



Lecture 1: Introduction to Machine Learning 101

ITDS251x2 Fundamental Machine Learning

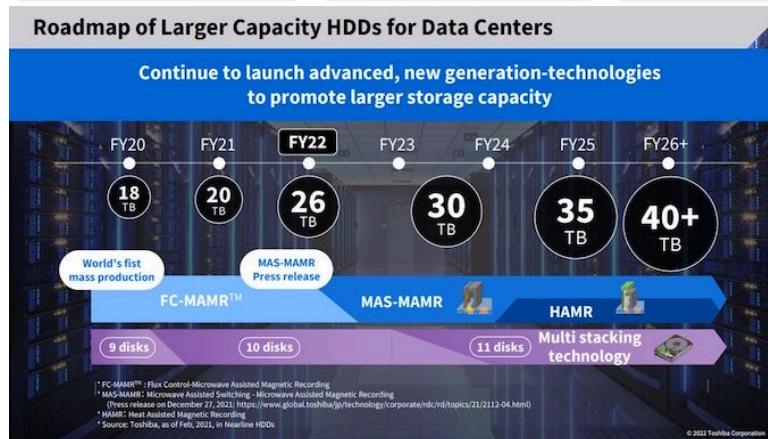
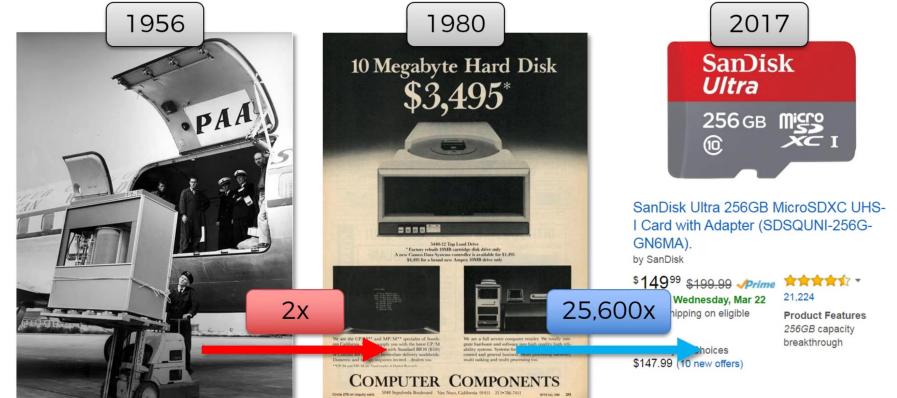
Instructor: Dr. Tipajin Thaipisutikul (Aj. Tip)

Contact: tipajin.tha@mahidol.edu



What is Deep Learning

1994: "Today Show": "What is the Internet, Anyway?"





What is Deep Learning

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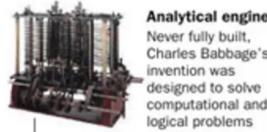
1 The accelerating pace of change ...



2 ... and exponential growth in computing power ...

Computer technology, shown here climbing dramatically by powers of 10, is now progressing more each hour than it did in its entire first 90 years

COMPUTER RANKINGS By calculations per second per \$1,000



Analytical engine
Never fully built, Charles Babbage's invention was designed to solve computational and logical problems



Colossus
The electronic computer, with 1,500 vacuum tubes, helped the British crack German codes during WW II



UNIVAC I
The first commercially marketed computer, used to tabulate the U.S. Census, occupied 943 cu. ft.



Power Mac G4
The first personal computer to deliver more than 1 billion floating-point operations per second



Apple II
At a price of \$1,298, the compact machine was one of the first massively popular personal computers

3 ... will lead to the Singularity

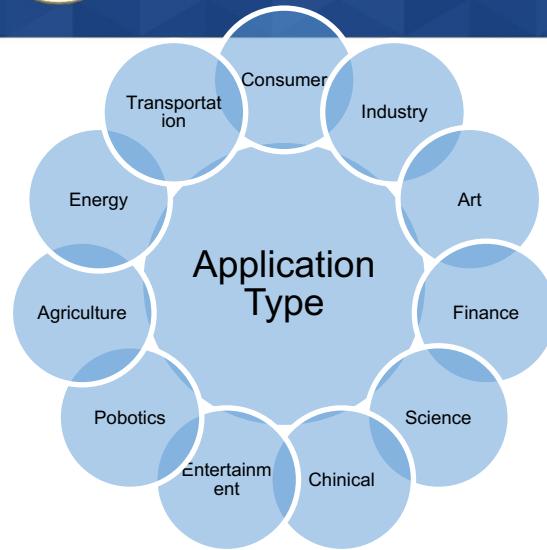
10^{26}
Surpasses brainpower equivalent to that of all human brains combined



10^{20}
Surpasses brainpower of human in 2023



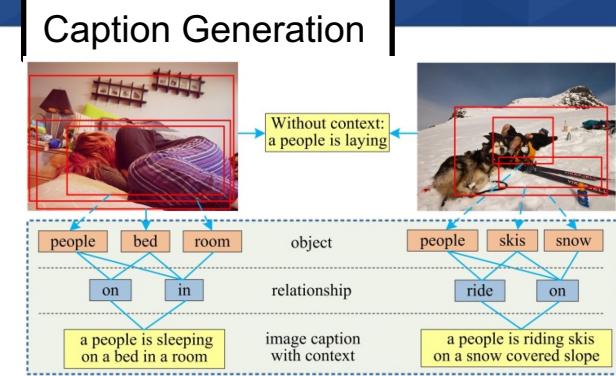
10^{15}
Surpasses brainpower of mouse in 2015



- Fraud detection.
- Web search results.
- Real-time ads on web pages
- Credit scoring.
- Prediction of equipment failures.
- New pricing models.
- Network intrusion detection.
- Recommendation Engines
- Customer Segmentation
- Text Sentiment Analysis
- Customer Churn
- Pattern and image recognition.
- Email spam filtering.



