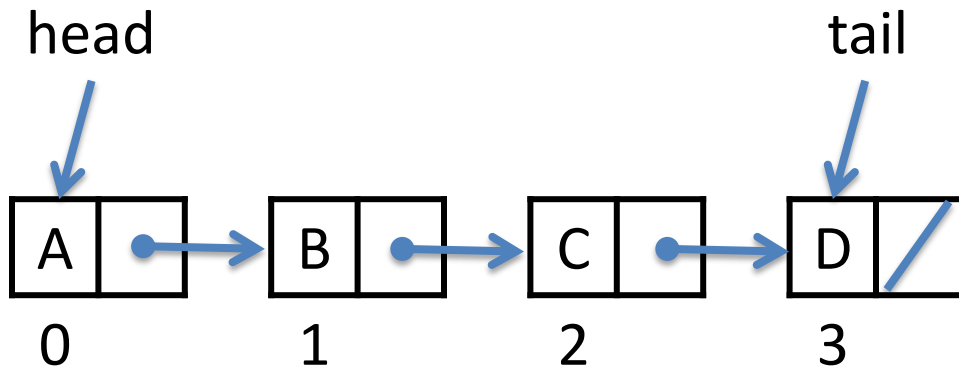
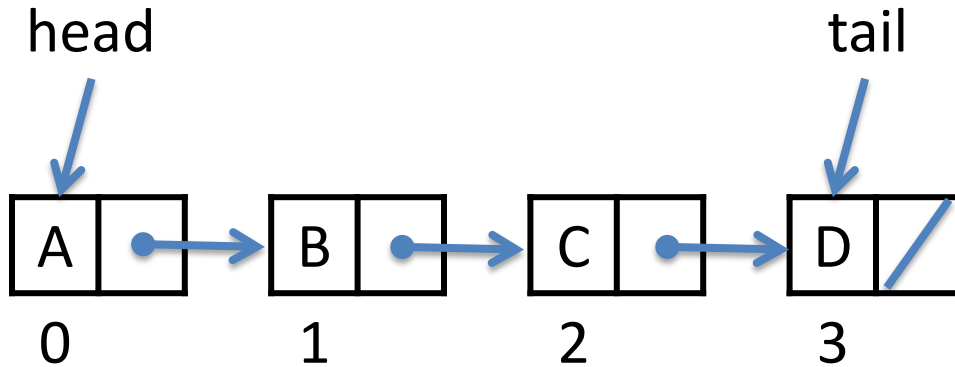


