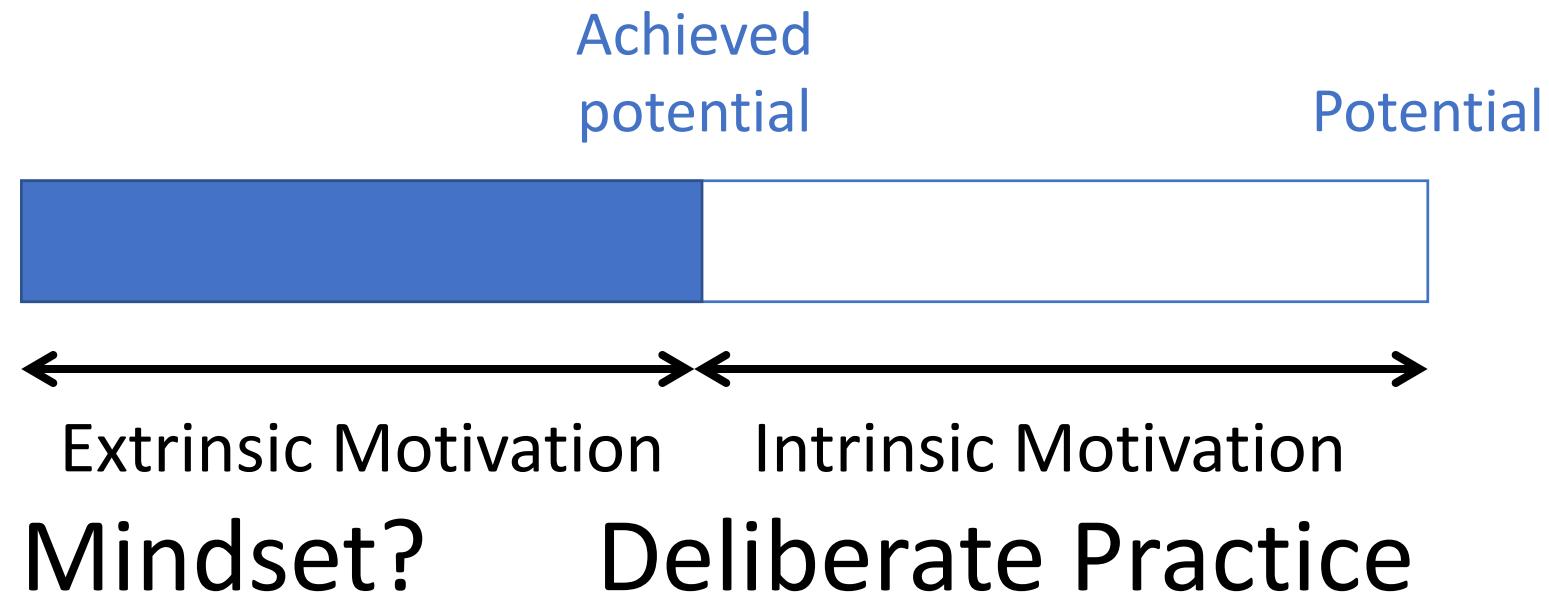
Good news: most people are probably less than 50%



How far along are you?
How do you get to the full potential?

Model

Good news: most people are probably less than 50%



3 Lessons to learn

Lesson #1:

What is education?

What is
School for?

Seth Godin



What is school for? If you're not asking that, you're wasting time and money.

— *Seth Godin* —

AZ QUOTES

<https://www.youtube.com/watch?v=sXpbONjV1Jc>

Give a man a fish
and you feed him
for a day.

Teach a man to fish
and you feed him
for a lifetime.”

Today's Problem

Is there going to be
fish tomorrow?





Innovation is the only
way to win.

Steve Jobs

Tip:

Keep learning
like there's no
tomorrow

Tip:

Do not be satisfied
Keep asking can you do
better?

A dark, atmospheric photograph showing several silhouetted figures of people standing in front of a bright, orange and yellow light source, possibly a campfire or a large firework. The light creates a strong glow and illuminates the figures from behind.

Mindset
values

Do what is right

vs

Do what is easy

ALL THE BEST

HEROES

are

ORDINARY PEOPLE

WHO MAKE

themselves

EXTRAORDINARY

- GERARD WAY

Sense of entitlement

Should we be wary of a heightened sense of entitlement?

