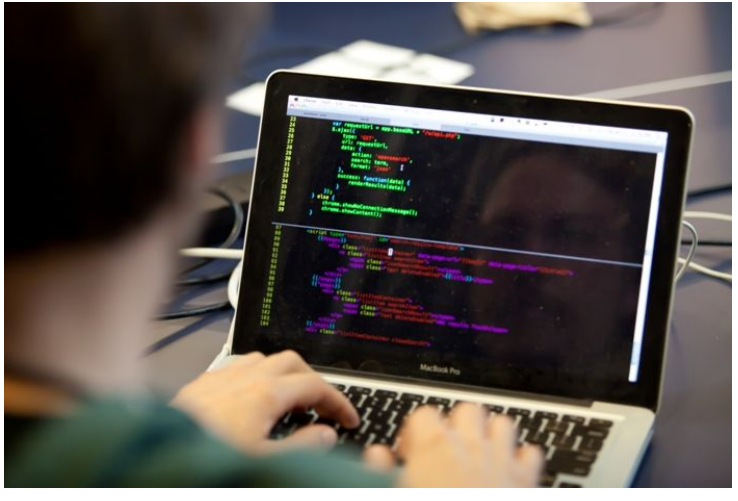
CO 322

Data Structures and Algorithms

Damayanthi Herath, BSc. Eng. (Hons), PhD

A warrior should not just possess a weapon, he must know when and how to use it.



By the end of this lecture you will be able to

1. Define data structures and algorithms
2. Discuss the importance of data structures and algorithms in computer engineering

Data Structures and Algorithms

Data structure:

Algorithm:

In class group activity

Group 1:

1. Write a pseudo code of an algorithm to make a cup of tea.
2. How many distinct steps are in your pseudo code?
3. If you are making tea for 1000 people how many steps will you have in total?

If you are making tea for 1000 people, how will you optimize your algorithm?

Group 02:

You are given a deck of cards with letters in an order.

1. Reverse the deck of cards.
2. Tell the class the algorithm you used to reverse the deck of cards.

Let's say it was already reversed , how long will it take?

Group 03:

You are given a deck of cards in an order.

1. Sort the deck of cards.
2. Tell the class the algorithm you used to sort the deck of cards

Group 04:

1. Find the e/no s of the 5 highest marks in GP 106 in your group.
2. Tell the class how you did it?

What is the data structure you'd use to store this information? Why?

Group 05

1. List the hometown s of all the group members
2. Find the shortest way to visit from home of A to home of B iva the listed home towns

What is the data structure you'd use to store this information? Why?

Data Structures and Algorithms (DSA): What

Data structure:

- A way to store and organize data to facilitate access and modifications.

Algorithm:

- Informally: A process that takes a set of inputs and produces a set of outputs.
- A finite sequence of instructions
  - No ambiguity, and each step precisely defined
  - Should work for all (well-formed) input
  - Should finish in a finite (reasonable) amount of time

Data Structures and Algorithms (DSA): What

Data structure:

- A way to store and organize data to facilitate access and modifications.

Linear and non linear data structures. Arrays, lists: linked list, ordered linked list and doubly linked list; push down stacks; queues: FIFO queue and deque. Tree structures – trees in general, binary search tree (BST), root insertion to BST, splay tree, 2-3-4 trees, radix tree and red-black tree; Graphs; Implementation of depth first search,breadth first search

Algorithm:

- Informally: A process that takes a set of inputs and produces a set of outputs.
- A finite sequence of instructions
  - No ambiguity, and each step precisely defined
  - Should work for all (well-formed) input
  - Should finish in a finite (reasonable) amount of time

**What is in the course

Algorithms

Algorithms :

