# Data Structures and Organization

## (p.1 – introduction & course review)

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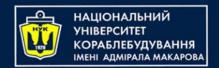http://www.berkut.mk.ua

# Course outline

1. Data Structures for what?
2. Arrays: sorting & searching
3. Linear Structures: Stacks, Queues, Deques…
4. Linked Lists
5. Recursion
6. Binary Trees
7. Hash Tables
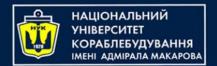8. Graphs: Oriented Graphs, Weighted Graphs…

# Data Structures – for what?

- A *data structure* is an arrangement of data in a computer's memory (or sometimes on a disk). Data structures include arrays, linked lists, stacks, binary trees, and hash tables, among others.

- *Algorithms* manipulate the data in these structures in various ways, such as searching for a particular data item and sorting the data.

- Situations in which they're useful might be divided into three categories:

  ➢Real-world data storage

  ➢Programmer's tools

  ➢Modeling

# Real Data Storing

- By real-world data, we mean data that describes physical entities external to the computer.
- A non-computer example of real-world data storage is a stack of 3-by-5 index cards.
- These cards can be used for a variety of purposes. If each card holds a person's name, address, and phone number, the result is an address book. Practically all, that in past was done with cards, now can be done with computer.
- Suppose you want to update your old index-card system to a computer program. What kind of problems will wait for you?

# Data Organization Problems

- How would you store the data in your computer's memory?

- Would your method work for a hundred file cards? A thousand? A million?

- Would your method permit quick insertion of new cards and deletion of old ones?

- Would it allow for fast searching for a specified card?

- Suppose you wanted to arrange the cards in alphabetical order. How would you sort them?

# Programming Tools

- Not all data storage structures are used to store real-world data

- Some data storage structures, however, are not meant to be accessed by the user, but by the program itself

- Programmer uses such structures as tools to facilitate some other operation

- Stacks, queues, and priority queues are often used in this way

- Some data structures directly model real-world situations.

- The most important data structure of this type is the graph. You can use graphs to represent airline routes between cities or connections in an electric circuit or tasks in a project.

- Other data structures, such as stacks and queues, may also be used in simulations. A queue, for example, can model customers waiting in line at a bank or cars waiting at a toll booth

- Java ☺
  - JDK8 + IntelliJ IDEA (best of all, but you can use another IDEs)

- C++
  - MinGW or Cygwin + CLion
    (may be Code::Blocks or Visual Studio)

- Another languages
  - Pascal, PHP, Python
    (you can use them for your own risk)

- Н. Вирт "Алгоритмы + структуры данных = программы"
- А.В. Ахо, Д.Э.Хопкрофт, Д.Д.Ульман: Структуры данных и алгоритмы
- Лафоре Р. Структуры данных и алгоритмы в Java.
- Томас Х. Кормен, Чарльз И. Лейзерсон, Рональд Л. Ривест, Клиффорд Штайн. Алгоритмы: построение и анализ
- Томас Х. Кормен "Алгоритмы. Вводный курс"
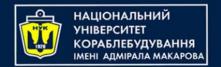
1. Work #1. Arrays processing. Sorting and searching
2. Work #2. Stacks, queues, deques
3. Work #3. Linked lists
4. Work #4. Recursion. Recursive data structure
5. Work #5. Binary trees
6. Work #6. Graphs. Representing a graph in a program. Topological sorting with directed graphs
7. Work #7. Weighted graphs. Algorithms on graphs

# Questions?

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