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# Collaborative Course Development for Blended Learning: A Case Study

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# NTU Digital Literacy Initiative

**With the wide spread digitalization appearing in every aspect of our life, and the arrival of industrial revolution 4.0**

- **NTU aims to prepare all its undergraduate students for their future with enhanced digital literacy starting academic year 2018**

**A NTU's level working committee was formed in Jan 2018**

- **to plan and implement the appropriate courses for this DL initiative**
- **monthly meetings were held to discuss and monitor the implementation progress of the relevant courses**



# Approach

**The DL courses will consist of 2 courses (each of 3 AUs)**

- **Level 1 - Introductory**
- **Level 2 - Intermediate**

**Different set of courses will be developed by each college to be used by its Schools**

- **in modular format such that module can be shared across colleges and Schools if appropriate**
  - **minimize duplication of resources working on the same contents**



# Challenges

- **Large number of students involved**
- **Different background of students**
  - **STEM and non-STEM**
- **Different disciplines within STEM and non-STEM**
  - **E.g. Chemical Engineering vs Computer Science**
- **Not to unduly increase the students' workload**
- **Short implementation window (6 months)**



# CoE DL Courses

**SCSE is tasked to develop two DL courses for Schools in CoE and CoS**

- 1. Introduction to Computational Thinking (CT)**
  - **targeted for August 2018 launch**
- 2. Introduction to Data Science and AI (DS&AI)**
  - **targeted for January 2019**

**in collaboration with NTU's Centre for IT Services.**



# Introduction to CT

## Computational Thinking

- the process of breaking down a problem into small parts
- such that the solution can be solved in the form of algorithms implementable on computers

## Can be broadly divided into 4 processes/components

- Abstraction
- Decomposition
- Pattern Recognition
- Algorithm Design

Program coding using Python, C, R, MatLab etc.



# Blended Learning Design

- i. **1 hour of weekly **online** LAMS** (Learning Activity Management System) based module
  - interspersed with online knowledge check questions
  - each module contains an introduction of the basic concept
    - follows by implementation (coding examples) in selected language
  
- ii. **2 hours of weekly face-to-face lessons**
  - 1 hour of **small class** team based **discussion** style
  - 1 hour of **hands-on practical** implementations

**Each School is able to customise the 2-hr face-to-face lesson**







National TEL 2019

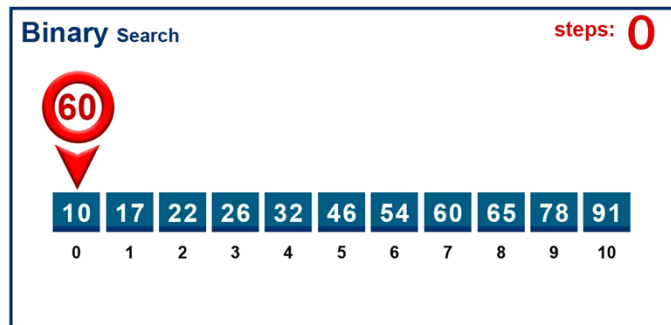


# Logarithmic Complexity $O(\log n)$


$O(\log n) \equiv$  Logarithmic Complexity

Execution time grows as the log of input

## Example: Binary Search



# CPU Operation



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Introduction to Computational Thinking  
**Fetch-Decode Execute Cycle**



# Knowledge Check Questions

3. \* In computer programming, this refers to a sequence of instruction that is continually repeated until a certain condition is reached?

Choose one of the following answers.

- Loop
- Continue
- Break
- Selection

4. \* Arrange the following steps according to the chronological logic of general looping structure.

