Link Nodes

Introduction

- Linked node: a class containing one or more data fields that store data, and a *reference* to another linked node
- The data can be a primitive type or an object
- Linked nodes connect objects together to form a list (chain) of link nodes
- Linked nodes are the building blocks of programs (data structures) that store a large number of data without using an array.

Node class

- Below are two examples of linked nodes classes.

```
public class Node {
  public Node next; //Point to next node
  public String data; //Value (String) for this node data
  //Constructor
  public Node(String data, Node next) {
    this.data = data;
    this.next = next;
  }


  //data fields are public
  // no need for getters and setters


}
```

This node will store a String value

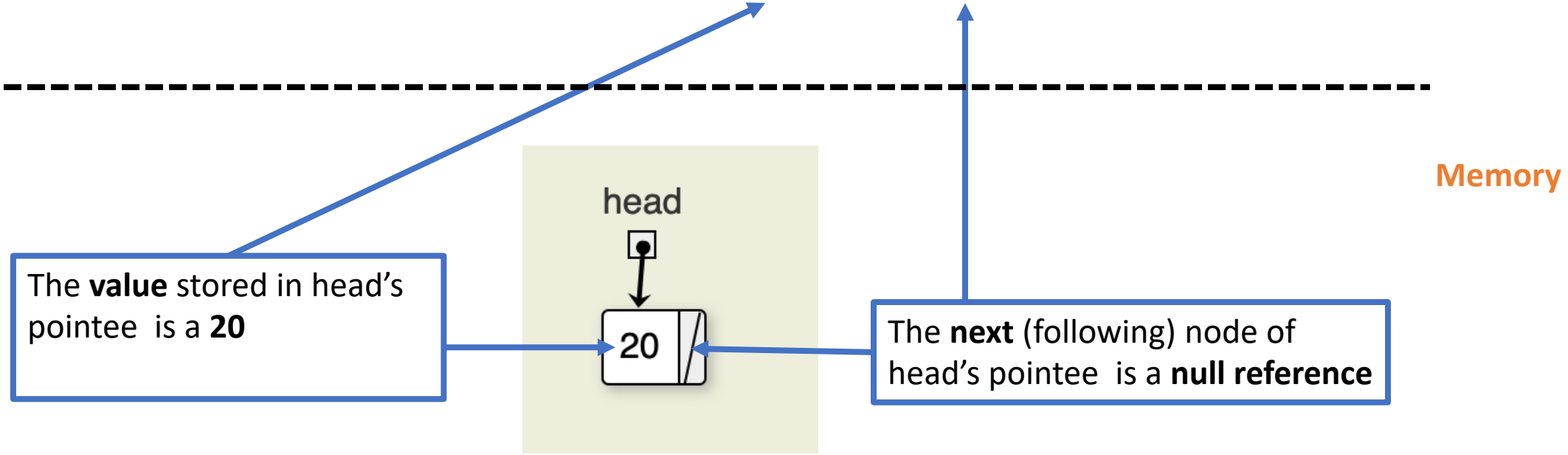
```
public class Node {
  public Node next; //Point to next node
  public Computer data; //Value (Computer)for this node data
  //Constructor
  public Node(Computer data, Node next) {
    this.data = data;
    this.next = next;
  }


   //data fields are public
   // no need for getters and setters


}
```

This node will store a Computer value

Chain of nodes

- Let's build a chain of nodes.
- Each node stores an integer value

```
Node head = new Node(20, null);
```