William Wan For The Straits Times

© PUBLISHED JUN 21, 2016, 5:00 AM SGT



Recently, netizens were in an uproar over a Facebook video which showed a livid female customer berating a deaf cleaner and his manager at JEM food court. What appeared to be a simple case of miscommunication on the part of the cleaner (due to his inability to communicate verbally) escalated into the most talked-about topic in town. It even had our national leaders weighing in.

Such reactions did not come as a surprise. The woman's outburst happened amid a slew of other reports of ill-treatment towards service staff in the healthcare, food and beverage, and retail industries. The Straits Times recently reported that nurses are experiencing more physical and verbal abuse from patients and their family members. In another article by The New Paper, a customer almost turned violent after a restaurant owner told him about their no-split-bill policy.



ST VIDEOS ►



Make-up etiquette video by Japanese train company faces backlash



Malaysian man wants to shed 100kg from current weight of 250kg



Sarawak mall dumps 1,500 bowls of 'unhealthy' laksa after setting national record



I Learned More at McDonald's Than at College

Lesson #2:
Failure is
not all bad



On failure

<https://www.youtube.com/watch?v=wHGqp8lz36c>

*“Ultimately, we have to decide for
ourselves what constitutes failure.”*

- JK Rowling

Education is not about
Stuff

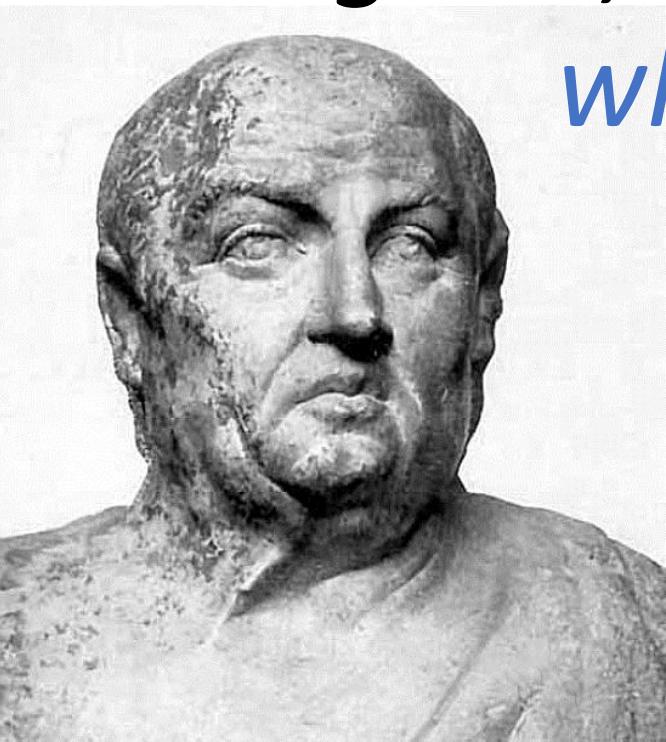
“Life is not a checklist of acquisition and achievements. Your qualification, your CV is not your whole life.”

- JK Rowling

*“Life is difficult and
complicated and beyond
anyone's total control.”*

- JK Rowling

“As is a tale, so is life: not how long it is, but how good it is, is what matters.”



- Seneca

*“If it ain’t hard,
it ain’t worth doing.”*



- Ben Leong

Lesson #3:

What is the

meaning of life?



many paths to
success

LIFE
is about *trade-offs*

Everything has a value
and a price

Optimization problem

Currency:

TIME



The Art of Stealth Studying: How To Earn a 4.0 With Only 1.0 Hours of Work

[Tips: Studying](#) [Study Hacks](#)

October 3rd, 2007, 1:40pm

Welcome new readers. Study Hacks is a blog dedicated to productivity hacks for students. If you like this article, you might also like these posts on how as an MIT grad student I never work past 5 PM, the difference between work and pseudo-work, and the key to becoming both impressive and relaxed. If you prefer more technical advice, consider my article on using a Monotypic e-mail inbox, this survey of effective student time management techniques, this story of a student who got a 4.0 with 0.0 notes, and these instructions for building a paper research database.