object recognition



Caption Generation



Data Center



Automatic Driving

Content Generation





ITDS251

- CLO1: กำหนดวิธีการแก้ไขปัญหาในชีวิตจริงให้อยู่ในรูปแบบและวิธีการทำงานด้านการเรียนรู้ของเครื่องได้อย่างถูกต้อง
- CLO2: ทำการทดลองอย่างถูกต้องตามหลักวิทยาศาสตร์และปรับแต่งการทำงานของแต่ละอัลกอริทึมทางด้านการเรียนรู้ของเครื่องในการทดลองเพื่อให้ได้แบบจำลองที่เข้ากับสถานการณ์
- CLO3: อธิบายหลักการทำงานของอัลกอริทึมทางด้านการเรียนรู้ของเครื่องอย่างถูกต้อง

ITDS252

- CLO1: ทำการทดลองเพื่อสร้างแบบจำลองโดยอัลกอริทึมการเรียนรู้ของเครื่องได้อย่างถูกต้องตามหลักวิทยาศาสตร์และหลักการเรียนรู้ของเครื่องเบื้องต้น
- CLO2: สร้างโปรแกรมที่มีการนำแบบจำลองไปใช้งาน



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sirawich.vac@mahidol.ac.th



- Lecture 2 hours + Lab 2 hours
- Lecture @334, Lab @106
- Mycourse (Slides + Lab Submission)
- **Submit Lab with LA to get Lab scores**
(Upload .ipynb to mycourse after submission to LAs for back-up)
- Github Datasets:
<https://github.com/TipGreenTea/ITDS251x2-ML>



ITDS251 - Fundamental of ML

- แบบทดสอบ (Quiz) 50%
- สอบกลางภาค (Midterm Exam) 25%
- สอบปลายภาค (Final Exam) 25%

ITDS252 - Fundamental of ML Lab

- Lab Assignment 50%
- สอบกลางภาค (Midterm Exam) 25%
- สอบปลายภาค (Final Exam) 25%

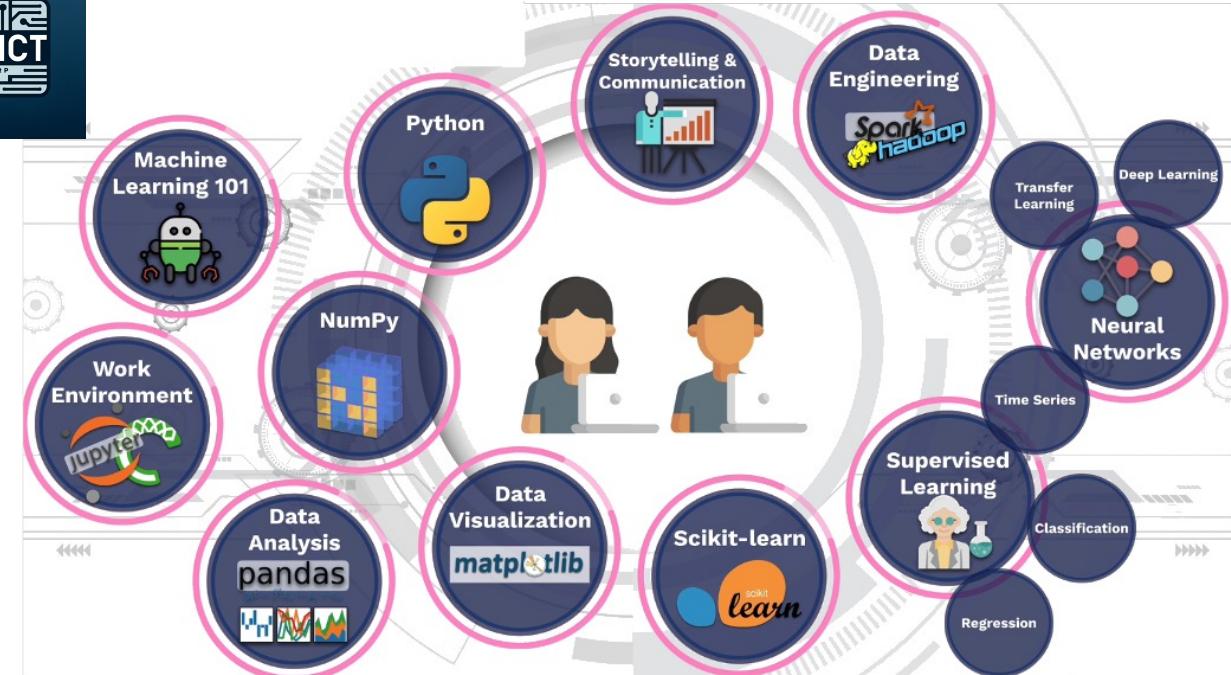
เกรด	ความหมาย	ค่าจริง	เกณฑ์คะแนน
A	ยอดเยี่ยม	4	≥ 80
B+	ดีมาก	3.5	≥ 75
B	ดี	3	≥ 70
C+	ค่อนข้างดี	2.5	≥ 65
C	ปานกลาง	2	≥ 60
D+	อ่อน	1.5	≥ 55
D	อ่อนมาก	1	≥ 50
F	ไม่ผ่าน	0	น้อยกว่า 50



- Module1: Welcome to the course
- Module2: Data Science || Data Analysis || Data Engineering || AI
- Module3: What is Machine Learning?
- Module4: Machine Learning Types
- Module5: Environment Setup (Colab)
- Module6: Pandas Data Analysis



Welcome! You're our
new Machine Learning
and Data Science
expert!





What is Machine Learning?



Call me Chogun

How to get to Chogun's house?

Is this person angry?

What is a cat?

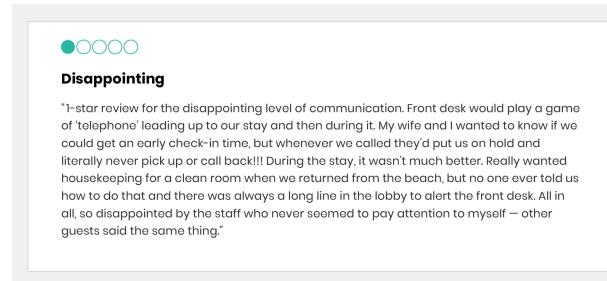
Can U program this?