Singly-Linked Lists



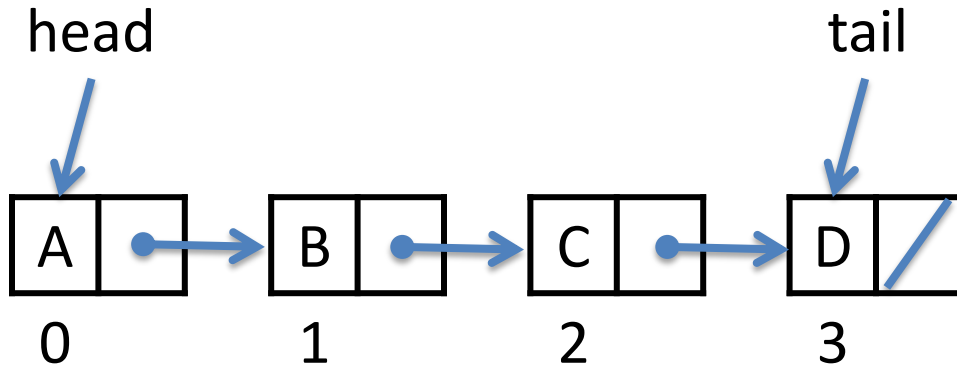
Singly-Linked Lists



A singly-linked list is a sequence of Nodes

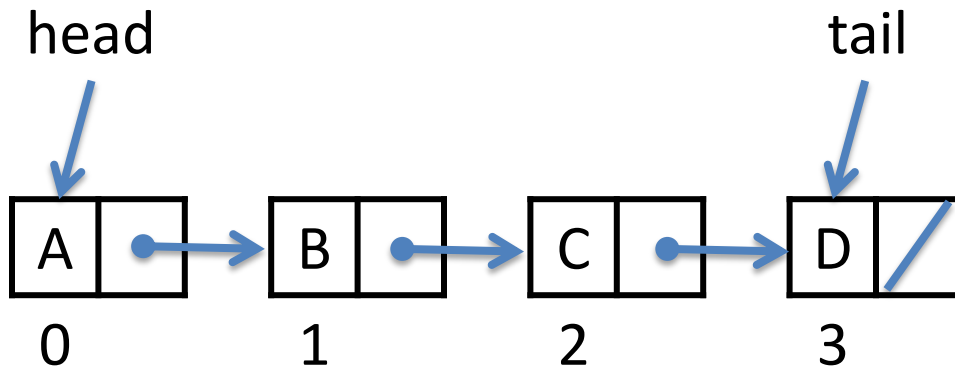
A **Node** stores **data** and a **reference to the next node** (or null if there is no next node)

