Section 02: Asymptotic Analysis

1. Asymptotic Notation

If the order of growth of some function f(N) is in Θ(logN), which of the following asymptotic bounds can also be used to describe f(N)?

• O(logN) • O(N) • O(N2)	• Θ(logN) • Θ(N) • Θ(N2)	• Ω(logN) • Ω(N) • Ω(N2)

Explain why each of your choices apply in the space below. *Consider using inequalities or graphs!*

Challenge Question: What if we only knew that the order of growth of some function f(N) was in O(N)?

2. Design Decisions: Restaurant

A restaurant wants to table customers in the order they arrived, unless an inspector comes by. When an inspector comes in to check the service by ordering, the sandwich shop also hopes to give them a table before other customers. Since there is a really long wait time for tables, waiters only look at the ADT representation when giving out tables.

Please choose ADTs from the following:

- List
- Stack (LIFO)
- Queue (FIFO)
- Deque
- Map

Please choose corresponding data structures to implement your chosen ADTs. *For example, "ArrayList" for the List ADT.*

Justify your reasoning. You do not need to determine the implementation of the Map if you use one.

What are your Abstract Data Type(s) (ADTs)?

Describe the data structure implementation you are building. Describe why it works "best" for each of the functionalities described above. Think carefully about how you are justifying "best" in this case! What are the advantages and tradeoffs of using this implementation as opposed to the other?

3. Design Decisions: Disneyland

Disneyland has hired you to find a way to improve the processing efficiency of their long lines at attractions. There is no way to forecast how long the lines will be. In addition, "the Disability Access Service (DAS) is intended for Guests who have difficulty tolerating extended waits in a conventional line environment due to disability. This service doesn't provide immediate access to experiences, but rather allows Guests to request a return time for a specific experience that is comparable to the current standby wait."

The `Map` ADT for key, value pairs will be used for those utilizing the Disability Access Service and will help with lookup when a customer comes back to check how much time they have left to wait and what place in line they would be in, if they would like to re-join now.

Please choose how we should implement the program of the line for the attraction. We want the functionality of the line to be able to:

- Add customers to the end of the line
- Remove customers from the front of the line, when it's their turn for the specific experience
- Add customers, utilizing DAS, at the x^{th} spot in the line, when they return for the specific experience. When using lookup for customers in the `Map`, you will receive the place number of how many people are in front of the customer.

Please choose an ADT from the following:

- List
- Stack (LIFO)
- Queue (FIFO)
- Deque
- Map

Justify your reasoning. You do not need to figure out the implementation of the given `Map`.

Pick an Abstract Data Type (ADT):

(Last question on next page.)

Describe the data structure implementation you are building. Describe why it works best for each of the functionalities described above.