Programming ||
Describing | Give instructions to machine

If: route 1 < route 2
If: route 1 < route 3
If: route 1 < route 4
If: route 1 < route 5

then: pick route 1

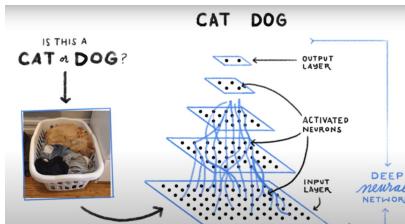
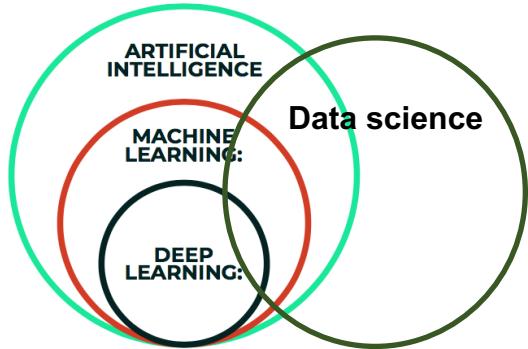


●●●●●
Disappointing

"1-star review for the disappointing level of communication. Front desk would play a game of 'telephone' leading up to our stay and then during it. My wife and I wanted to know if we could get an early check-in time, but whenever we called they'd put us on hold and literally never pick up or call back!!! During the stay, it wasn't much better. Really wanted housekeeping for a clean room when we returned from the beach, but no one ever told us how to do that and there was always a long line in the lobby to alert the front desk. All in all, so disappointed by the staff who never seemed to pay attention to myself – other guests said the same thing."



4GIFS.com



Machine Learning: Automated Analytical models

Neural Networks: A type of machine Learning architecture modeled after biological neurons.

Deep Learning: A neural network with more than one layer.

Contact: tipajin.tha@mahidol.edu. [Credited Tipajin T.]

Artificial Intelligence (AI): Science that empowers computers to mimic human intelligence such as decision making, text processing, and visual perception.

- Narrow AI – good at 1 task
- General AI – multiple abilities

Machine Learning (ML): Machine Learning is a subfield of AI that enables machines to improve at a given task with experience. It is important to note that all ML techniques are classified as AI ones. However, not all AI could count as ML since some basic Rule-based engines could be classified as AI but they do not learn from experience therefore they do not belong to ML category.

- **ML** uses algorithms to parse data, learn from that data, and make informed decisions based on what it has learned

Deep Learning (DL): structures algorithms in layers to create **an artificial “neural network”** that can learn and make intelligent decisions on its own

- DL is a subfield of ML. While both fall under the broad category of AI, DL is usually what's behind the most human-like artificial intelligence



Data science

Encompass entire process of analyzing data to extract knowledge and insights

Data Analysis

Descriptive Analysis

Statistical Analysis

Data Visualization

Understand what has happened in the past.

Prescriptive Analysis

Suggesting actions to achieve desired outcomes based on predictive analytics

Predictive Analysis

AI vs ML vs DL
ເຖິງບັດ ຫຼື 3 ຄຳຕ້ອງຮູ່
ຕ່າງກັນຍັງໄວ ເກີນໄກ ຫຼື ກົດກັນ

Artificial Intelligence
ຄໍານັ້ນ :
ເຫັນວ່າທີ່ໄດ້ໃຫຍ່ພວດວຽກ
ສາມາດຮັບຮັບຂໍ້າງ
ແລະ ໂອດມາດ
ສັດກາຕົວຈຳນວນ :
ປະໂຫຍດເຊັ່ນໃຫຍ່
ໃຫຍ່-based
ໂຄງການທີ່ມີຄວາມ
ການເປັນດັກ

Machine Learning
ຄໍານັ້ນ :
ເປັນເປົ້າຂອງ AI
ໂດຍໃຫຍ່ຕົວມີຄົງທີ່ໄດ້ຮັບ
ຮູ້ຜູ້ໃຫຍ່ກົດກັນໄດ້

Deep Learning
ຄໍານັ້ນ :
ເປັນເປົ້າຂອງ ML
ໃຫຍ່ເພື່ອແນະນຳ
ມີຄວາມ
ການເປັນດັກ

ອາວຸດ :
ສາມາດເປັນໃຫຍ່ພິເສດຖາ
ໄນ້

ຕົວຢ່າງທີ່ໄດ້ຈຳນວນ :

- Chatbots (ໂຄງການ
ຮ່ວມມືຢູ່)
- Language Translation
(ໂຄງການຮ່ວມມືຢູ່)
- Email Filtering
(ໂຄງການຮ່ວມມືຢູ່)

ອາວຸດ :
ມີຄວາມ
ການຮັບຮັບຂໍ້າງ
ຈົດຈັດ

ຕົວຢ່າງທີ່ໄດ້ຈຳນວນ :

- Recommendation Systems
(ໂຄງການຮ່ວມມືຢູ່)
- Credit Scoring
(ໂຄງການຮ່ວມມືຢູ່)
- Anomaly Detection
(ການຈົດຈັດ ທີ່ມີຄວາມ
ກາງ)
- Classification (Fraud
Detection ທີ່ມີຄວາມ
ກາງ)

ອາວຸດ :
ມີຄວາມ
ການຮັບຮັບ
Unstructured
Data ສະໜັບສະໜັບ
ແລະ
ຕົວຢ່າງທີ່ມີຄວາມ
ກາງ

ຕົວຢ່າງທີ່ໄດ້ຈຳນວນ :

- Image Processing
(ການເພື່ອແນະ
ມີຄວາມ
ກາງ)
- Speech Recognition
(ການເພື່ອແນະ
ມີຄວາມ
ກາງ)
- Autonomous Vehicles
(ຫຼັບ Autopilot)

Using statistical models and forecasts to understand what might happen in the future

Data Engineering

Data Infrastructure

Data Storage & Management Systems

Focus on practical application of data collection & analysis

Big Data Techniques

Data Integration & ETL process

Extract, transform, load data from various sources to make it usable for analysis



Machine learning
“Field of study that gives computers the ability to learn without being explicitly programmed.”
-Arthur Samuel (1959)

Data science
Science of extracting knowledge and insights from data.