Singly-Linked Lists

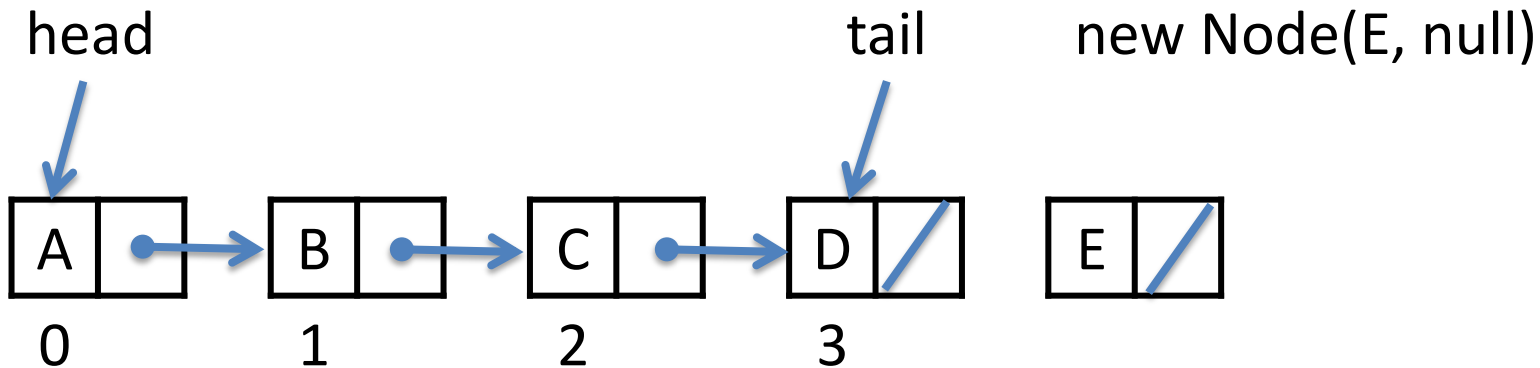


Add an element to the end of the list

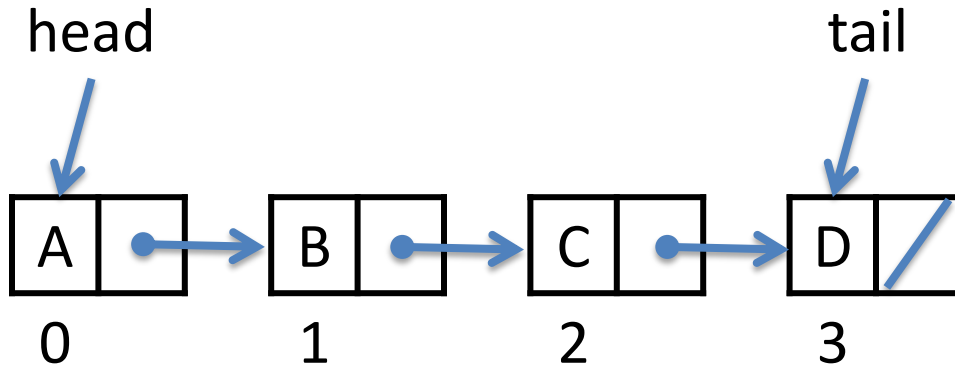
Singly-Linked Lists



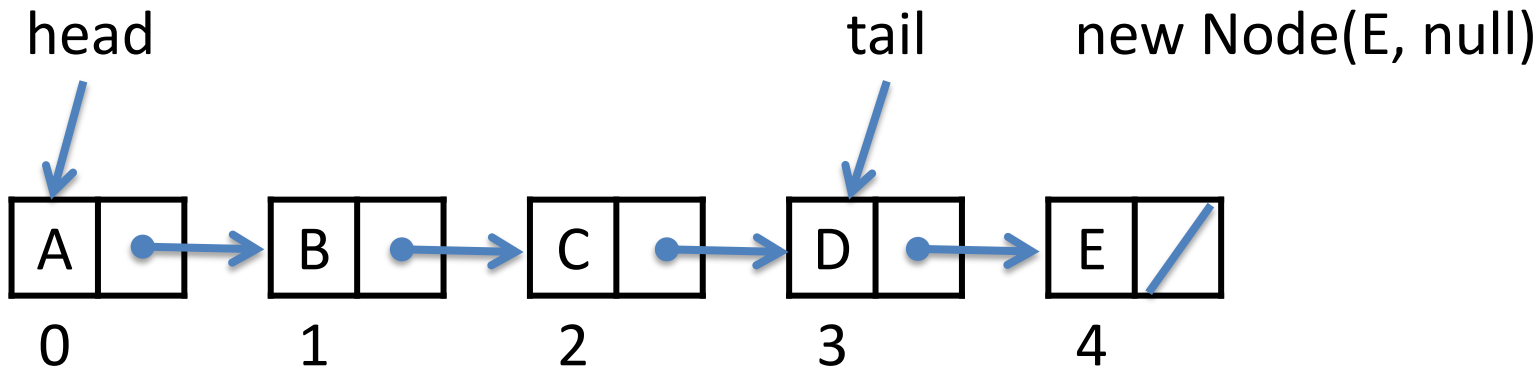
Add an element to the end of the list