Sort answers in the right order

Initialize	↓
Test	↑ ↓
Update	↑ ↓
Loop body	↑



## Team Based Discussion

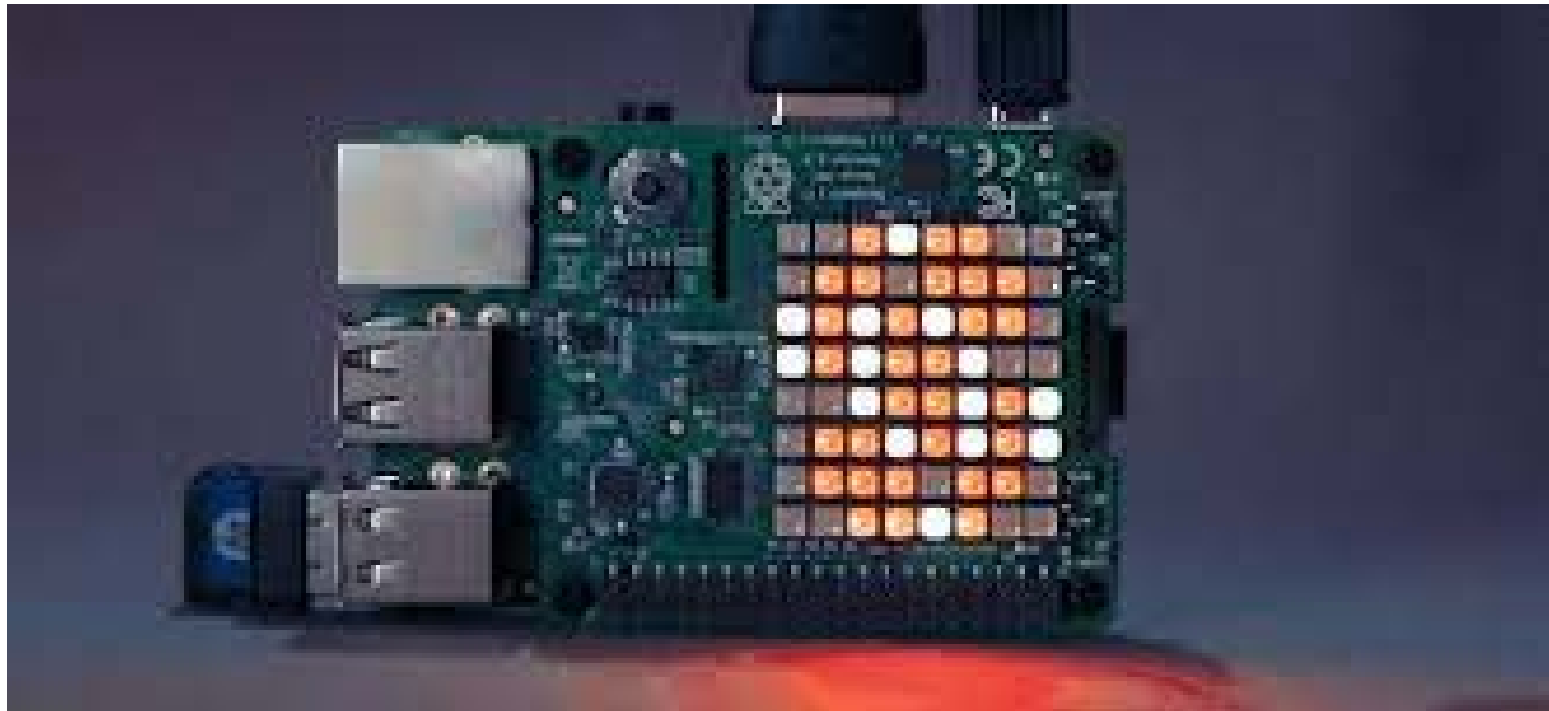
### Example: (on Basic Python program)

Write a Python program that requests the number of hours one worked in a month and then prints out the gross pay, taxes, and net pay. Assume that the pay structure and tax rate are as follow:

- Basic pay rate = \$10.00 per hour
- Overtime (>160 hours) = one and a half time of the basic pay rate
- Tax rate = 10% for first \$1000, 20% for next \$500, and 30% for the rest



# (SCSE) Hands-on Exercises



**Introduction to Computational Thinking (NTU's DL Course)**





# Learning can be fun

## Enjoying Computational Thinking – Step by Step



## Introduction to Computational Thinking (NTU's DL Course)



# Thank You