The Secret Art of Stealth Studying

Most students don't mind studying if the work gets done in focused chunks, spread out over a reasonable amount of time. For some, however, reasonable efficiency is not enough. They want more. They want to push academic productivity to its absolute limit. **They want nothing less than to eliminate studying all together!**

I can't get you all the way to this goal. But I do know a technique that can get you close. Imagine only having to study for one hour the day before a test? No more stress. No more long nights.

It's possible. During my research for Straight-A I came across exactly two out of the fifty students I interviewed who managed to accomplish this goal. (And were loving life because of it). Their technique is a little-known art I like to call: *Stealth Studying*.

In this post, I will teach you this art...

The Stealth Studying Philosophy

Before you torch your notebooks, I should make an important clarification. You cannot avoid capturing and internalizing information. It's like a law of nature. These activities must



Stealth Studying



A simple Help Desk app focused on helping you turn customers into fans.

ads via Carbon

Web Hosting Provided By...



Work life
~~Balance~~
Trade Off

Work-Life Balance My Foot

 Edit

July 11, 2013 at 2:38am 

It is a pity that I was not able to attend this year's Commencement because I was away on business in China.

Just landed a couple of hours ago, but something that I read in the Straits Times on the plane really bothered me, and I mean *really* bothered me. The title of the article was "Undergrads' top priority: Work-life balance".

I am writing this note to you, my students who are graduating this year, as a final warning -- in case some of you also subscribe to this grand notion that there's more to life than work.

Actually, it is indeed true that there is more to life than work. However, if you should step out into the working world thinking seeking this thing called work-life balance then I fear you might be setting yourself up for a perilous future.

It is possible to achieve work-life balance. Many have done it.

But what many young people fail to understand is that it is privilege, and not an entitlement. In other words, **you have to earn it**. This is a mistake I hope you do not make.

And the way to earn it is to become so damn good at what you do that your boss has no choice but to tolerate your work-life balance -- or for you to become your own boss.

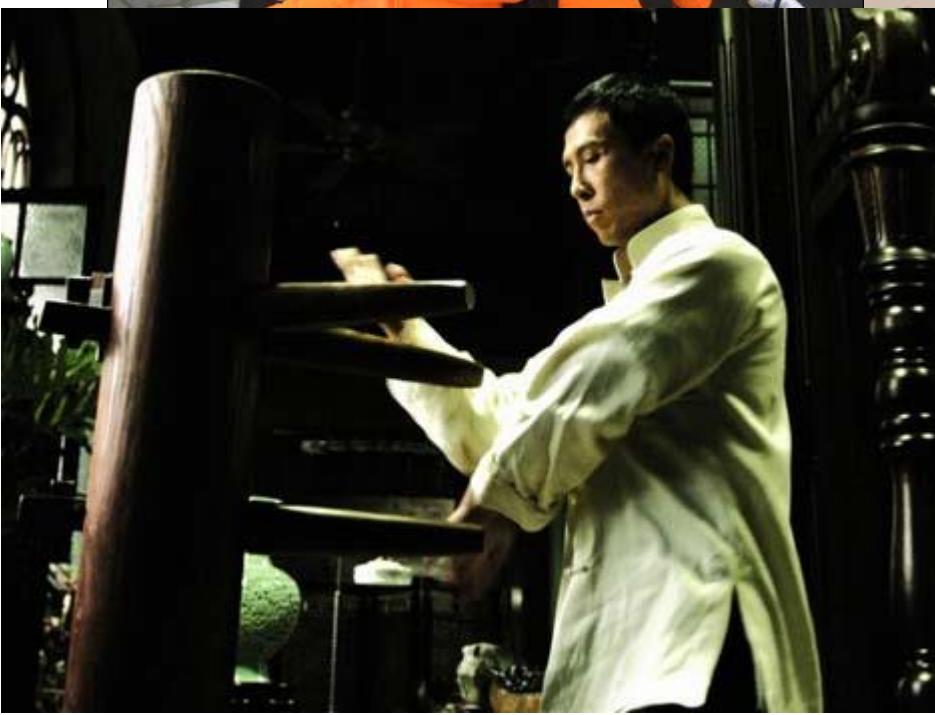
I am not sure how to be more subtle, but none of you -- yes, none of you, not even the First Class Honours -- is currently so damn good that you are completely indispensable.

