Chapter 1

Introduction to Data Structures and Algorithms

Introduction to Data Structures and Algorithms

- A *data structure* is a specific way to store and organize data in a computer's memory so that these data can be used efficiently later
  - General data structure types include the array, the file, the record, the linked list, the tree, and so on
- An *algorithm* is considered as a step-by-step procedure for solving a problem, especially by a computer in a finite number of steps
  - *Definition*: An algorithm is a Turing machine

Example: How to fry an egg?

Step 1: Get a frying pan on a medium-high heat until hot

Step 2: Add 2 tsp. of olive oil to the pan

Step 3: Crack an egg into the pan, reduce the heat to low

Step 4: Cook slowly until the white is completely set and the yolk begins to thicken but is not hard

Step 5: Slide the turner under the egg and carefully flip it over in pan

Step 6: Cook the second side to the desired doneness

Step 7: Sprinkle with salt and pepper

Algorithms vs. Computer Programs

- Programs are always implementations of algorithms
- They are different from each other
  - Algorithm is an *abstract* object, while a program is a *concrete* object we can run on a machine
  - An algorithm is a solution to a *family of problems*
  - A program cannot apply to any instance: only to those …
    - … which do not go beyond the resources of the machine which runs it
    - … which would not require an execution time exceeding the patience of the programmer

Introduction to Data Structures and Algorithms

Data Structures + Algorithms = Programs

Niklaus Wirth

The greatest singer in the world cannot save a bad song!

Supercomputers cannot rescue a bad algorithm!