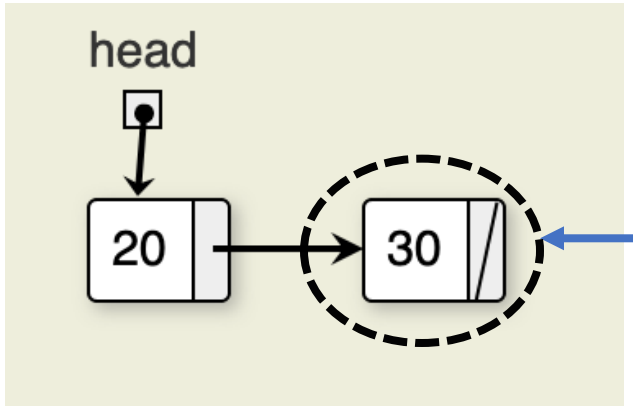


Chain of nodes

- `head.next = new Node(30, null);`

Update/add a new node at the end of the chain

Memory

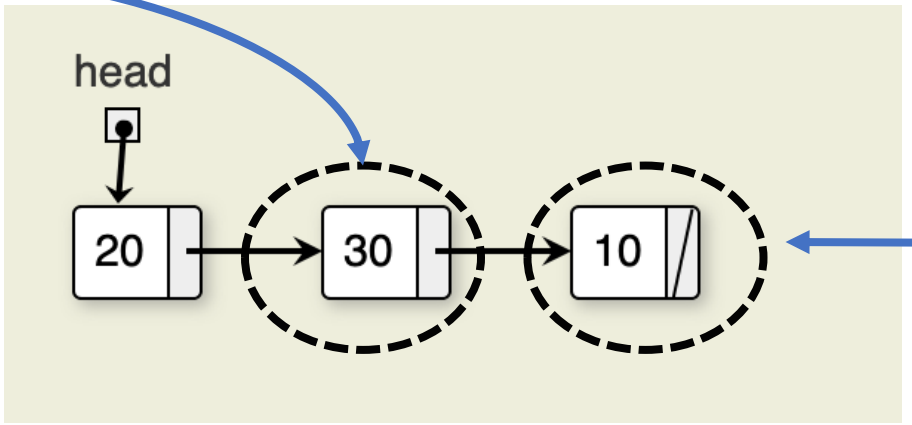


The **next** (follower) node of head's pointee is a **new Node storing 30**

Chain of nodes

- `head.next.next = new Node(10, null);`

Returns head's next (follower) node



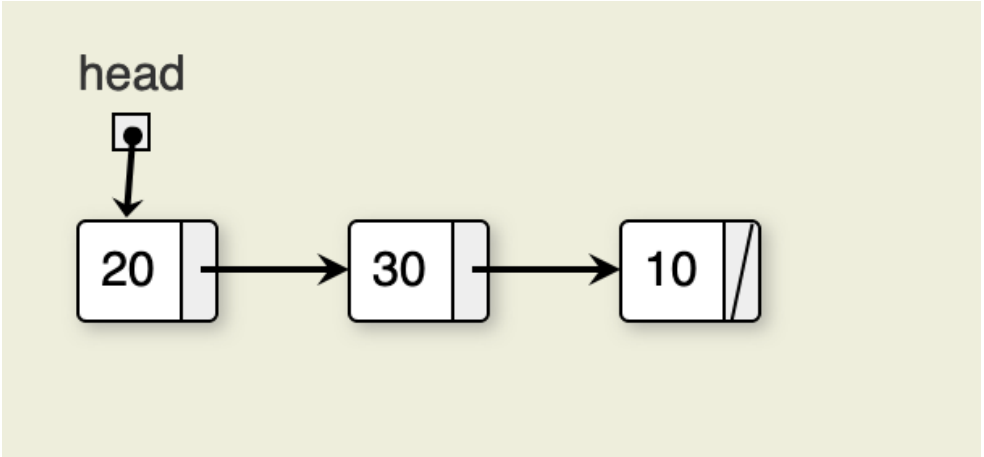
The **next** (following) node of head's follower is a **new Node storing 10**

Chain of nodes

Putting everything together:

```
Node head = new Node(20, null);
head.next = new Node(30, null);
head.next.next = new Node(10, null);
```

Will create the following chain:

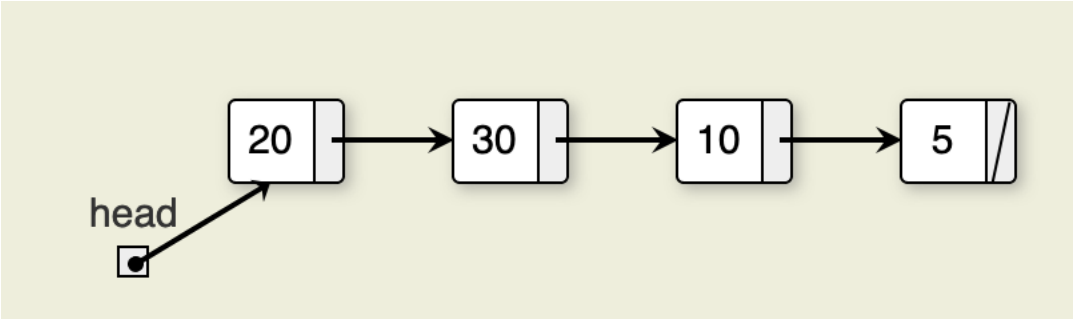


Chain of nodes: iteration

- To iterate through a chain of nodes:
- We don’t need to know how many nodes are in the chain
- The `last node` **next field** `points to a null reference`
- Steps **:**
  1. Create a temporary node that points to the head of the chain (sharing)
  2. Iterate/loop by following the next references with each iteration, update the pointee of the temporary node
  3. Stop when the temporary node points to a null reference

Chain of nodes: iteration

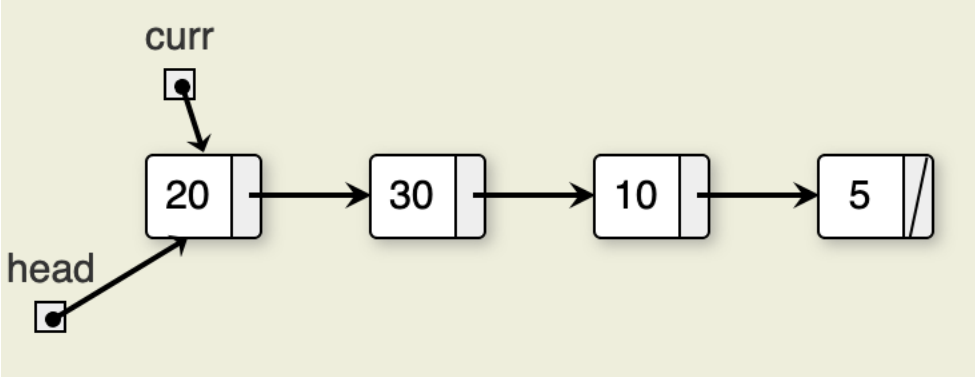
- Given the following chain



Chain of nodes: iteration

- Create a temporary node that points to the head of the chain

`Node curr = head;` //curr and head are aliases for each other



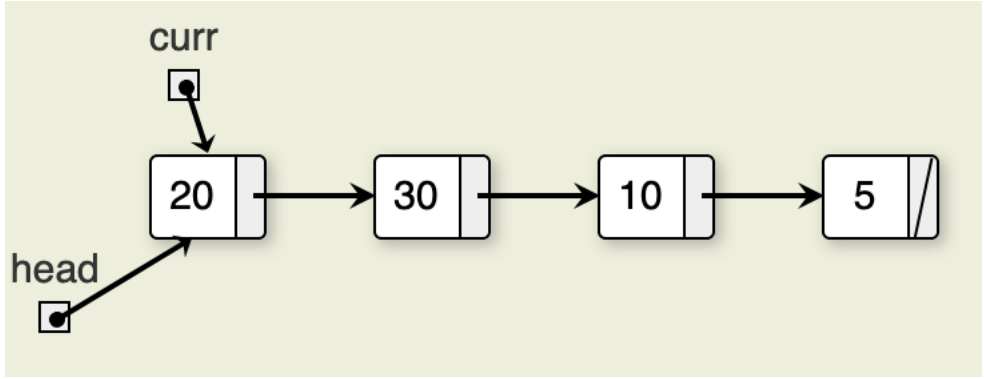
Chain of nodes: iteration

- Create a temporary node that points to the head of the chain

```
Node curr = head;  //curr and head are aliases for each other
```