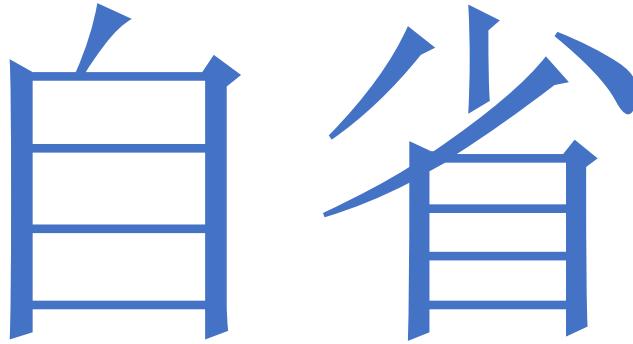
If you put in enough work and effort, then maybe, just maybe, in 10 years, you might find

<https://www.facebook.com/notes/ben-leong/work-life-balance-my-foot/10151518399452549/>

What is success?

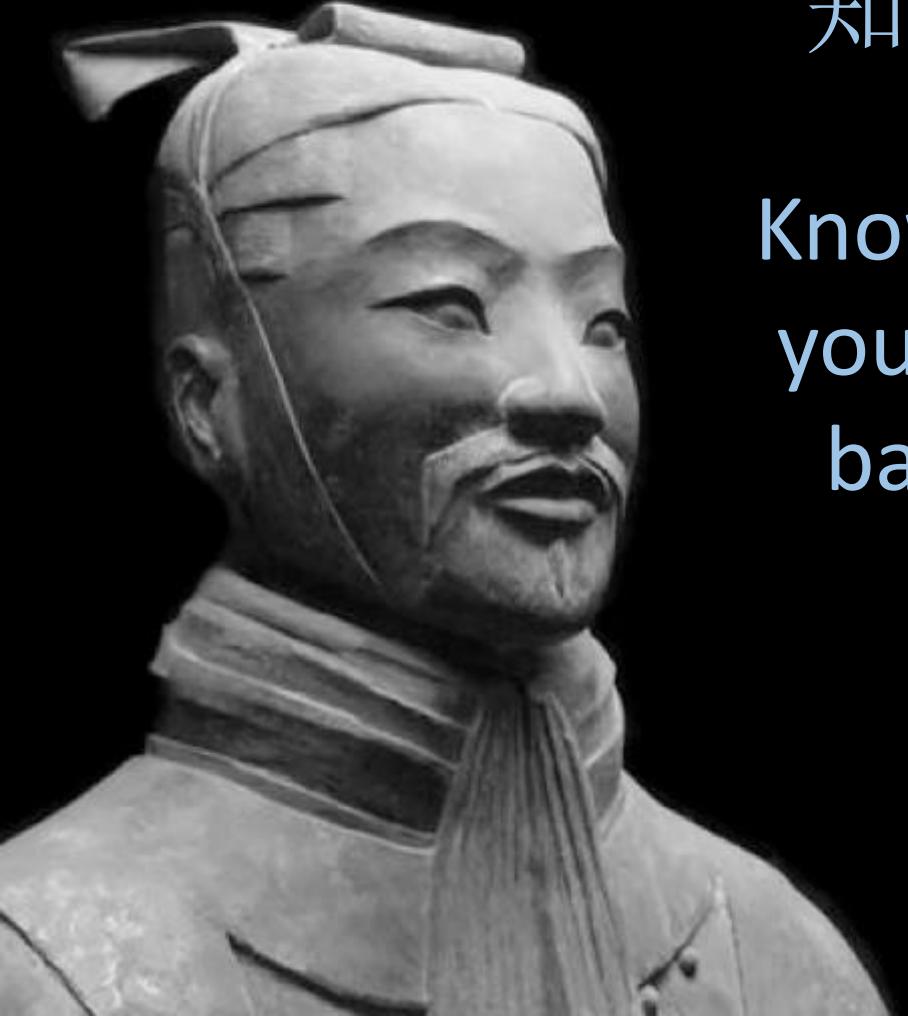