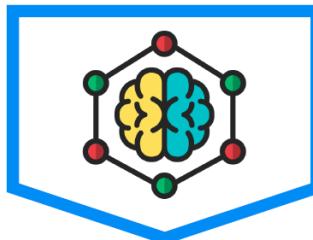


1. Data Pre-Processing

- Import the data
- Clean the data
- Split into Training & Testing sets
- Feature Scaling



- Feature Extraction and Scaling
- Feature Selection
- Dimensionality Reduction
- Sampling



2. Modelling

- Build the model
- Train the model
- Make predictions

- Model Selection
- Cross-validation
- Performance Metrics
- Hyperparameter Optimization



3. Evaluation

- Calculate Performance metrics
- Make a verdict



What can Teachable Machine do?

Teachable Machine is a web tool that makes it fast and easy to **create machine learning models for your projects**, no coding required. Train a computer to recognize your images, sounds, & poses, then export your model for your sites, apps, and more.



- จำนวน Data
- คุณภาพ Data

≡

About FAQ Get Started

Teachable Machine

Train a computer to recognize your own images, sounds, & poses.

A fast, easy way to create machine learning models for your sites, apps, and more – no expertise or coding required.

[Get Started](#)

Get Started button highlighted with a red border.

Icons at the bottom: TensorFlow, p5.js, Coral, Node.js, Arduino, and a circular icon.

≡ Teachable Machine

About FAQ Get Started

How do I use it?

Class 1: Class 2:

[TRAIN MODEL](#)

1 Gather

Gather and group your examples into classes, or categories, that you want the computer to learn.

[Video: Gather samples](#)

2 Train

Train your model, then instantly test it out to see whether it can correctly classify new examples.

[Video: Train your model](#)

3 Export

Export your model for your projects: sites, apps, and more. You can download your model or host it online.

[Video: Export your model](#)

Train Model button highlighted with a red border.

MY PROJECT icon shown in the top right corner.



How did we get here?

Spreadsheets



Customer data



Relational DB

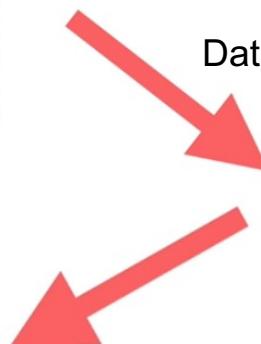


SQL

Data like Click, Like, Dislike, Img, Sound

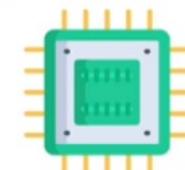


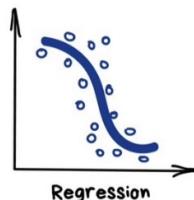
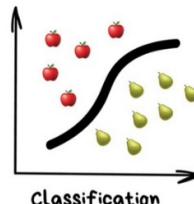
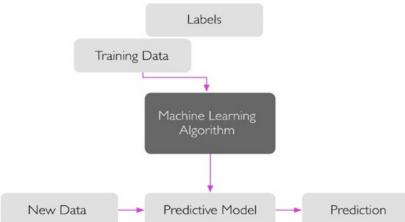
Machine Learning



"Big Data"

NoSQL





ARTIFICIAL INTELLIGENCE
Science that enables computers to mimic human intelligence.
Subfields: Machine Learning, robotics, and computer vision

MACHINE LEARNING
Subset of AI that enable machines to improve at tasks with experience

Supervised Learning

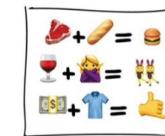
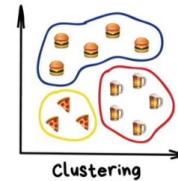
- > Labeled data
- > Direct feedback
- > Predict outcome/future

Unsupervised Learning

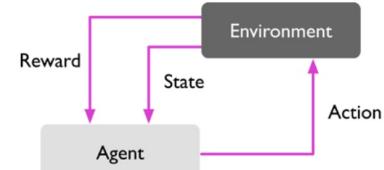
- > No labels
- > No feedback
- > Find hidden structure in data