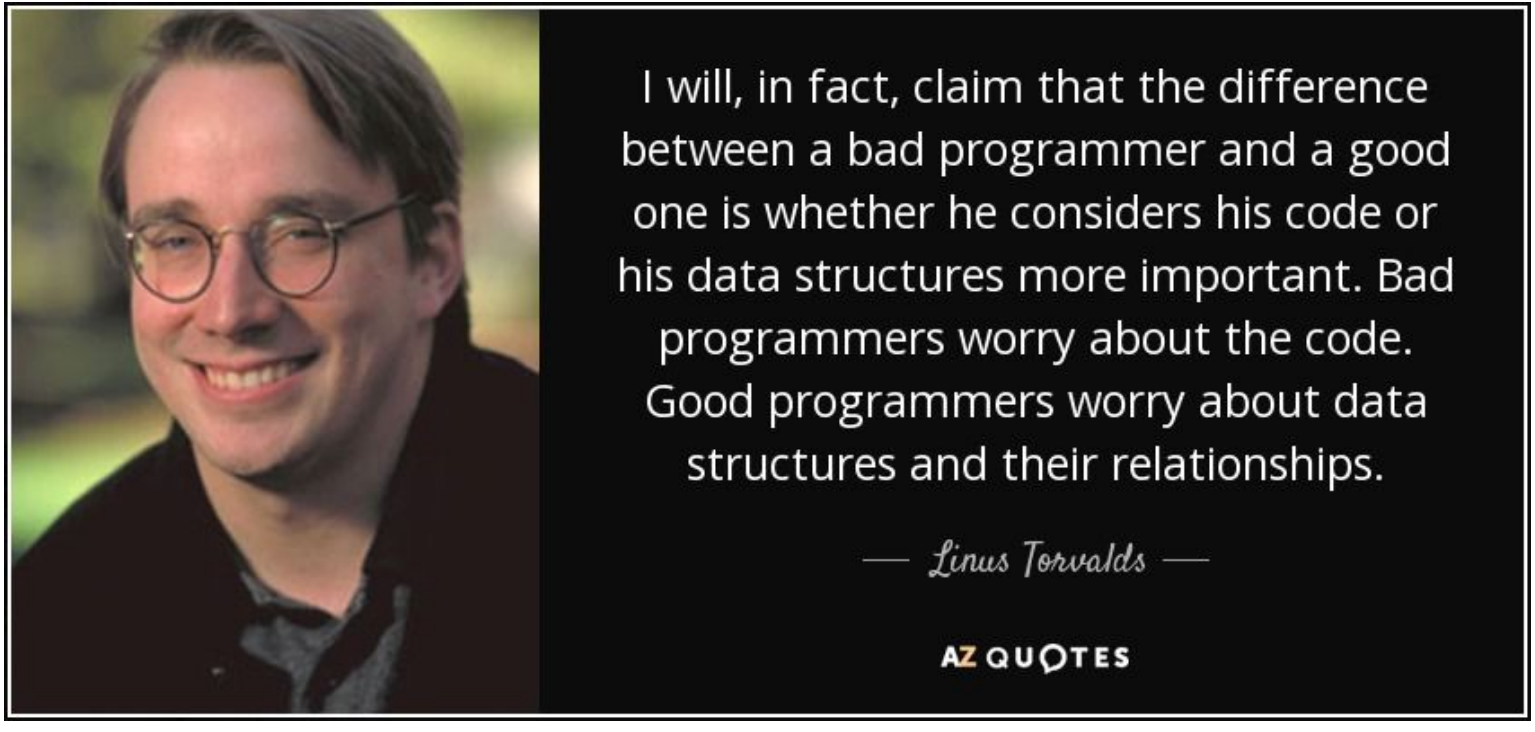
Sorting algorithms: bubble sort, selection sort, insertion sort, quick sort, heap sort, merge sort and external sorting methods.

Hashing: hash functions and collision resolution: separate chaining, linear probing and double hashing.