It depends ☺





zì xǐng

Self Awareness



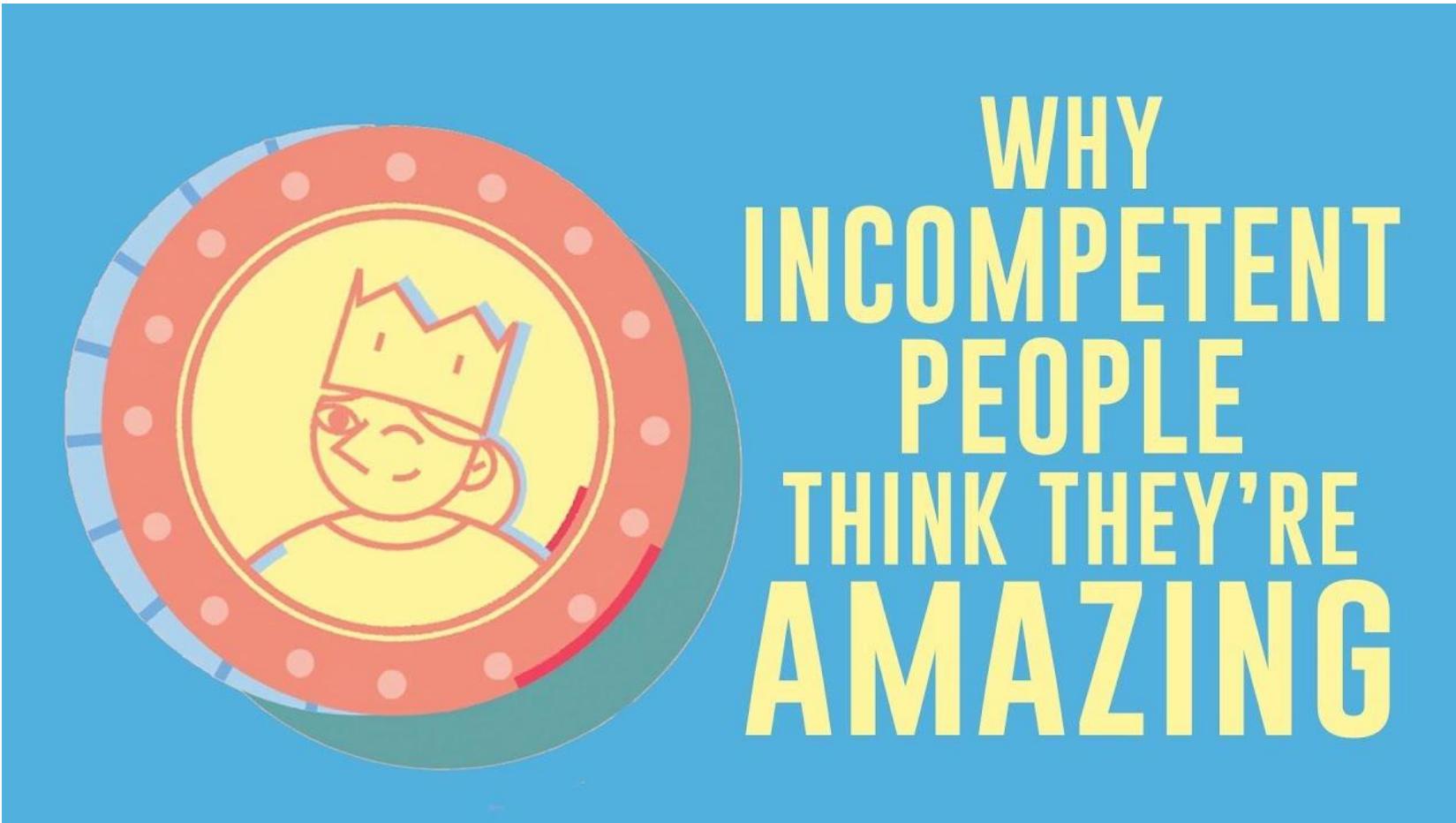
知彼知己，百戰不殆

Know the enemy and know
yourself, and in a hundred
battles you will not fear
defeat



不知彼，不知己，每戰必殆

Know neither the enemy
nor yourself, every battle
sure die.