Reinforcement Learning

- > Decision process
- > Reward system
- > Learn series of actions



Assocation Rule Learning





Supervised Learning

1. Feed Forward Neural Networks



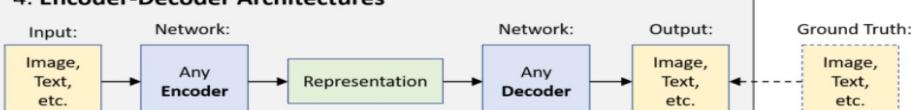
2. Convolutional Neural Networks



3. Recurrent Neural Networks



4. Encoder-Decoder Architectures

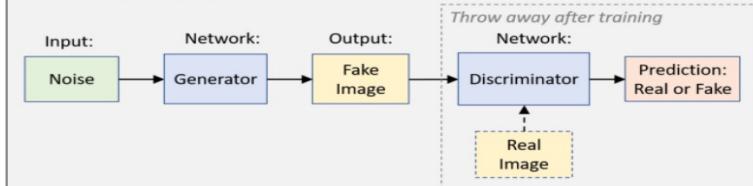


Unsupervised Learning

5. Autoencoder



6. Generative Adversarial Networks



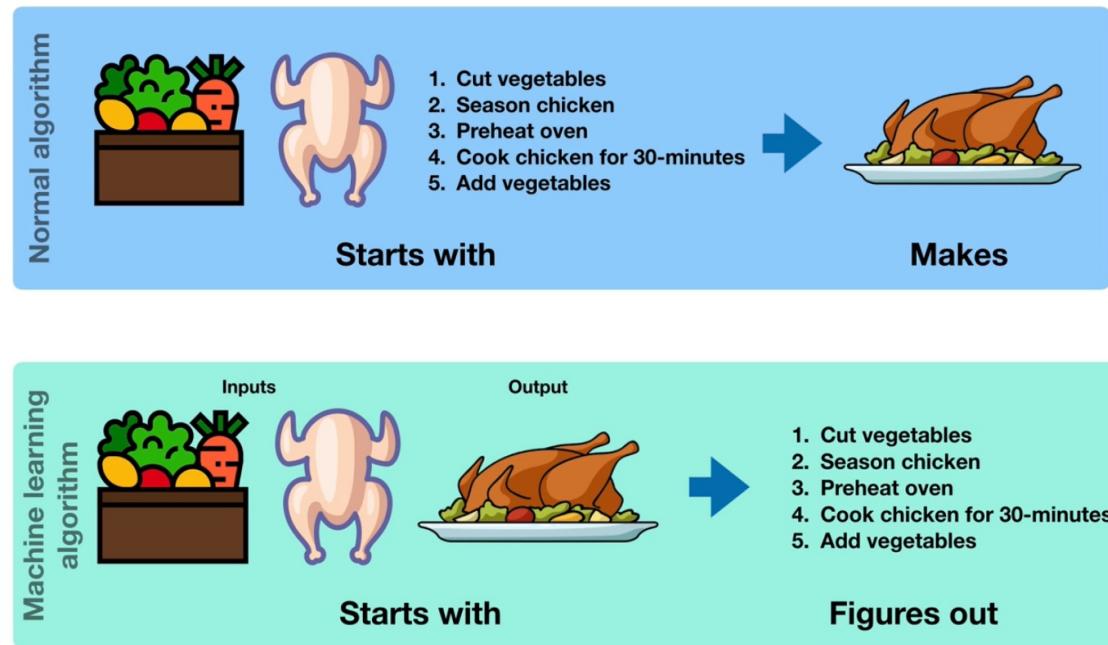
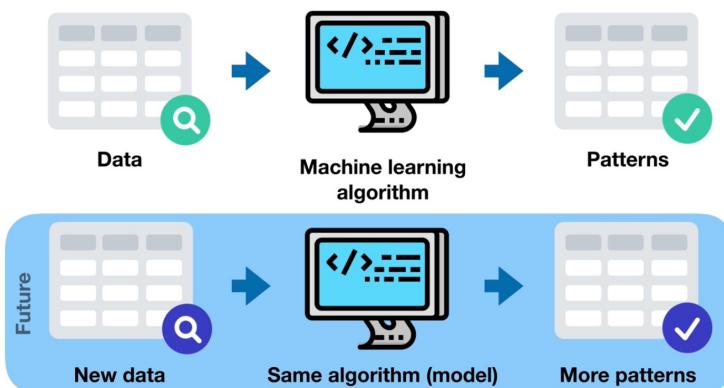
Reinforcement Learning

