Lecture 1

Data, Algorithms, and Computer

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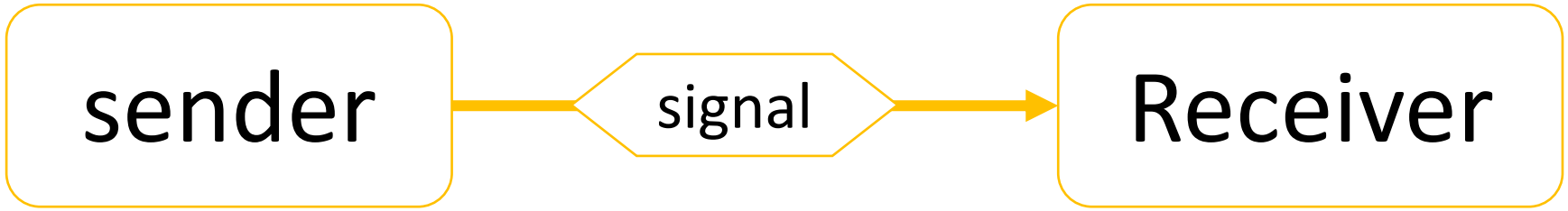
Why Data Structures & Algorithms?

- Data structures + algorithms = program

So, what is data?

- Data is facts
- Data is information → something created when there is a signal from sender to receiver [Claude Shannon]



- There are abundant data in the wild, we can only make use some of them
- With computer, have capability to make use more and more of them.

What to do with data?

- Basic Operation – CRUD
  - Create
  - Retrieve
  - Update
  - Delete

Process

Communicate

Data Processing

- Data vs Information
  - In some definition, **data** mean raw data where **information** mean data ready to be used
  - We process data to make it useful
- So, how to process data?

What is Algorithms?

- Can be viewed as “ways to achieve a certain goal”.
  - Processing data is one of them.
- An algorithm is a procedure that you can follow.

Basic Question: What is computer?

- Information processing machine
- Help us solving problem by processing information faster
- Need data structures and algorithms to work
  - Recent development: data can be mined, algorithms can be learnt

What to learn in DSA class?

- Characteristics of good data structures / algorithms and tool for analyzing them.
- Basic data structures
  - Array, Linked List
- Concept of Abstract Data Structure (ADT) and some simple ADT
  - Stack, Queue, Heap, Tree, Graph
- Fundamental algorithms
  - Sorting and searching
- Some advance data structures and algorithms
  - Binary Search Tree (BST), AVL Tree, Splay Tree
  - Minimal Spanning Tree, Shortest Path
  - Hashing

Summarize

- Data Structure + Algorithm = Program
- There are abundant data in the world
  - Some of them are useful to us.
  - We have capability to make use more and more of them.
- We create, retrieve, update, and delete useful data.
- Data can be processed to make it even more useful.
- Algorithms can be thought as ways to process data
- Computer makes DSA necessary
  - although DSA are useful even before the age of computer
- In Data Structures and Algorithm class, we will learn
  - Some basic data structures and algorithms
  - How to recognize good ones
  - Also, some advanced ones