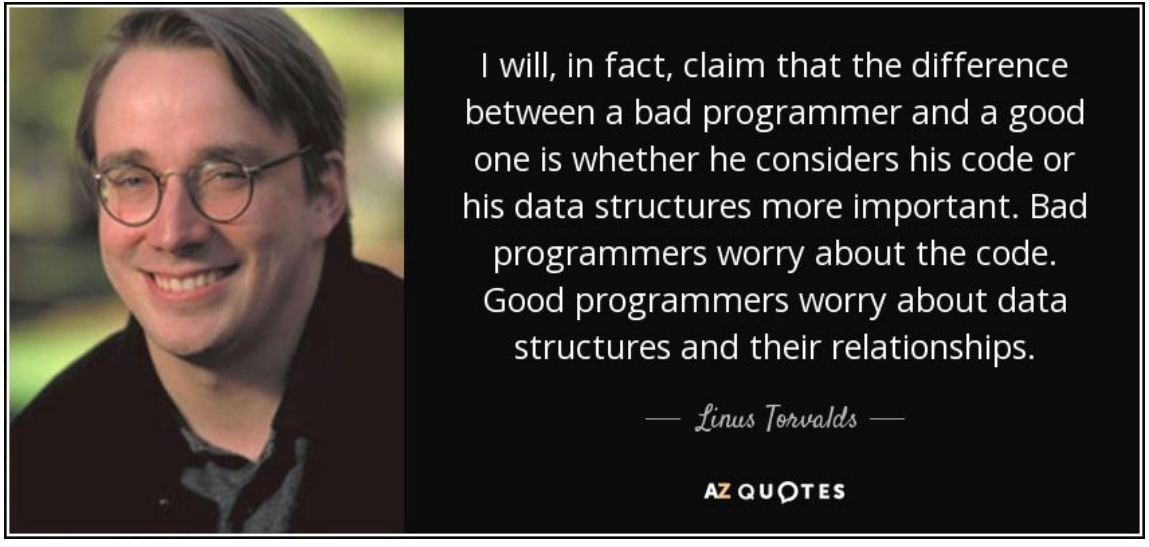
Algorithm Analysis : Analysis of algorithms: time complexity, big O notation.

Algorithm designs : Classification of Algorithms by Implementation and Design Paradigm: Divide & Conquer Algorithms, Dynamic Programming, Greedy Algorithms, Recursive Algorithms, Backtracking, Alfa-Beta pruning, Branch & Bound Search.

