Data Structures and Algorithms

By

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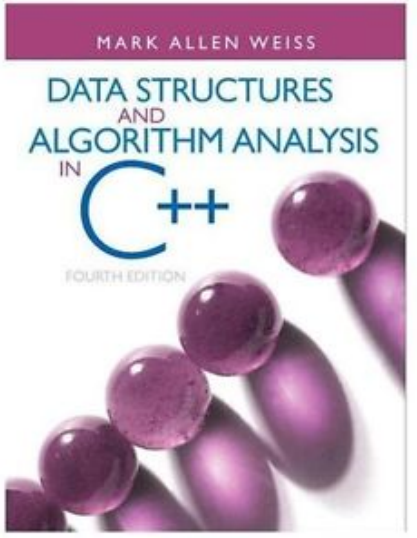
(Lecture 1)

Description
What the course is about

- This is a Theory course, not programming
  - Primary focus on concepts, creating, retrieving and manipulation of data structures
  - Abstract Data Types
  - The basics of analysis of algorithms
  - Includes coding assignments, but no programming taught
  - C++ competence expected
- Prerequisites
  - Refresh your coding and debugging skills

Text Book



- Data Structures & Algorithm Analysis in C++
  by Mark Allen Weiss

Grade Composition

- 4 Quiz
- 4 Assignments
- Midterm exam (20%)
- Final exam (60%)

- All assignments are to be your own work.
- No group projects or assignments are allowed.
- Exams are closed-book.

- Attend all lectures!

What are your goals?

- A step towards the BS degree
- Just a requirement of CS course
- Becoming a well-rounded computer scientist
- Intellectual (theory) aspects of CS
- Clever ideas
- Interview questions at well-known software companies

Why Study Algorithms and Data Structures?

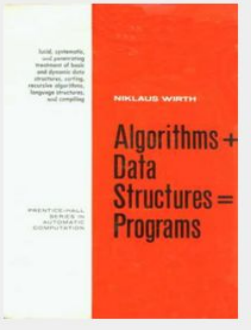
- To become better computer scientist

To become a proficient programmer.

" 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*



Why Study Algorithms and Data Structures?

