Introduction

CMPU 101 – Problem Solving and Abstraction

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Textbook

- A Data Centric Introduction to Computing
  - Kathi Fisler, Shriram Krishnamurthi, Benjamin S. Lerner, Joe Gibbs Politz
  - Freely available at: http://dcic-world.org

What is Computer Science?

- According to Wikipedia (so it must be true!) it is…

- The study of computation, i.e., using computers, algorithms and data-structures to solve computational problems.

- Do we know what these terms mean?

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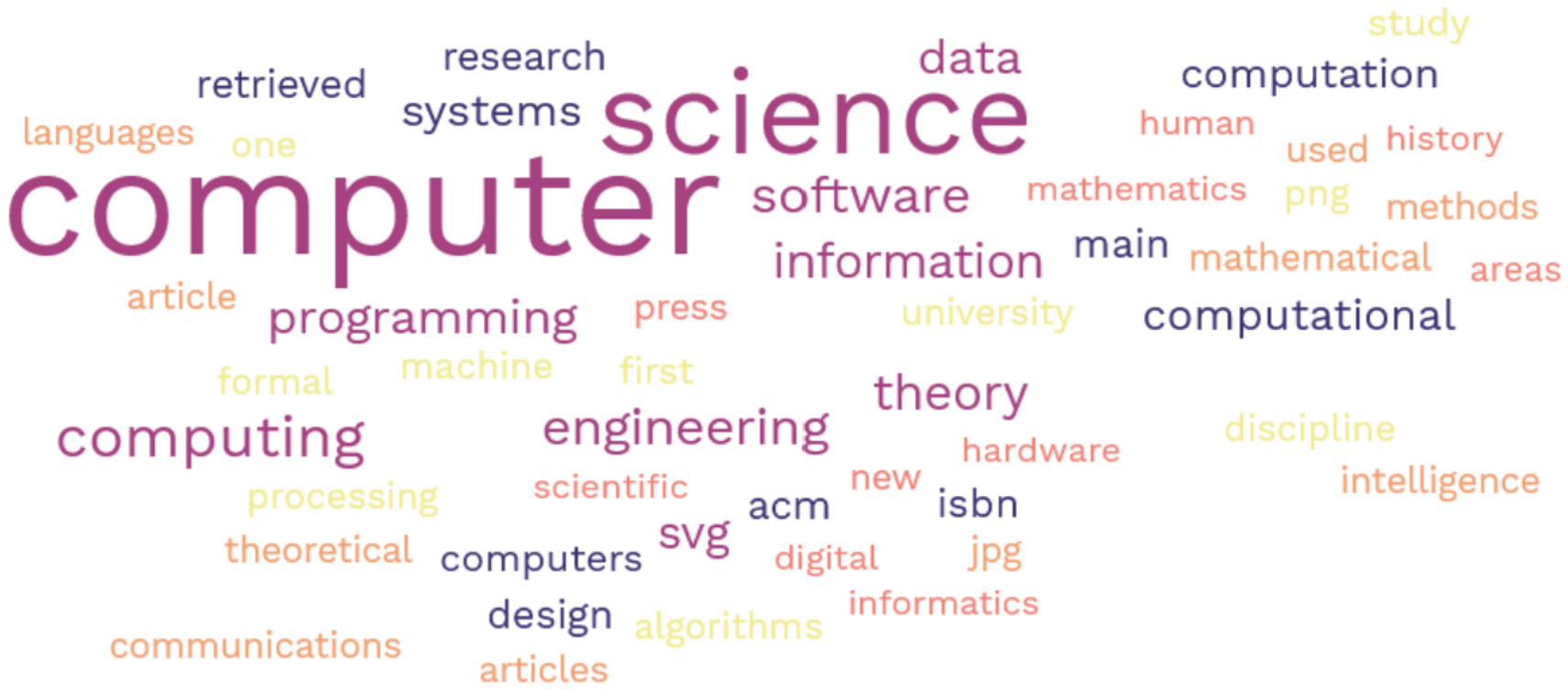
- **Do we know what these terms mean?**
  - **Algorithm:** A step-by-step procedure for solving a problem or performing a task.
  - **Data-Structure:** A collection of data organized to facilitate solution of a computational problem
  - What about **computation**?

Procedure for computationally solving a problem

1. Define the problem:
   - What data do we have? (our input)
   - What data or end result do we want? (our output)
   - What is the relationship between the input and output?
   - This last question leads us to step 2…
2. Design an algorithm (and a runnable program) that…
   - Creates a way to structure the data and
   - Manipulates the data structure to get the end result we want.

Let’s see an example…

Word Cloud of Text on Computer Science Page on Wikipedia



Our Example

1. Define the problem:
   - We have the text of the computer science Wikipedia page
     - i.e. our input
   - We want a luxurious word cloud picture of the most used terms
     - i.e. our output
   - We want the font size to represent the relative frequency of the words
     - i.e. relationship between I/O

Our Example, step 2

- Design an algorithm (and a runnable program) to…
  - Create a table of the (important) words & also includes the number of occurrences of each word and
  - Displays each word in the table at a random position with a font size proportional to number of occurrences.

Let’s try one together!

- Reference:

https://www.cbsnews.com/sanfrancisco/news/elon-musk-twitter-trial-judge-orders-both-sides-turn-over-more-documents/

DOVER, Del. – A Delaware judge ordered both Twitter and Tesla CEO Elon Musk to turn over more information to opposing lawyers in their tussle over Musk's agreed-to-then-abandoned $44 billion deal to acquire the social platform.

Chancellor Kathaleen St. Jude McCormick on Thursday ordered Twitter to provide Musk's attorneys more data regarding the company's estimates that less than 5% of the accounts on its platform are fake. The judge also rejected Musk's attempts to shield details about analyses he used in his attempt to terminate the deal.

That work was done by data scientists who examined live-feed information from Twitter about public user accounts to test the company's daily-user counts.

Let’s try one together, ripped from the headlines!

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output?

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input?

More Computer Science Terms

- Computability
  - What class of problems can even be solved by a computer?
  - What class of problems can NOT be solved by a computer?

  - Example: The Halting Problem… If we supply data to a program will the program eventually stop or run forever? Can we write a program to solve this?

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  - We cannot solve this problem with a program for every combination of data & program

More Computer Science Terms

- Complexity
  - How does program runtime grow as problem sets grow? Proportionally? Asymptotically? Etc.
  - What kinds of problems are intractable (hard)?
    - Example: The “traveling salesman problem… Given some number of cities, can we find the optimal path (i.e. shortest distance travelled) of cities to visit?

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Intractable! We have to check every possible route! Is there any other way?

Addressing our Textbook

- What does it mean to be Data-Centric?
  - First, we focus on data!
    - Data types
    - Organization of data (data structures)
  - Only later will we emphasize algorithms
    - We'll design our algorithms based on data structures and
    - We'll design our data structures based on the algorithms we develop