



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.

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.

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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 The Title of 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