7. Networks for Actions, Values, Policies, and Models



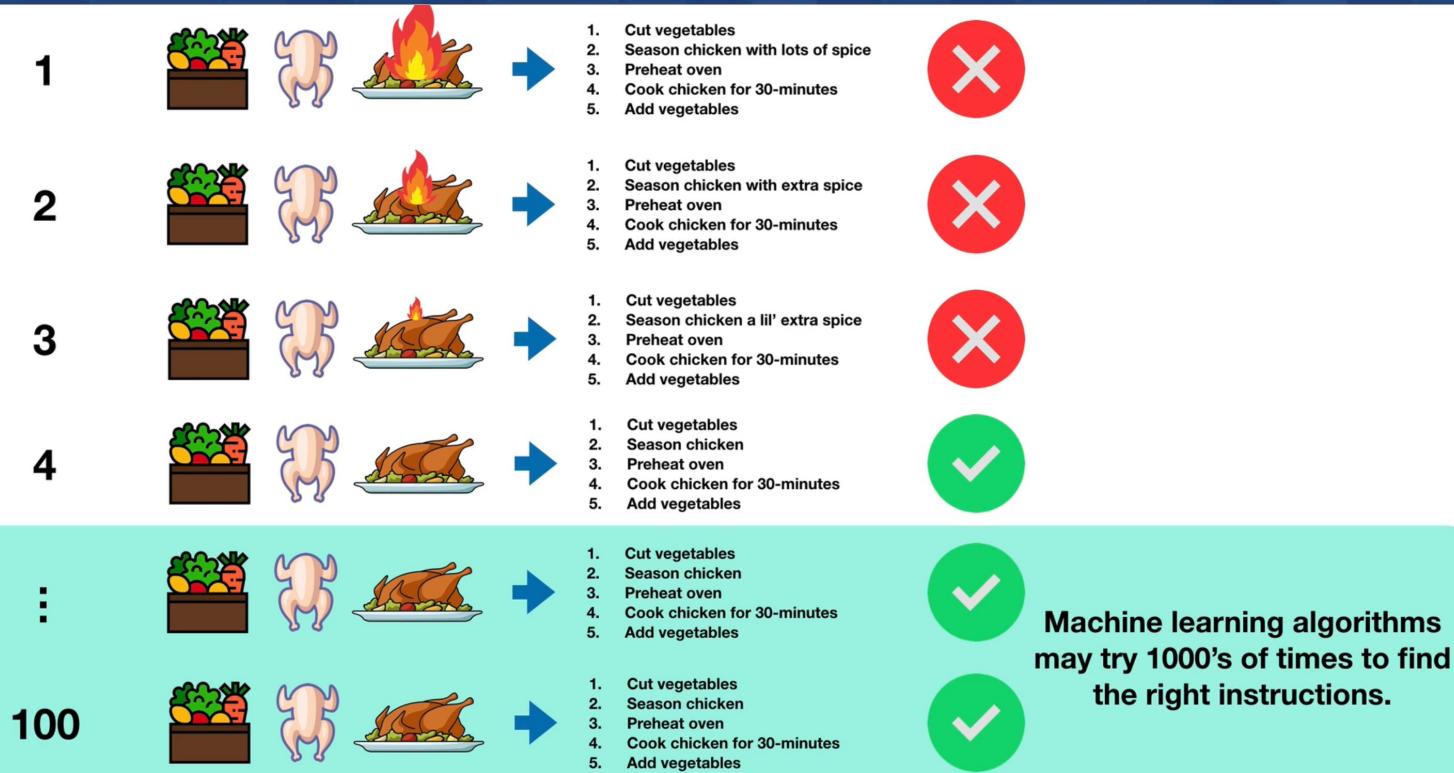


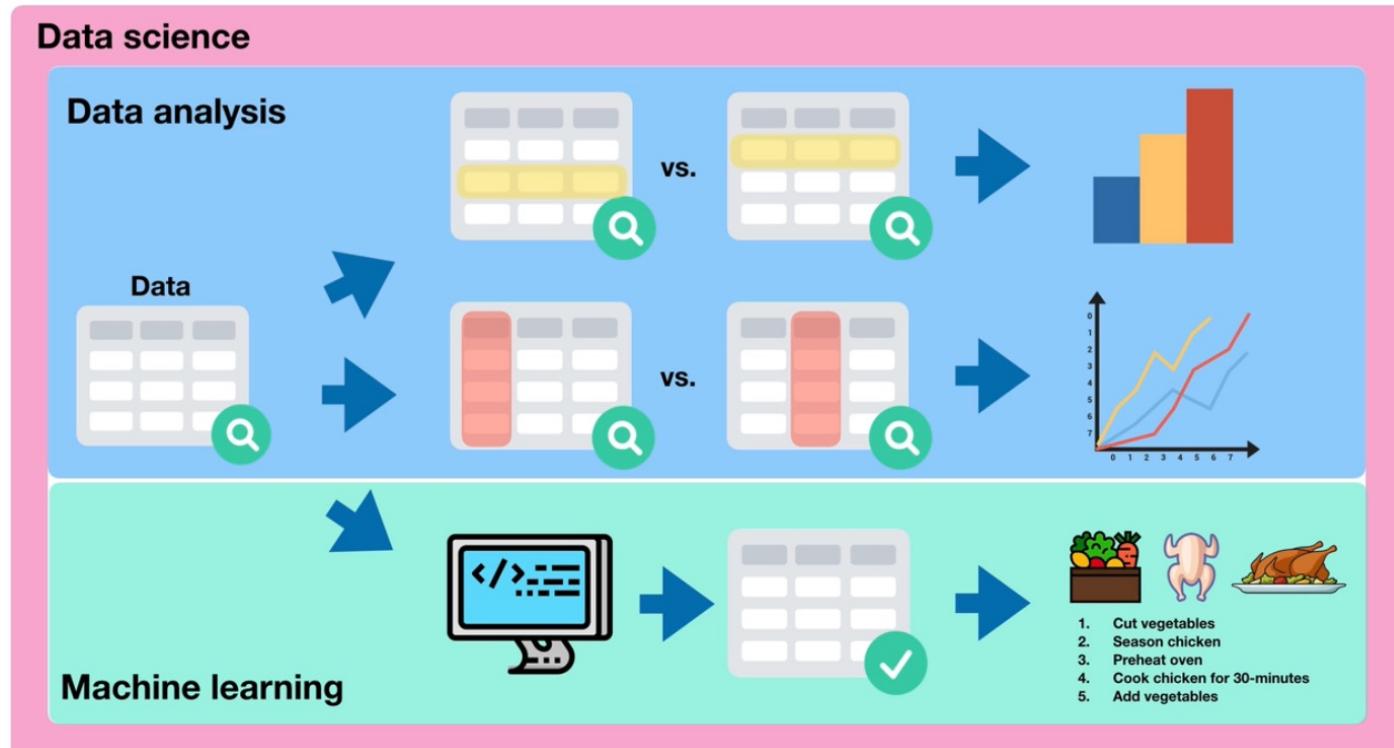
So, What is Machine Learning?





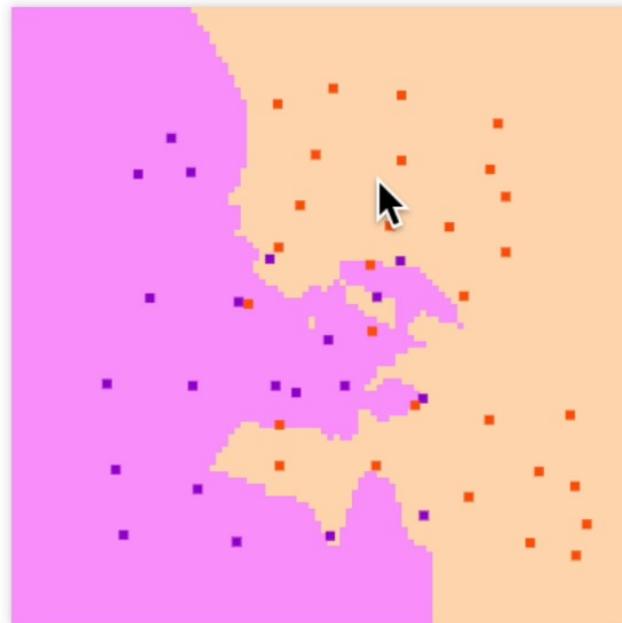
So, What is Machine Learning?







Machine Learning Playground



Upload Data Save Data

K Nearest Neighbors	Perceptron	Support Vector Machine
Artificial Neural Network	Decision Tree	

Parameters:

K: 3

Train

Label: Class สีส้ม หรือ สีม่วง
สีส้ม คือ VDO ที่เราชอบ
สีม่วง คือ VDO ที่เราไม่ชอบ

<https://ml-playground.com/#>



Welcome! You're our
new Machine Learning
and Data Science
expert!