- Start the loop we stop when `curr` points to the last node in the chain

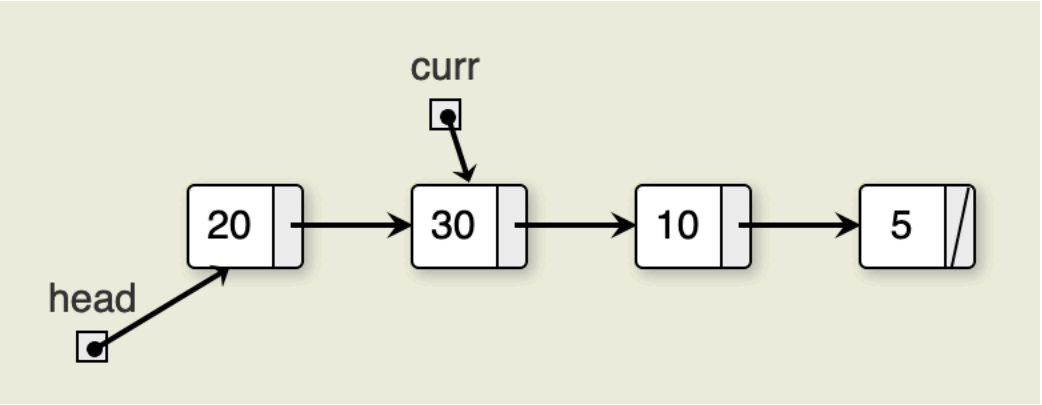
```
while(curr != null){  // the pointee of curr is not null
    curr = curr.next;  //we advance curr
}
```



Chain of nodes: iteration

- Curr now points to the node storing 30

```
while(curr != null){   // the pointee of curr is not null
    curr = curr.next;  //we advance curr
}
```

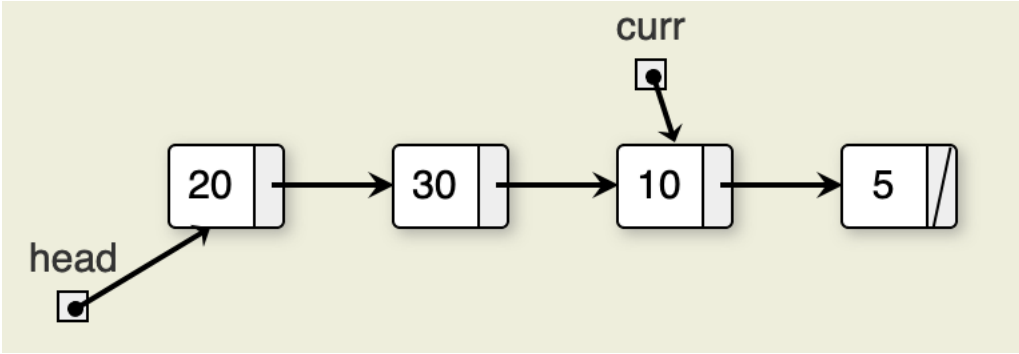


Note that `head` did not move.

