Data Structures and Algorithms

course_content

Stacks and Queues

Week 4

Class Quiz!

bit.ly/DSA1920Quiz4

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

Stacks

- Think of a 'stack' of plates or 'stack' of books.

- How does it work? What can you *easily* do to the stack?

- What do you think are the primary methods of a stack?

- What does LIFO mean?

Stacks

- What do the following mean in the context of stacks?
    - mystack = EmptyStack()
    - mystack.push(val)
    - mystack.pop()
    - mystack.peek()

Queues

- Think of a 'queue' of people waiting for a service

- How does it work? What can you *easily* do to the queue?

- What do you think are the primary methods of a queue?

- What does FIFO mean?

Queues

- What do the following mean in the context of queues?
  - myqueue = EmptyQueue()
  - myqueue.enque(val)
  - myqueue.dequeue()
  - myqueue.peek()

Stacks and Queues

Stacks	Queues
LIFO/FILO protocol	FIFO/LILO protocol
push - O(1)	enqueue - O(1)
pop - O(1)	dequeue - O(1)
peek - O(1)	peek - O(1)

Exercise - Pseudocode

- In Groups of 3, without using the internet

- Write pseudocode for the following using the basic methods. You should

  write the method for both stacks and queues

  - Access i'th element

  - Search for a specific element

  - Reverse

  - Insert

  - Delete

- What is the time and space complexity for each in the worst case?

Applications

Stacks - ideal for reversing and **pushing results to next item**
- Parsing in a compiler.
- Undo in a word processor.
- Back button in a Web browser.
- Implementing function calls in a compiler.

Queue - each item is processed independently one by one
- Data Buffers
- Asynchronous data transfer (file IO, pipes, sockets).
- Allotting requests on a shared resource (printer, processor).
- Traffic analysis.
- Determine the number of cashiers to have at a supermarket.

Source: Tech Differences

Advantages and Disadvantages

- …… requires 2 pointers while ……… require only 1 pointer

- Both are great when you simply want to add and remove elements without easily accessing most of them but ………. are more useful when you want to make changes to your recent additions.

- Both can be implemented using arrays and linked lists (next week!).

- There are many types of …….. including circular …………, double-ended ………., priority ……………. There is a branch of mathematics/computer science called …….. theory dealing with the study of …………. and how to optimise them.

Exercise - Questions

- A letter means push/enque while * means pop/dequeue done from left to right. What is the result of?
  - E A S * Y * Q U E * * * S T * * * I O * N * * *
  - L A * S T I * N * F I R * S T * * O U * T * * * * * *
- Suppose that an intermixed sequence of stack push and pop operations are performed. The pushes push the integers 0 through 9 in order; the pops print out the return value. Which of the following sequences could not occur?
  - 4 3 2 1 0 9 8 7 6 5
  - 4 6 8 7 5 3 2 9 0 1
  - 2 5 6 7 4 8 9 3 1 0
  - 4 3 2 1 0 5 6 7 8 9

Questions