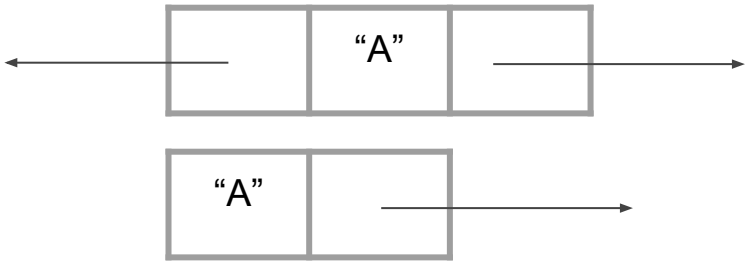
Nodes and Linked Lists

Node

- A node is a basic data structure.
- A node stores:
  - Data
  - One or more pointers to other elements (helps to link nodes together)



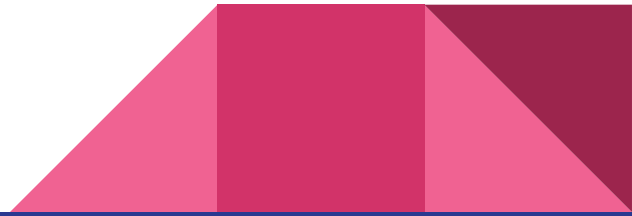
Class ListNode

```
public class ListNode{
  private String data;
  private ListNode next;

  public ListNode(String d){ //default next should be null
  }
  public ListNode(String d, ListNode n){ }

  public String toString(){} //Return the string of the data

  public String getData(){} //return the data

  public ListNode next(){} //return the next node

  public String setData(String newdata){} //replace the data, with the newdata, return the original data.

  public void setNext(ListNode n){}

}
```

Pointers Exercise 1

Make a diagram to represent the following code using nodes and pointers (analize one line at the time).

```
ListNode node1 = new ListNode(“a”);

ListNode node2 = new ListNode(“b”);

node1.setNext(node2);

node2.setNext(new ListNode(“c”));

node2 = new ListNode(“d”);

ListNode node3 = new ListNode(“e”, node2);
```



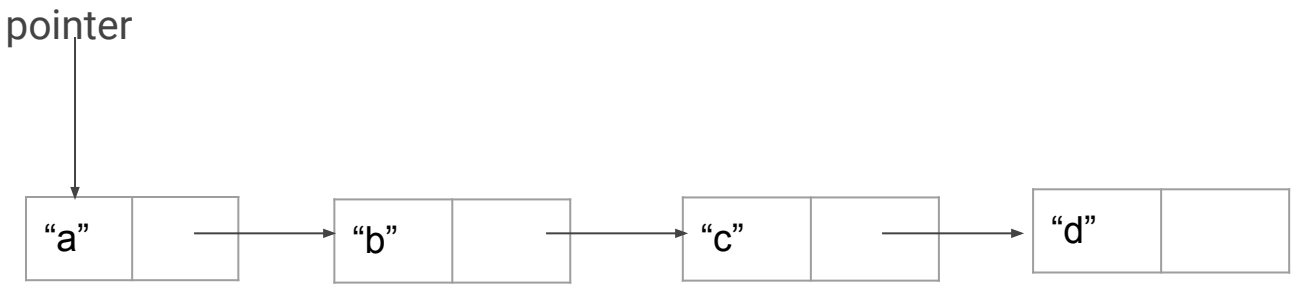
Pointers Exercise 2

Use the previous diagram and do the following:

node2.setNext(node1);

node1 = node3;

Pointers Exercise 3

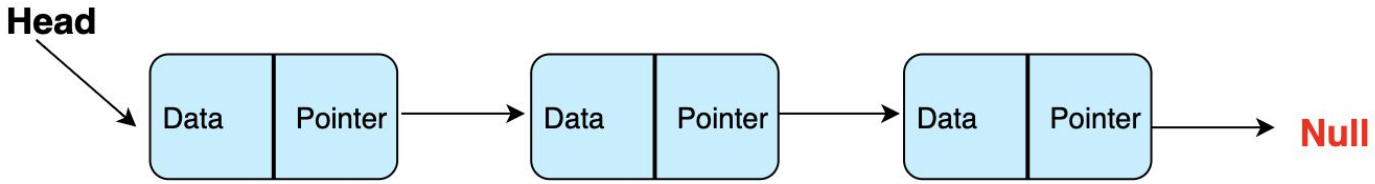


Write a few lines of code to perform the following steps:

1. Create a new `ListNode` variable set it to point to the node with the “b” in it.
2. Create a new `ListNode` variable and instantiate it to a new `ListNode` with a value of “e”.
3. Write the code to insert this new `ListNode` between the “b” and the “c”

Linked List

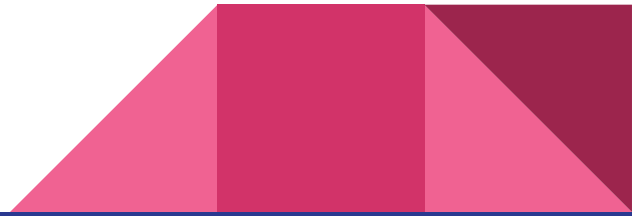
- It is a linear data structure made of a chain of nodes.
- Each node contains a value and a pointer to the next node in the chain.
- It has a Head pointer which points to the first node
- The last element point to null



Linked List

How would you access the linked list chain?

How would you traverse the elements in a linked list?



Class Linked List

How would you access the linked list chain?

We need a pointer to track the first element of the list.

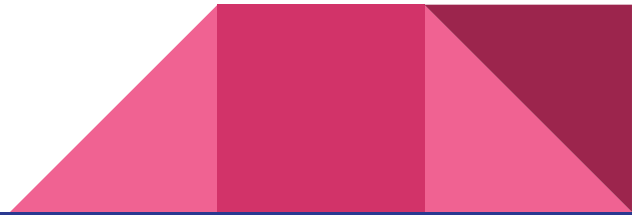
public ListNode head; // head of the linked list

How would you traverse the elements in a linked list?

Having the first element, we can go over the next elements in the list.

Linked List Characteristics

- The size increases dynamically
- No need to know the size of the element when we create a linked list
- Easy to insert/delete (change pointers)
- Linked list uses extra memory to store links



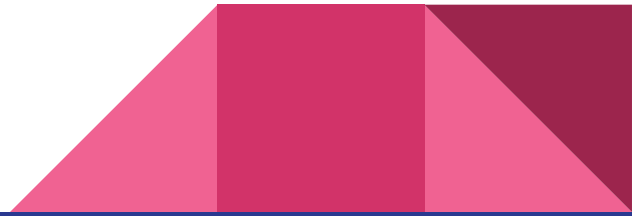
Types of Link List

Singly: It is a list where each node has data and a reference pointer to its next node.

Doubly: Each node in this list has 3 attributes which are data, next node reference and previous node reference.

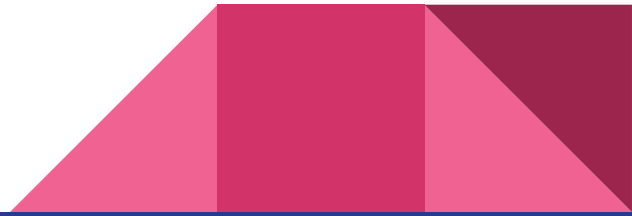
Applications of Linked List

- In music players: Your playlist may be created using a linked list.
- Photo gallery applications were you can access the previous/next picture.
- URLs that have previous/next buttons to navigate between pages



Linked List Operations

- Insertion ： adds a new element to the linked list
- Deletion : delete existing element form the linked list
- Searching : search for an element by its value in the linked list
- Traversal : traverse all elements starting from head in the linked list



Insert

- Inserting new node at the beginning.
- Inserting new node at the end.
- Inserting new node at random position of the linked list.

Delete

- Deleting node at the beginning.
- Deleting node at the end.
- Deleting node at random position of the linked list.