DSA: Why

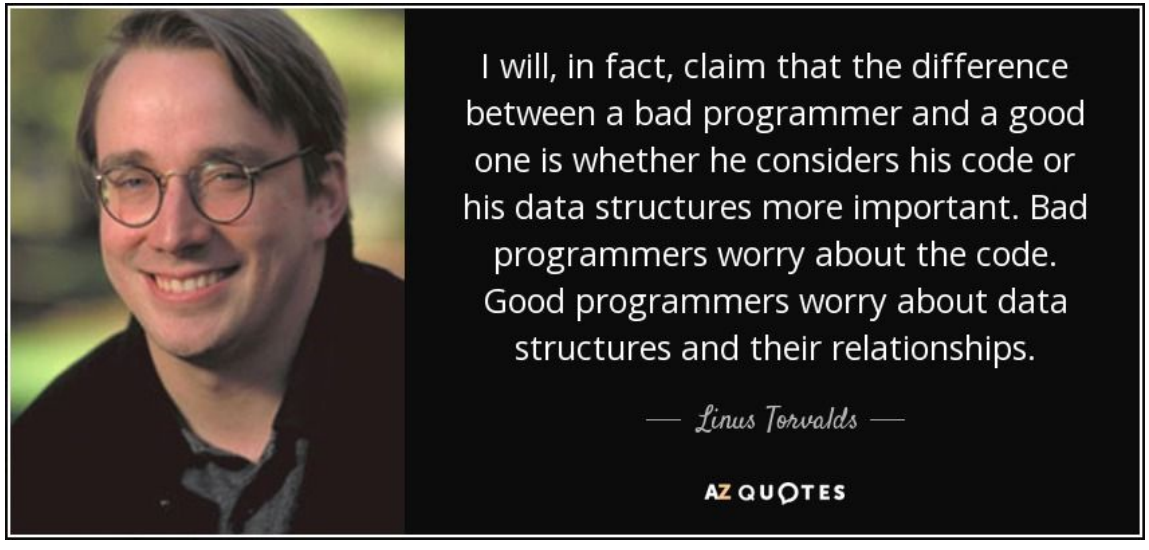

I will, in fact, claim that the difference between a bad programmer and a good one is whether he considers his code or his data structures more important. Bad programmers worry about the code. Good programmers worry about data structures and their relationships.
— Linus Torvalds —
AZ QUOTES

DSA: Why



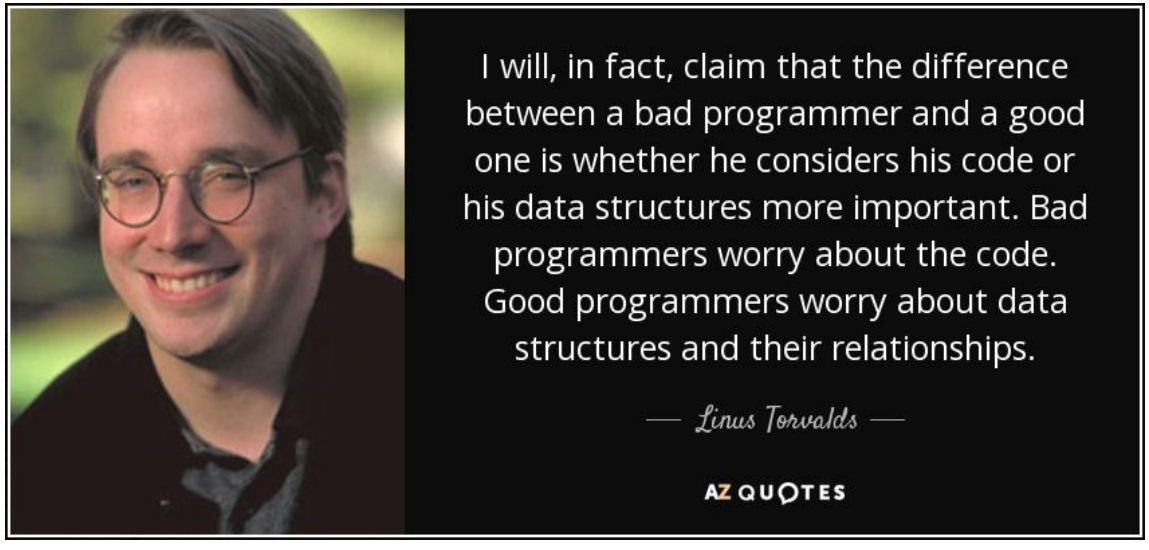
- Every program depends on algorithms and data structures, but few programs depend on the invention of brand new ones - Kernighan & Pike

DSA: Why



- Every program depends on algorithms and data structures, but few programs depend on the invention of brand new ones - Kernighan & Pike
- Essential for any computing professional