Tell Your boss and co-workers in 1 sentence

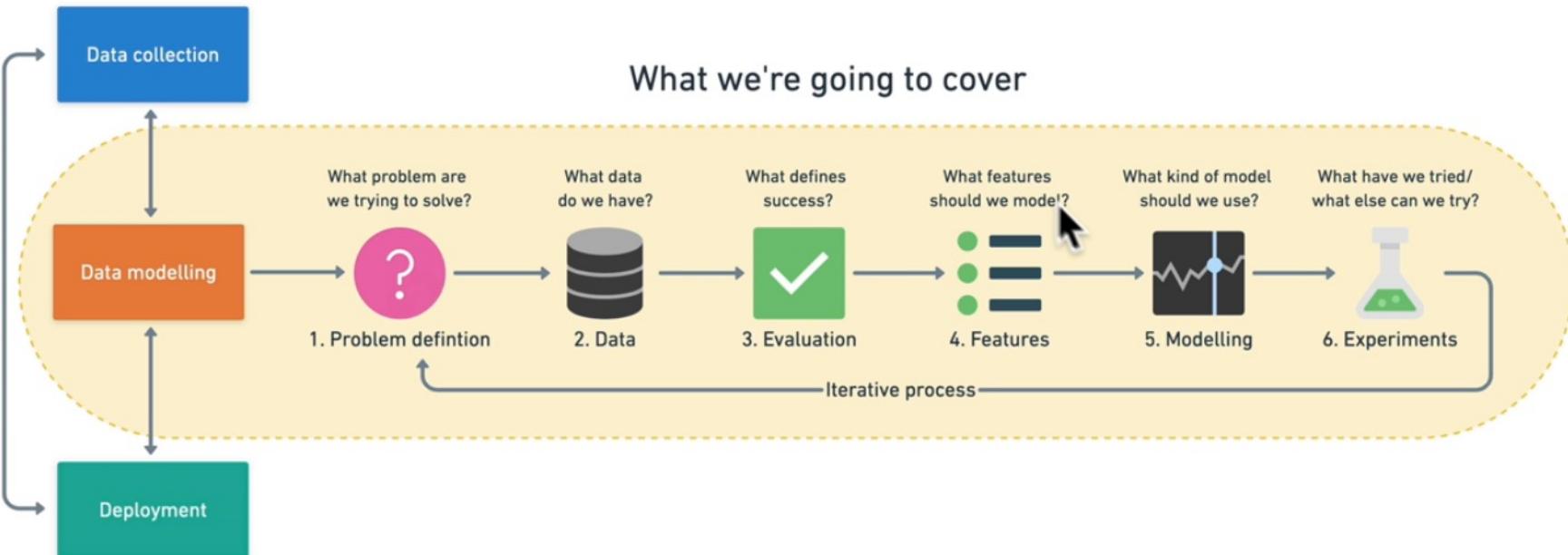


What's Next?: Machine Learning & Data Science Framework





Steps in a full machine learning project



What do you think the hardest part is?



Google Colab



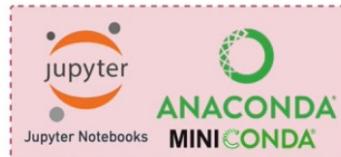
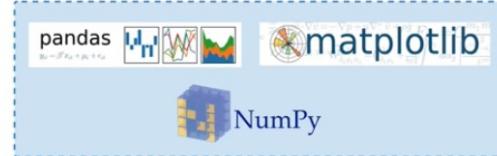
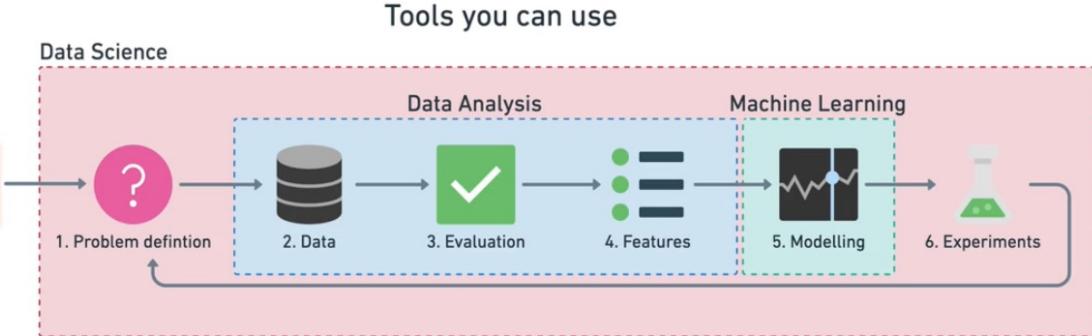
- <https://colab.research.google.com/>
- Online Jupyter Notebook for free
 - No basic installation required → you need a web browser
- New Virtual Machine (VM) for each session
 - Offer temporarily storage
 - Also offer GPU, but with limited session time per month
 - VM will be destroyed (along with the data inside) if inactive or closed
- Mount to Google Drive for persistent storage
- Install Python package → need to reinstall if VM is destroyed



We needs some information on Car Sales! Help us out!



Data modelling





What are we going to cover?

- Most useful functions
- Pandas datatypes
- Importing & Exporting data
- Describing data
- Viewing & Selecting data
- Manipulating data