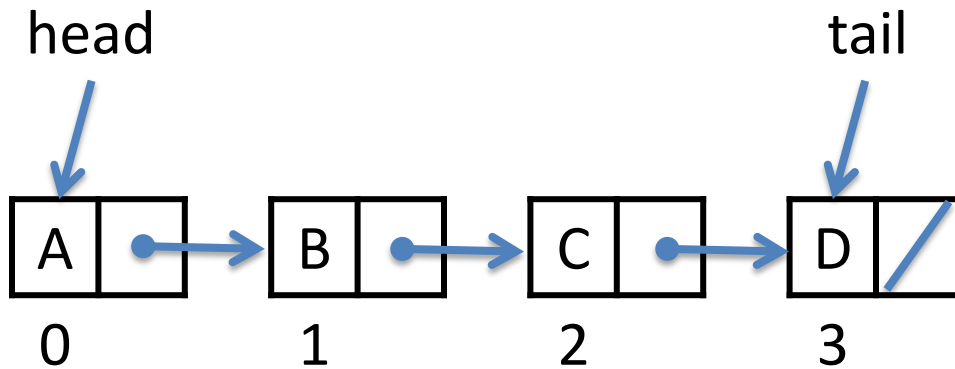
Singly-Linked Lists



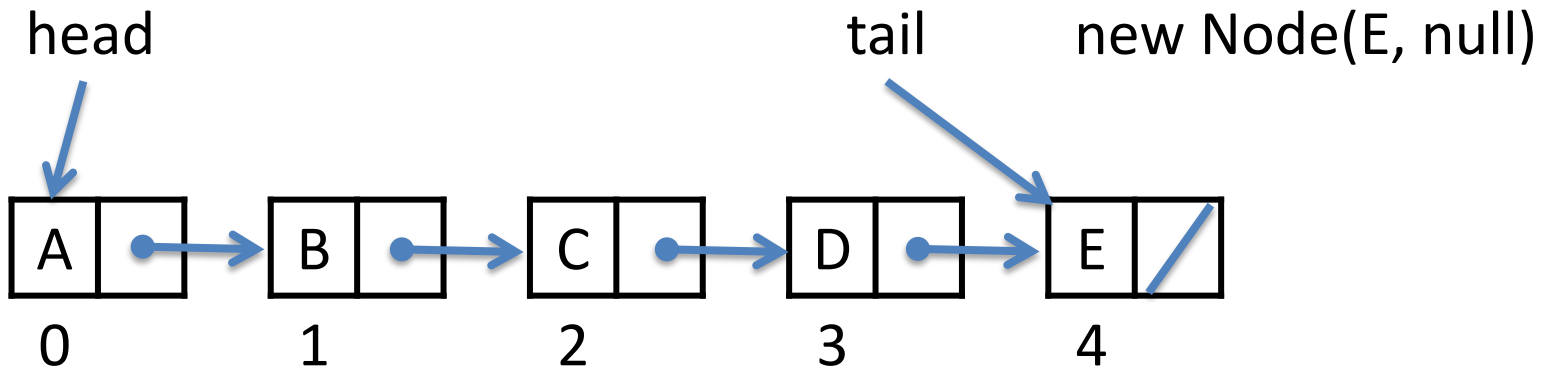
Add an element to the end of the list



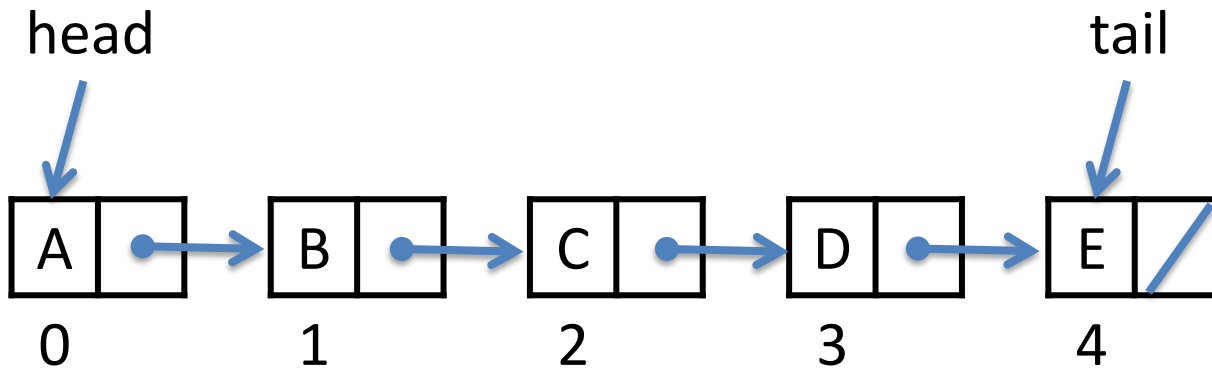
Singly-Linked Lists



Add an element to the end of the list