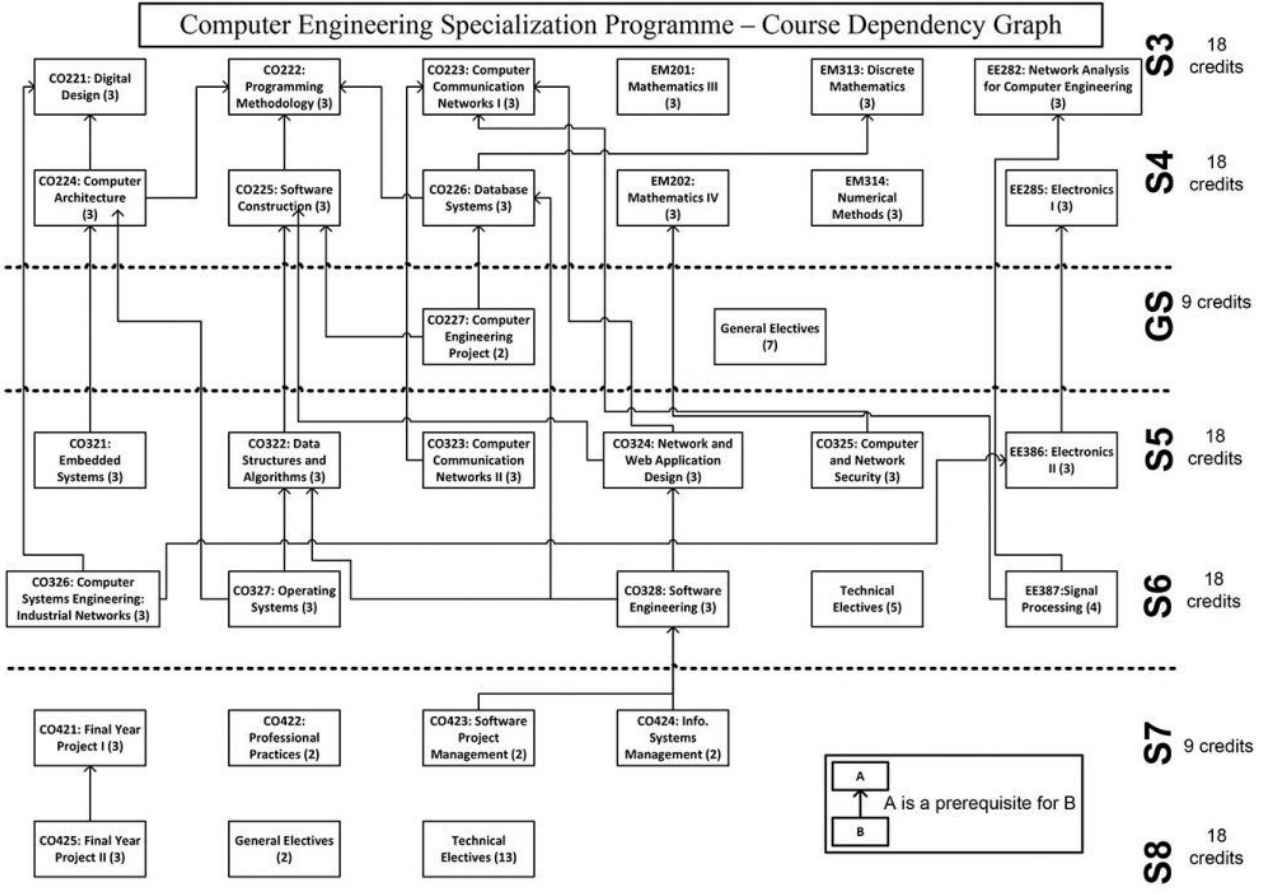
DSA: Why



- Every program depends on algorithms and data structures, but few programs depend on the invention of brand new ones - Kernighan & Pike
- Essential for any computing professional
- **Your interviews will be based on this**

CO 322-2022

3 credit, core course



CO 322

Syllabus

CO 322-E20: Teaching team

Dr. Damayanthi Herath
https://damayanthiherath.net/
damayanthiherath@eng.pdn.ac.lk
Course Coordinator

Mr. Ridma Jayasundara

The instructor in charge

Further details: http://people.ce.pdn.ac.lk

CO 322-2023: Plan

Course Plan including assessment Plan for the semester

By the end of this lecture you will be able to

1. Define data structures and algorithms
2. Discuss the importance of data structures and algorithms in computer engineering


LANKA
Sathosa
සතොස