ลูกค้าทำบริษัทรถยนต์ฯ

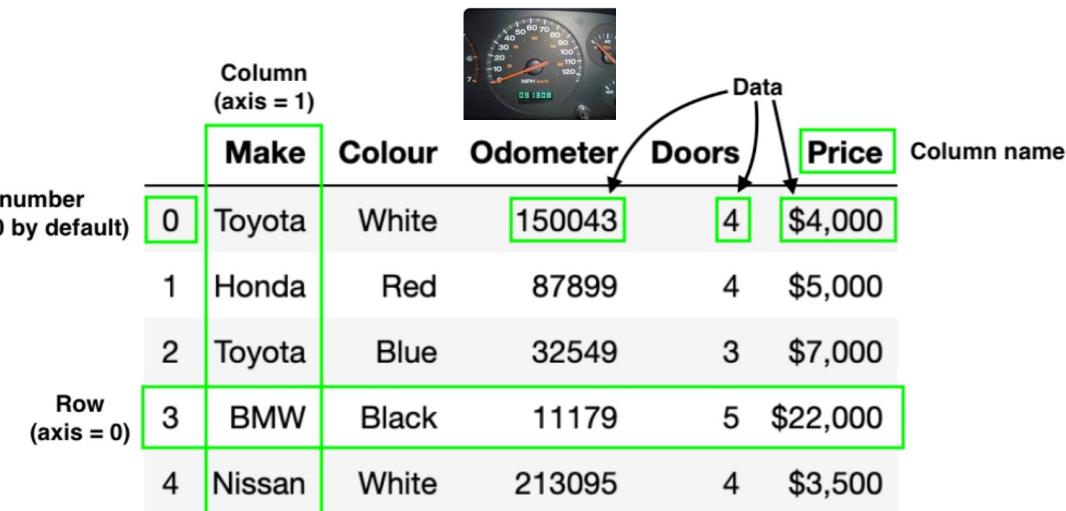




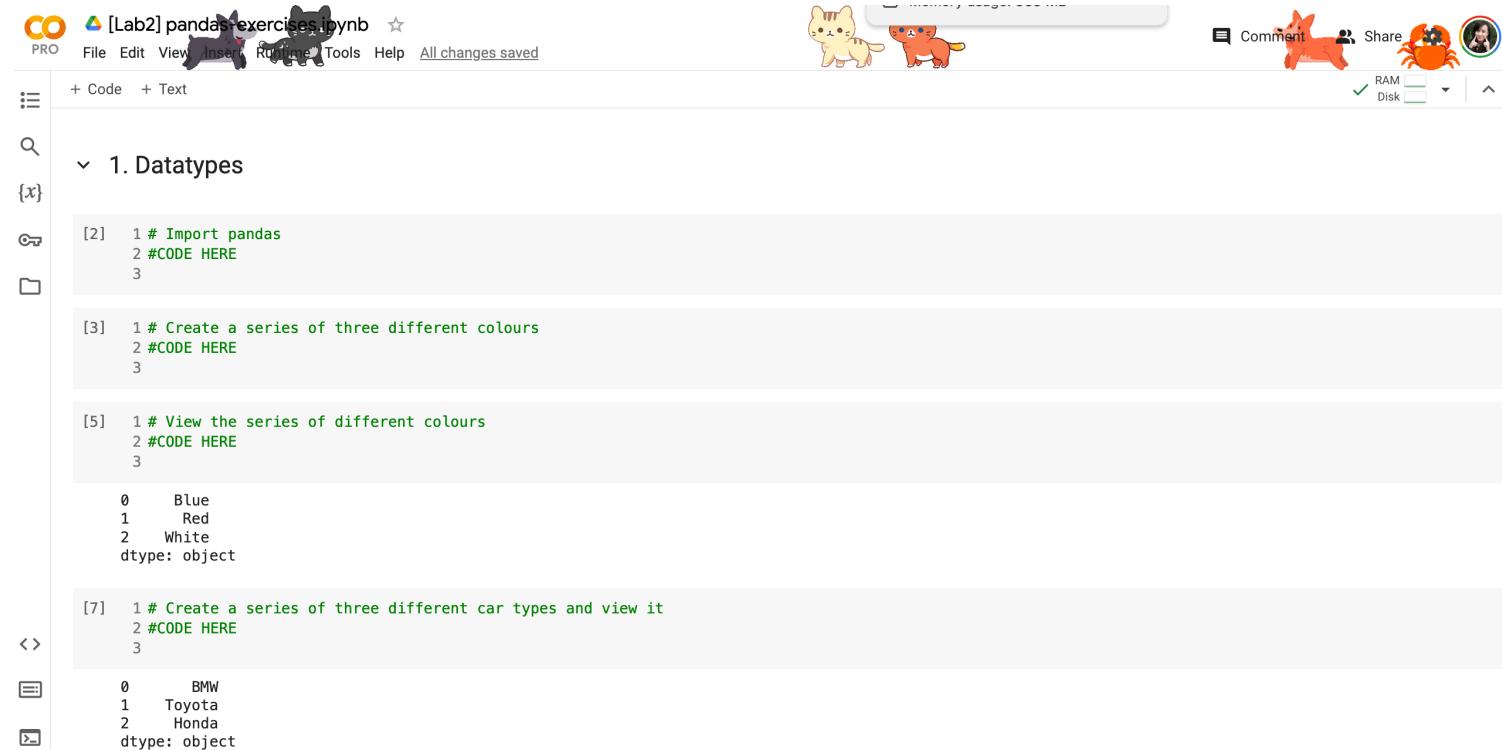
car-sales.csv

A	B	C	D	E
Make	Colour	Odometer (KM)	Doors	Price
Toyota	White	150043	4	\$4,000.00
Honda	Red	87899	4	\$5,000.00
Toyota	Blue	32549	3	\$7,000.00
BMW	Black	11179	5	\$22,000.00
Nissan	White	213095	4	\$3,500.00
Toyota	Green	99213	4	\$4,500.00
Honda	Blue	45698	4	\$7,500.00
Honda	Blue	54738	4	\$7,000.00
Toyota	White	60000	4	\$6,250.00
Nissan	White	31600	4	\$9,700.00

Anatomy of a DataFrame



มาตรฐานระดับโลก



The screenshot shows a Jupyter Notebook interface with the following details:

- Title:** [Lab2] pandas-exercises.ipynb
- Toolbar:** CO PRO, File, Edit, View, Insert, Run, Tools, Help, All changes saved.
- Code Cells:**
 - [2]:
1 # Import pandas
2 #CODE HERE
3
 - [3]:
1 # Create a series of three different colours
2 #CODE HERE
3
 - [5]:
1 # View the series of different colours
2 #CODE HERE
3
0 Blue
1 Red
2 White
dtype: object
 - [7]:
1 # Create a series of three different car types and view it
2 #CODE HERE
3
0 BMW
1 Toyota
2 Honda
dtype: object
- Right Panel:** Includes icons for Comment, Share, RAM, Disk, and a user profile.



- เป็นการสอบแบบ open sheets/books สามารถเอาอะไรเข้าไปก็ได้ ที่เป็นกระดาษ นศ ปริ้นเข้าไปเอง
- ไม่อนุญาตให้ใช้ Internet เปิดโปรแกรมอื่นนอกเหนือจาก MyCourse
- ระหว่างสอบโปรด เก็บเครื่องมือสื่อสารทุกชนิด
- หากพบรหัสทุจริตระหว่างสอบ ถือว่าได้ 0 คะแนนโดยไม่มีข้อยกเว้น
- ข้อสอบใน Mycourse มีเวลาในการทำ 15 นาที (11am-11.15am)