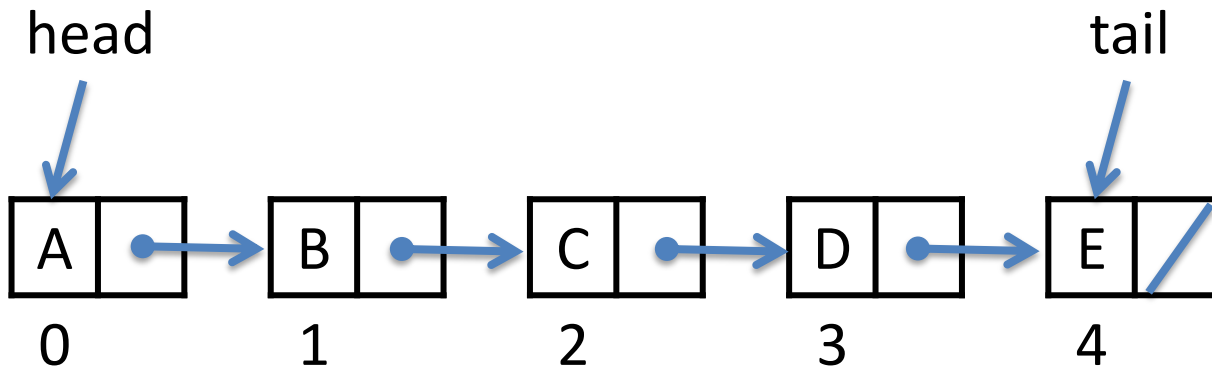


Singly-Linked Lists

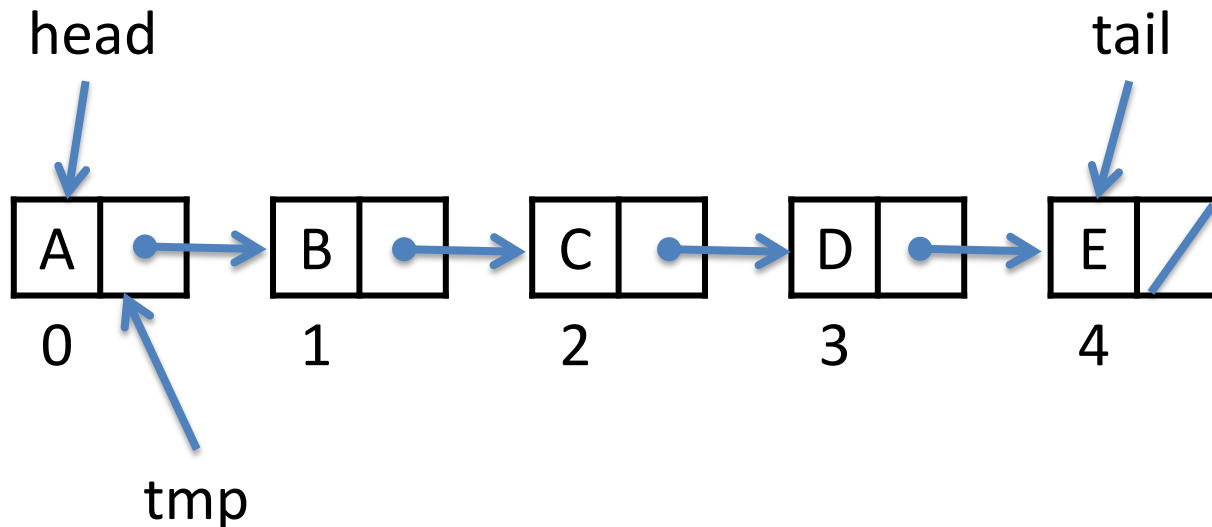


Remove the first element in the list

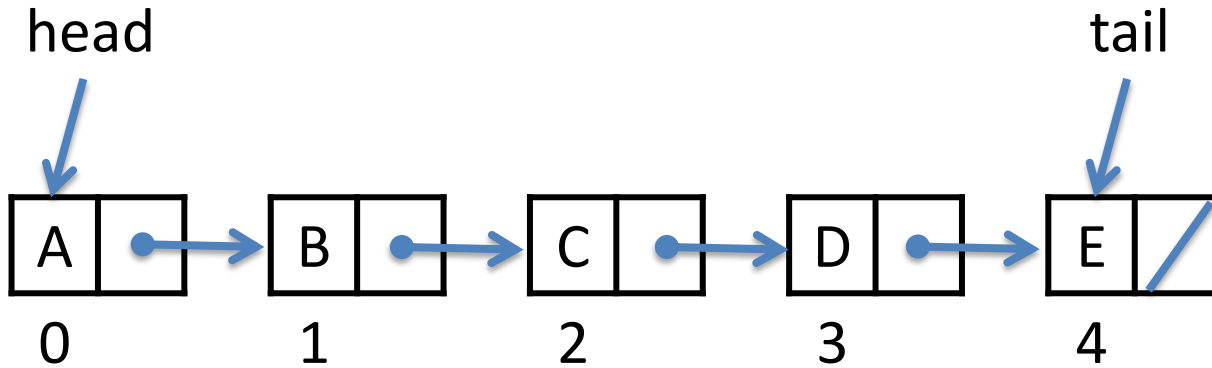
Singly-Linked Lists



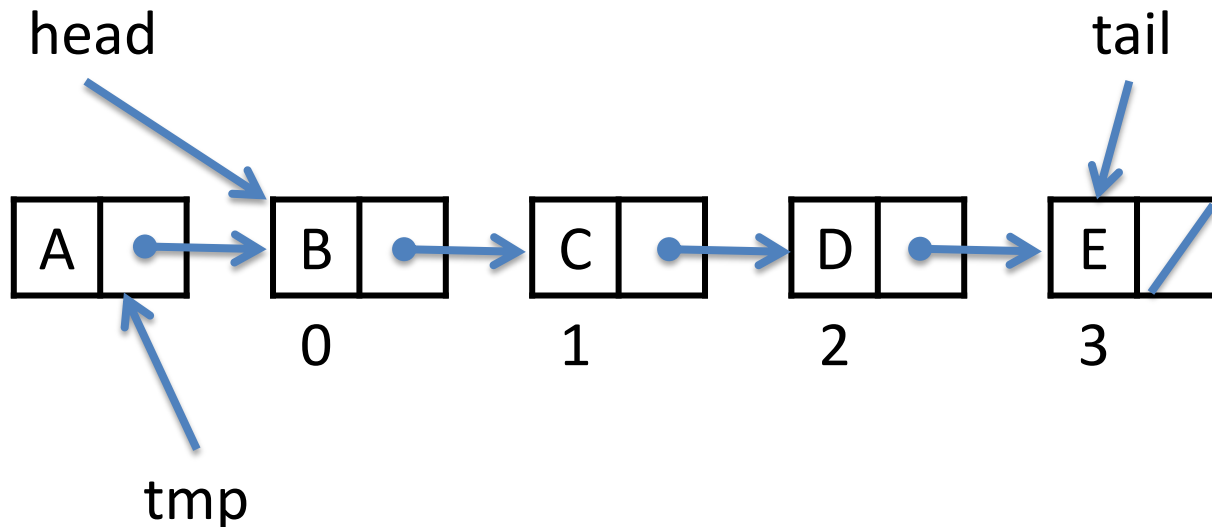