Chain of nodes: iteration

- Curr now points to the node storing 10

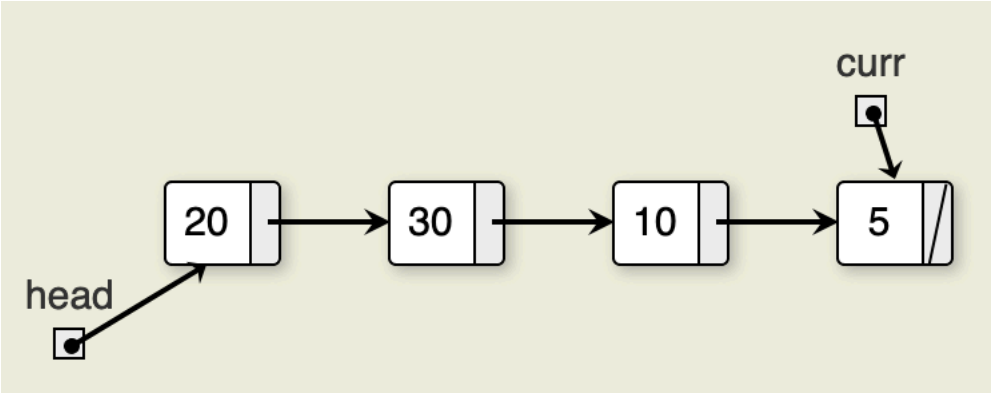
```
while(curr != null){  // the pointee of curr is not null
    curr = curr.next;  //we advance curr
}
```



Chain of nodes: iteration

- Curr now points to the node storing 5

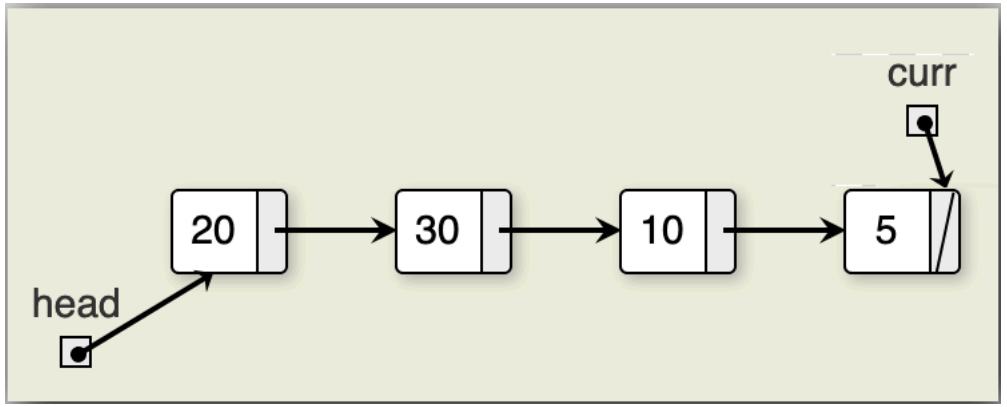
```
while(curr != null){   // the pointee of curr is not null
    curr = curr.next;  //we advance curr
}
```



Chain of nodes: iteration

- Curr now points to a null reference

```
while(curr != null){   // the pointee of curr is now null
    curr = curr.next;  //we exit the loop ⚠
}
```

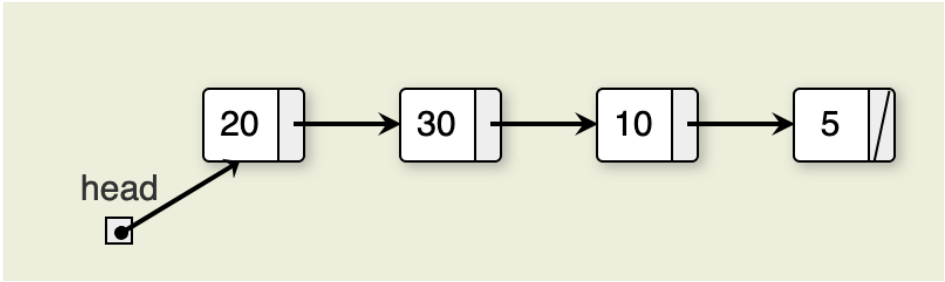


Chain of nodes: iteration

- Putting everything together:
- The following code will print all the values stored in our chain

```
Node curr = head;
while(curr != null){
     System.out.print(curr.data);
    curr = curr.next;
}
```

Will print: `20 30 10 5`



Chain of nodes: iteration (for loop)

- Putting everything together:
- The following code will print all the values stored in our chain

```
for(Node curr = head; curr != null; curr = curr.next){
    System.out.print(curr.data);
}
```

Will print: `20 30 10 5`