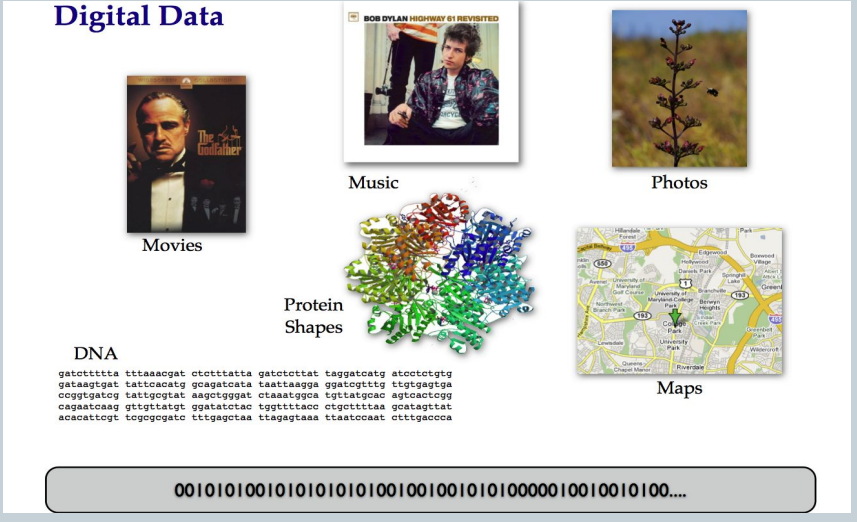
- World domination

Algorithms are Everywhere

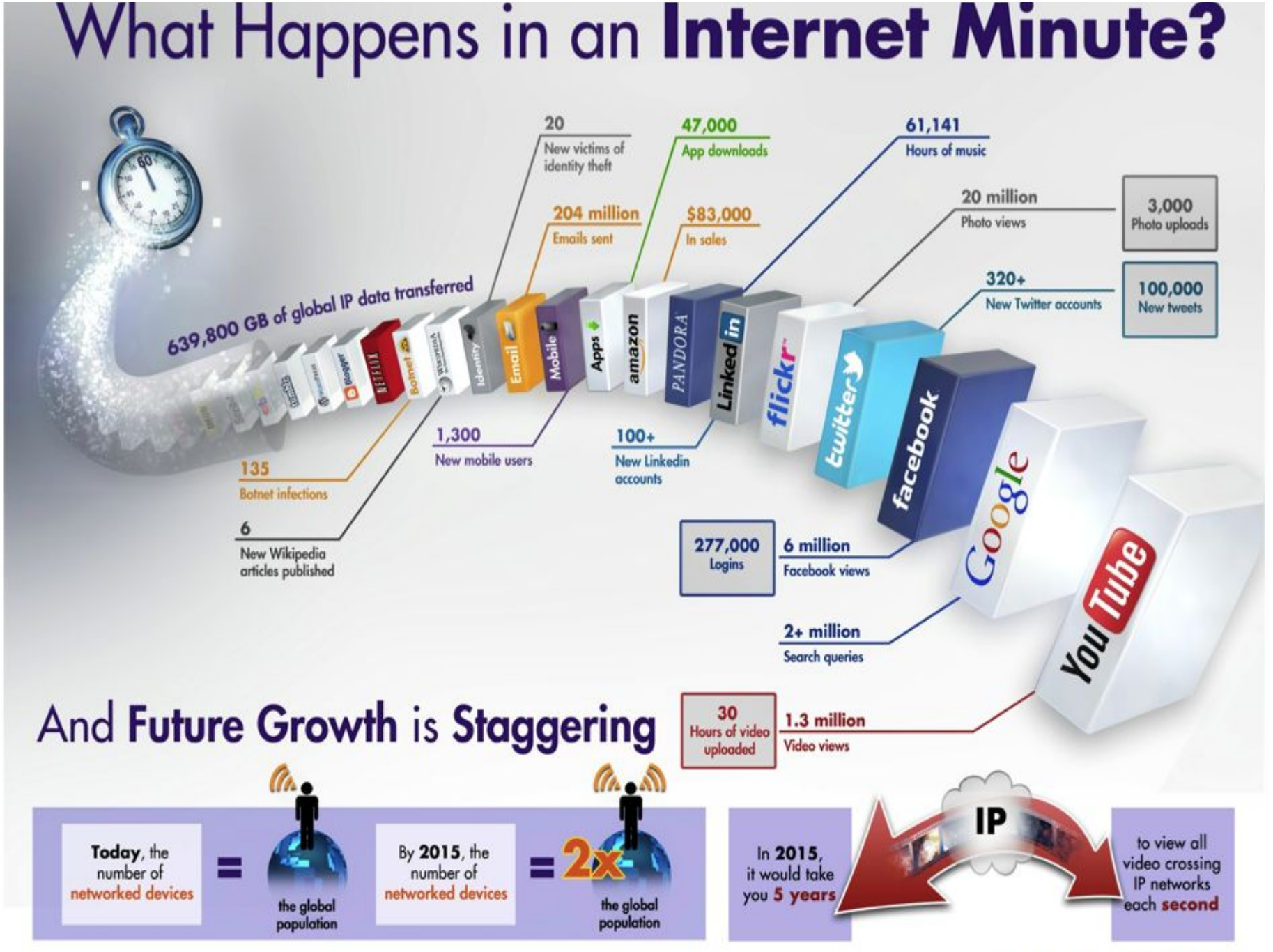
- Search Engines
- GPS navigation
- Self-Driving Cars
- E-commerce
- Banking
- Medical diagnosis
- Robotics
- Algorithmic trading
- and so on …

Modern World of Computing

- Age of Big Data, birth of Data Science
- Digitization, communication, sensing, imaging…
- Entertainment, science, maps, health, environmental, banking…



- Volume, variety, velocity, variability
- What all happens in 1 Internet minute?



Credit: Intel Corporation

Intelligent Computational Systems

"Big data" will allow us to put the "smarts" into everything …

- Smart homes
- Smart cars
- Smart health
- Smart robots
- Smart crowds and human-computer systems
- Smart interaction (virtual and augmented reality)
- Smart discovery (exploiting the data deluge)

Why Data Structures?

- Data is just the raw material for information, analytics, business intelligence, advertising, etc
- Computational efficient ways of analyzing, storing, searching, modeling data
- For the purpose of this course, need for efficient data structures comes down to:
  - Linear search does not scale for querying large databases
  - Smart data structures offer an intelligent tradeoff:
  - Perform near-linear preprocessing so that queries can be answered in much better than linear time