Remove the first element in the list



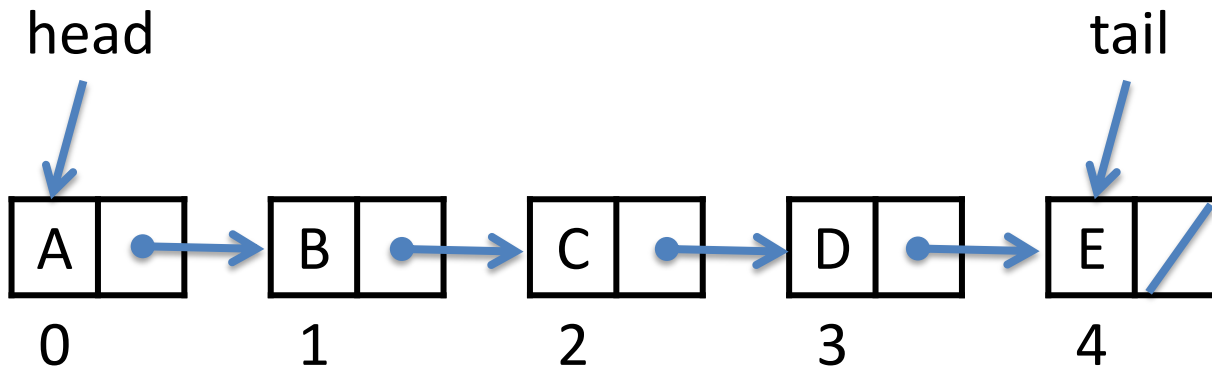
Singly-Linked Lists



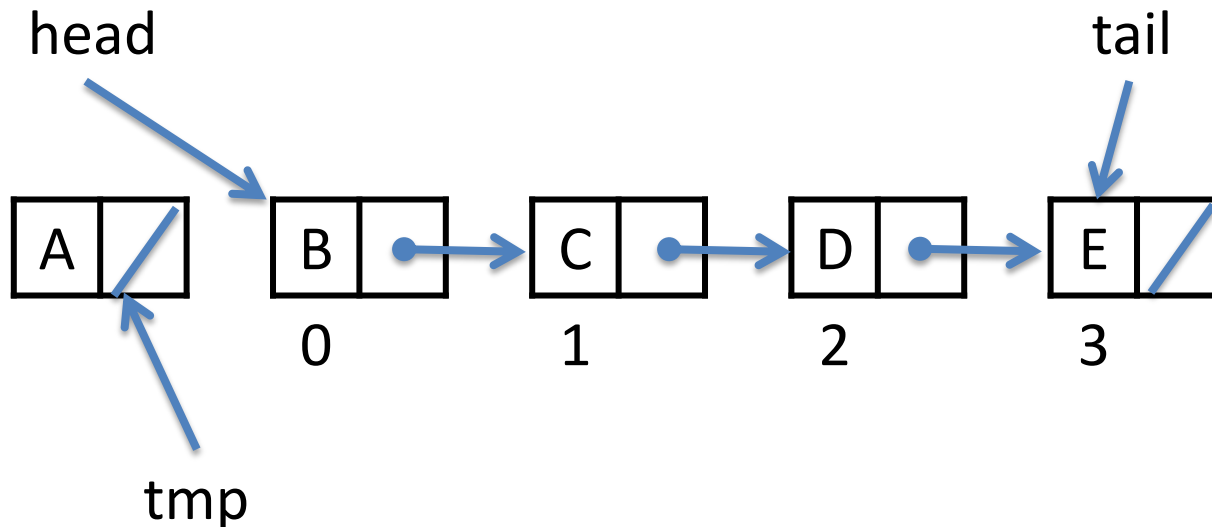
Remove the first element in the list



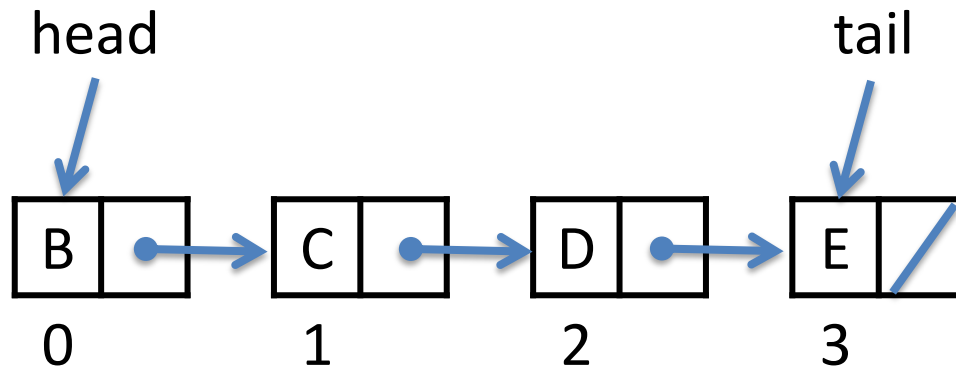
