CS 1.2: Intro to Data Structures & Algorithms

Linked List Time Complexity Worksheet

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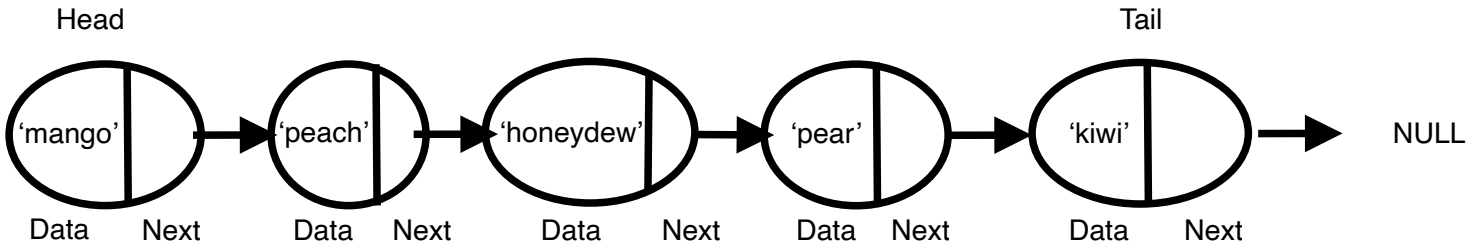
Linked List Diagram – organization of data structure in memory

Draw a diagram of how a linked list data structure is organized in memory using references. The linked list should contain exactly 5 items: `'mango'`, `'peach'`, `'honeydew'`, `'pear'`, and `'kiwi'`.
Label the `head`, `tail`, `data`, and `next` properties in appropriate places to complete the diagram.



Linked List Operations – implementation and time complexity

Using your diagram above to guide you, complete the table below. First, write a short summary in pseudocode (English) of the major steps performed in the implementation of each operation. Then, analyze each operation's best case and worst case time complexity using big-O notation. Use the variable ***n*** for the number of items stored in the list (equivalently, the number of nodes).

Linked List operation	*short summary in pseudocode (English) of the major steps performed in the implementation*	*best case running time*	*worst case running time*
`is_empty`	Check if head node exists	O(1)	O(1)
`length`	Iterate through all nodes, count 1 for each node.	O(n)	O(n)
`append`	Add new node to end after tail node. Update tail property to point to the new node.	O(1)	O(1)
`prepend`	Add new node to beginning before the head. Update the head property to point to new node .	O(1)	O(1)
`find`	Iterate through all nodes until matching value is found. If found return the data, if not return None.	O(1)	O(n)
`delete`	Iterate through all nodes untill matching value is found. If found, set previous node to point to the next node. Garbage collection will delete the unconnected node.	O(1)	O(n)