WHY INCOMPETENT PEOPLE THINK THEY'RE AMAZING

https://www.youtube.com/watch?v=pOLmD_WVY-E

Success is what you
define for yourself



Don't Compare Yourself to Others

<https://www.youtube.com/watch?v=0MPG-aLD-EY>

And one last thing

A photograph of a large, diverse crowd of people, likely spectators at a baseball game. The crowd is packed closely together, filling the frame. Many individuals are wearing baseball caps and casual summer attire. The lighting suggests an outdoor daytime event.

people
Matter



Dr Zhou Lifeng



Adi Yoga

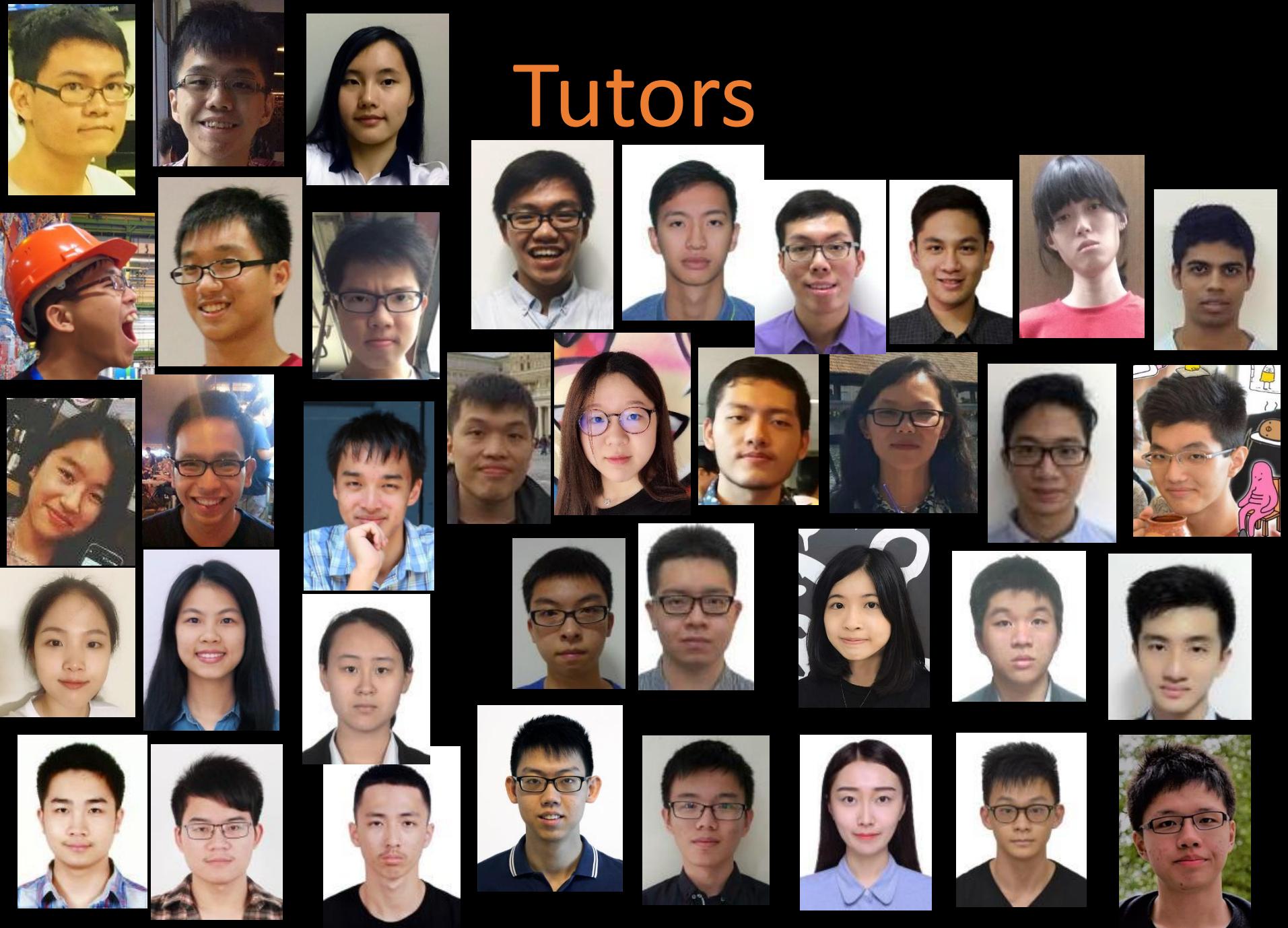


Oana Barbu

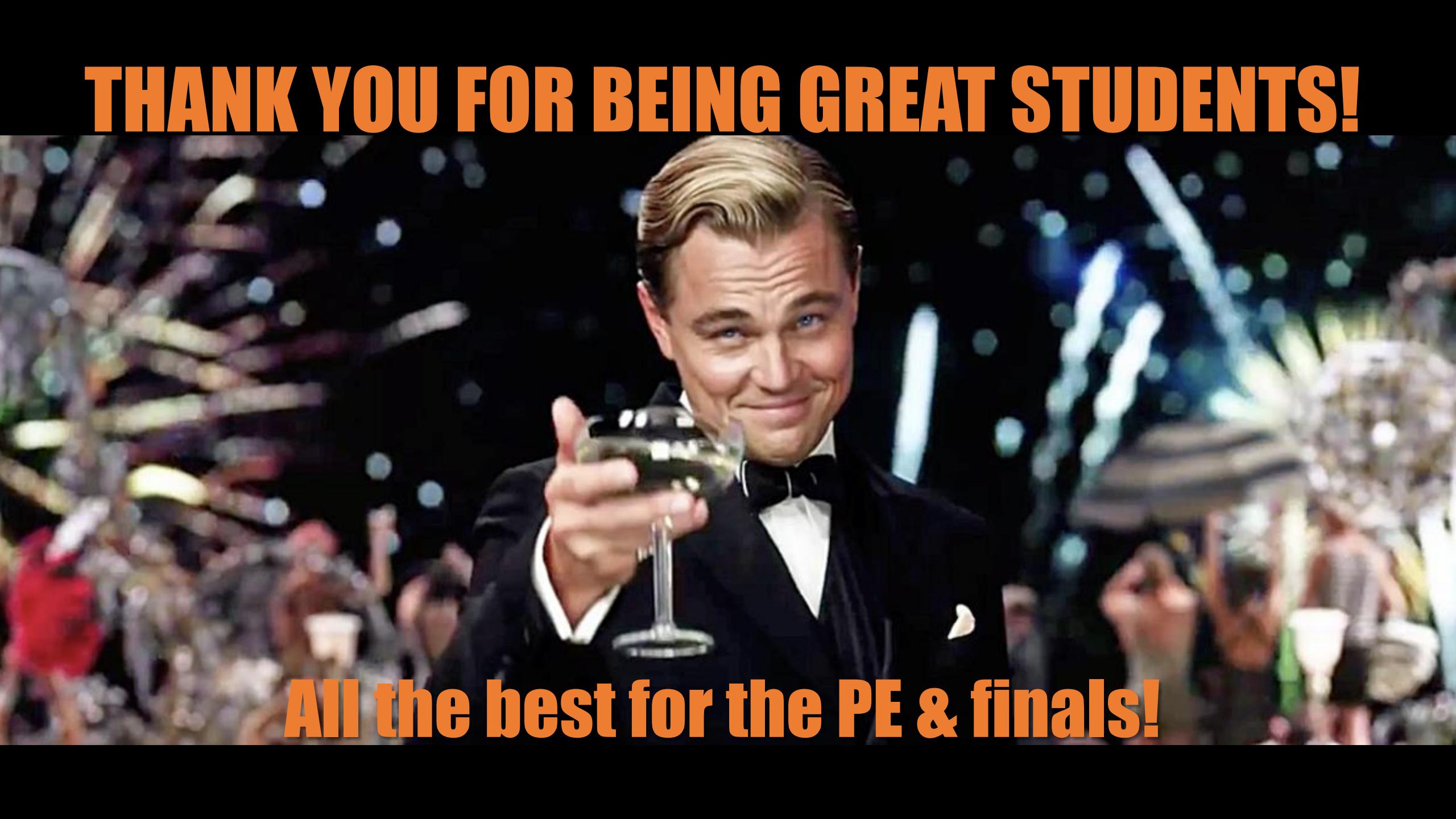


Jonathan Chen

Tutors



THANK YOU FOR BEING GREAT STUDENTS!

A photograph of Leonardo DiCaprio in a black tuxedo and bow tie, smiling and holding a glass of white wine towards the camera. He is standing in front of a dark background with blurred lights and other people, suggesting a celebratory event like an Oscar ceremony.

All the best for the PE & finals!