Singly-Linked Lists



Remove the first element in the list

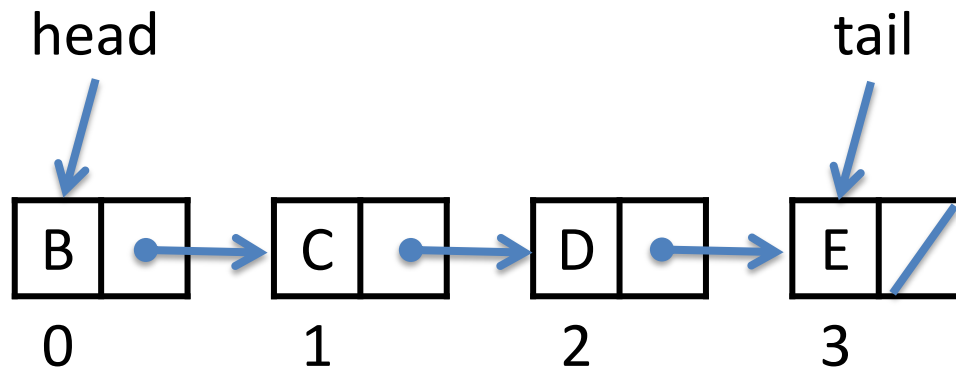


Singly-Linked Lists

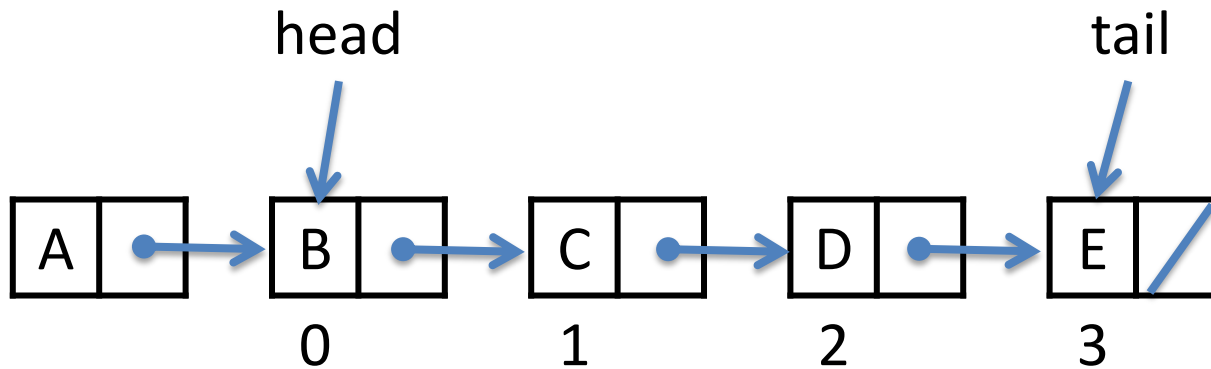


Add an element to the front of the list

Singly-Linked Lists

