INTRODUCTION

Data Structures and Algorithms

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About the course

- 3 credit hours course

- In this course, we discuss how about data structures and algorithms which would help to develop efficient computer programs.

- **Let's discuss the syllabus hand-out!**

Introduction

Data Structures

"In computer science, a data structure is a particular way of storing and organizing data in a computer so that it can be used efficiently."

(Wikipedia)

Algorithms

In mathematics and computer science, an algorithm is a step-by-step procedure for calculations, data processing, and automated reasoning.

(Wikipedia)

Why study data structures and algorithms?

Internet. Web search, packet routing, distributed file sharing, ...

Biology. Human genome project, protein folding, ...

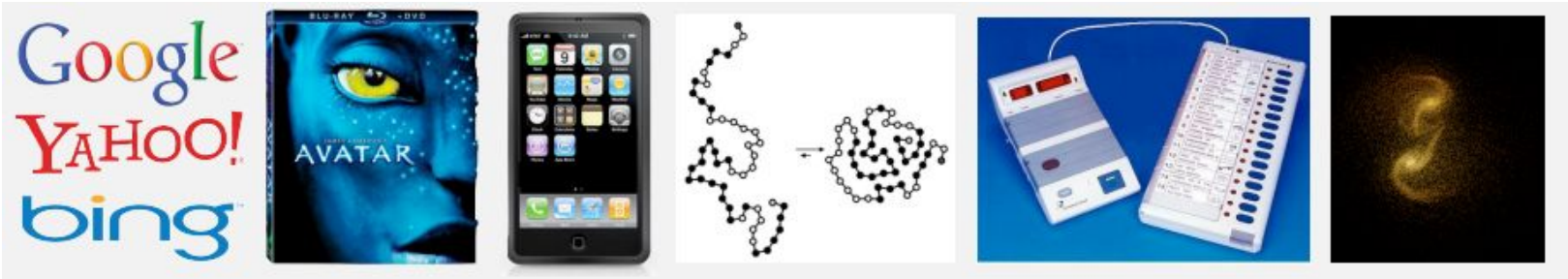
Computers. Circuit layout, file system, compilers, ...

Computer graphics. Movies, video games, virtual reality, ...

Security. Cell phones, e-commerce, voting machines, ...

Multimedia. MP3, JPG, DivX, HDTV, face recognition, ...

Social networks. Recommendations, news feeds, advertisements, ...



Data Structure Importance

Let's try to think about the importance of data types and data structures:

- You need to count number of people crossing the road during 9:00 am to 10:00 am.
- You need to store students record and perform some processing e.g., average age and height. How would you like to store the data?
- You need to find friends of friends on a social network.

Data Structure Importance (Cont.)

- Imagine implementing Undo functionality in MS Word — can you think of easy way to implement this feature?

- YouTube suggestions after watching a video — how are they personalized?

Examples to Use Algorithms

- A student needs to search allocated space for an entry test scheduled in a big hall where expected number of students are more than 10,000.

Examples to Use Algorithms (Cont.)

- A tourists wants to visit the entire attractive places in a city with minimum travel time and money.

Examples to Use Algorithms (Cont.)

- A mobile company wants to introduce a new calling package to maximize the number of users to switch to the new package.

" I will, in fact, claim that the difference between a bad programmer and a good one is whether he considers his code or his data structures more important. Bad programmers worry about the code. Good programmers worry about data structures and their relationships. "

— Linus Torvalds (creator of Linux)

" Algorithms + Data Structures = Programs. " *— Niklaus Wirth*

Prime Number Generator

- A **prime number** is a natural number greater than 1 that has no positive divisors other than 1 and itself. For example:
  - 2,3,5,7,11,13,17 are prime numbers

- Lets create a program to generate first N prime numbers

Singleton

- Let's discuss about creating a class that allows to create only one instance!

- A good reading on this topic is available at:
  - https://sourcemaking.com/design_patterns/singleton

Tasmanian Camel Puzzle

Tasmanian camels never go backwards, especially when on a precarious ledge. The camels will climb over each other, but only if there is a camel sized space on the other side.

The camels didn't see each other until there was only exactly one camel's width between the two groups.

How can all camels pass, allowing both groups to go on their way, without any camel reversing?

Source: http://www.folj.com/puzzles/

Next!

In next lecture, we are going to cover Abstract Data Types (ADT); Arrays, Strings, Lists.