course_content

top

Linear Data Structures Review

Week 5

Class Quiz!

Time:
5 min

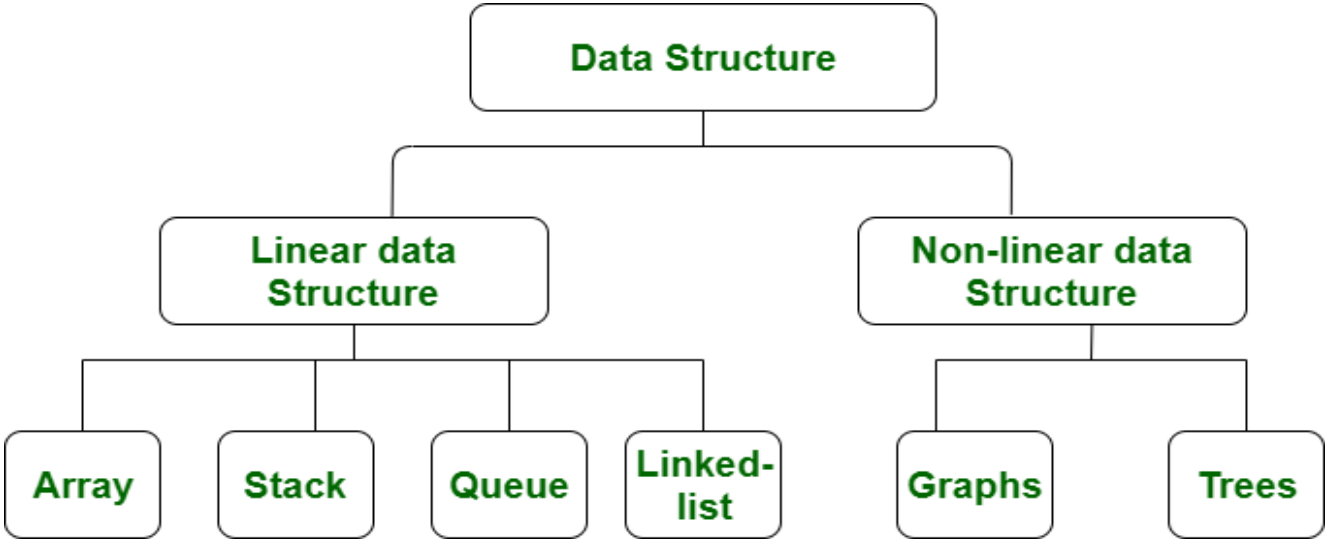
bit.ly/DSA1920Quiz5

Bonus question at the end to help you make up for other questions or missed quizzes..

Time:
5 min

Linear Data Structures

- Data is stored sequentially in a single level
- Can be traversed in one run



Source:
Geeks for Greeks

Time:
5 min

Overview of Data Structures

RunTime	Access	Search	Insert Element	Delete Element
Arrays (dynamic)				
Linked List				
Queue				
Stack				

Time:
5 min

Overview of Data Structures

RunTime	Access	Search	Insert Element	Delete Element
Arrays	O(1)	O(n)	O(1) - append O(n) - other	O(1) - pop O(n) - other
Linked List	O(n)	O(n)	O(1) - if prev node known O(n) - other	O(1) - if prev node known O(n) - other
Queue	O(n)	O(n)	O(1) - back O(n) - other	O(1) - front O(n) - other
Stack	O(n)	O(n)	O(1) - top O(n) - other	O(1) - top O(n) - other

Time:
5 min

High Level Comparison

- Linear data structures are ..... at searching
- Arrays are ..... space efficient than linked lists but the space needs to be ..... for arrays but for linked lists, memory can be anywhere
- For read-only data sets, one would most likely use .....
- ..... are used when modification only needs to happen to recent additions
- ..... are better when the oldest data is the most useful / important
- Both ..... and ..... can be used to implement ..... and .....

Time:
5 min

Data Structures Considerations

- Is space a constraint - do I have limited space or limited contiguous space?
- What kind of operations am I doing often? Accessing, Deleting, Inserting?
- How stable is the data? Will it be changed often?
- What primitive data types will I be storing? Can I limit some options?
- Does the order matter? Are duplicates a problem? How do I deal with them?
- Are there other hierarchies / relationships that matter (graphs/trees)
- What is easy to implement/use?

Time:
10 min

Career Brainstorm - Think, Pair, Share

- Individually, think about and write the answer to the following questions
  - What jobs/roles are you interested in?
  - What jobs/roles do you want to explore more?
  - What projects (any!) would help you improve your understanding or get experience in those jobs/roles?
  - What fields/problems do you want to show that you have experience in?
- Share it with a partner who can help you brainstorm ideas on what projects to work on. (In this class, other classes and outside!)

Time:
5 min

Data Structures Considerations

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Time:
5 min

Peer Project - 2 people

- You will be assessed on:
  - **1) Problem Analysis** - how well have you analysed and broken down the problem explaining why is it important to solve and what particular constraints the problem has.
  - **2) Problem Interpretation** - how well have you interpreted the problem in terms of data structures and algorithms. What are the requirements and resource constraints from a resource usage point of view? And what factors should we keep in mind when making decisions around the chosen data structures and algorithms.
  - **3) Problem Solution** - based on the interpretation of the problem, which specific data structures have you chosen to implement your solution and why? What are the advantages of your chosen solution and what are the limitations when another solution could have been better? How complex is the solution?
  - **4) Solution Implementation** - how have you implemented your solution? Does it solve the requirements of the problem? Does the code run smoothly and is it easy to read? Would a client or user be happy with your implementation? Is it tested thoroughly? Is it flexible to be changed if the problem scope changes?

Time:
5 min

Peer Project

- You will **not** be assessed on but you **may want to think about**:
  - The front-end user interface / experience
  - The data that you use - dummy data is fine
  - How well it integrates with other applications/interfaces (APIs)
  - What language you chose to use - any is fine
  - How secure is it?
  - How well does it run on different devices? (e.g. OS, Android etc)
- The focus is on the **functionality** of what you're building
- There should be some **data storage** and **manipulation** aspect

Time:
5 min

Peer Projects - Some ideas

- Games - Chess, PacMan, snake etc
- Tools - scheduling, accounting system, inventory management etc
- Apps - e-commerce, user-feedback system, events in Kigali
- ALU-specific - upload and store memes, attendance tracking, facilitator review
- Algorithms - NewsFeed, Recommendation System,
- Local Apps - process manager, file manager, video
- Others - Learning Management System (e.g. ALUx), Online Forum,

Time:
5 min

Peer Projects

- You **may** use other online repositories to help you with other aspects (e.g. integrations, user interface, security etc)
- You **must** write code for the core data structures and algorithms functionality.
- You **need** to present the problem and solution nicely in a PDF. You should discuss what you considered and why you made certain decisions.
- You **may** want to find a mentor (user) to help you think about the specific functions that would be useful for the use-case that you are looking for.
- You **need** to submit an initial abstract for your project to me on Piazza (private post) by **24/02.** You **can** also use Piazza to help you find a partner.

Time:
1 min

Questions