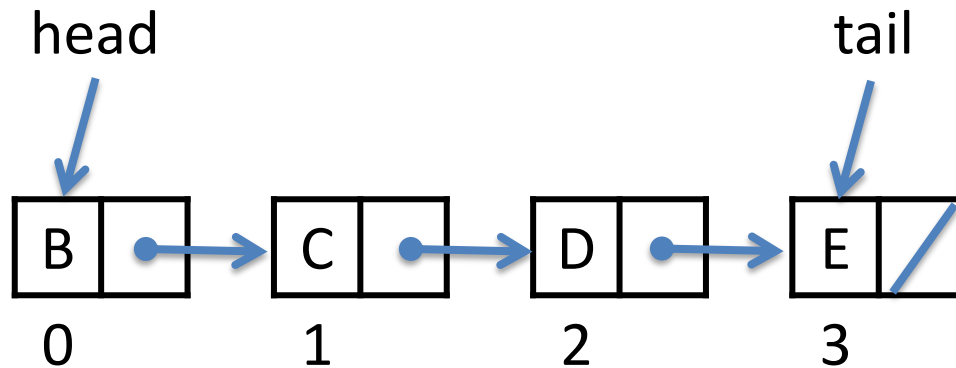


Add an element to the front of the list

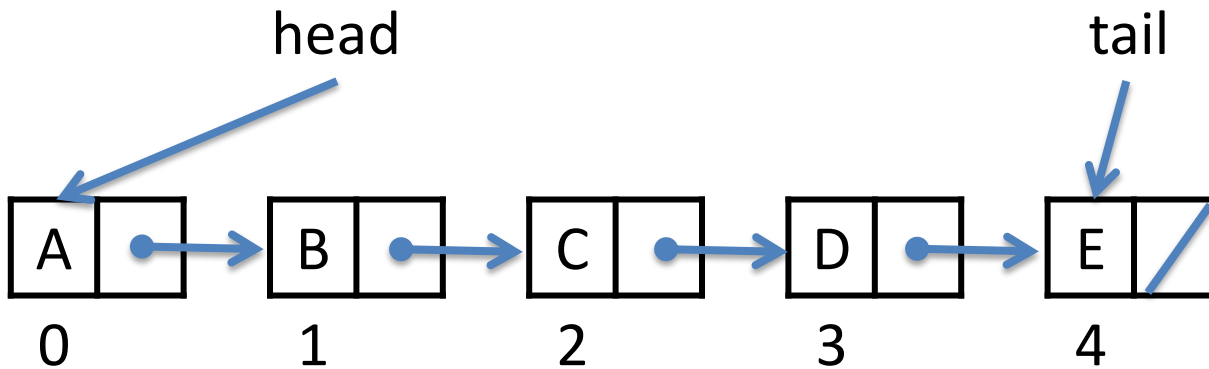


`new Node(A, head)`

Singly-Linked Lists

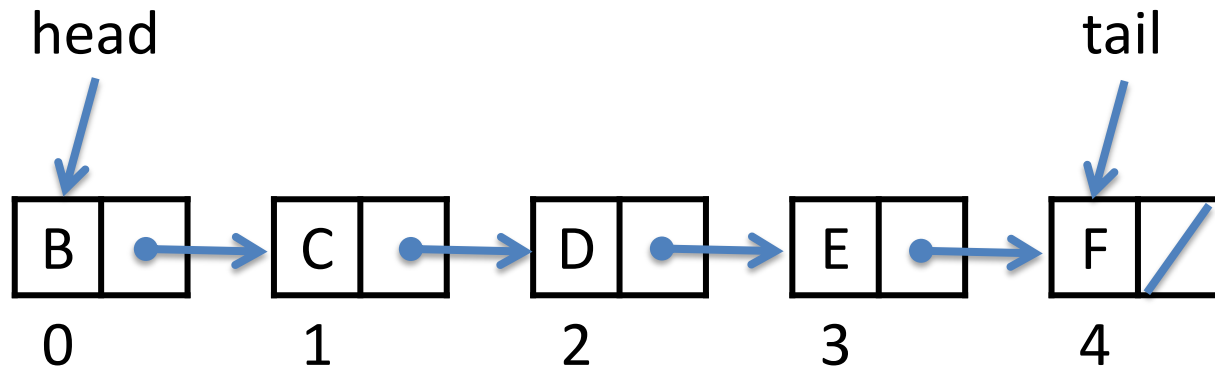


Add an element to the front of the list



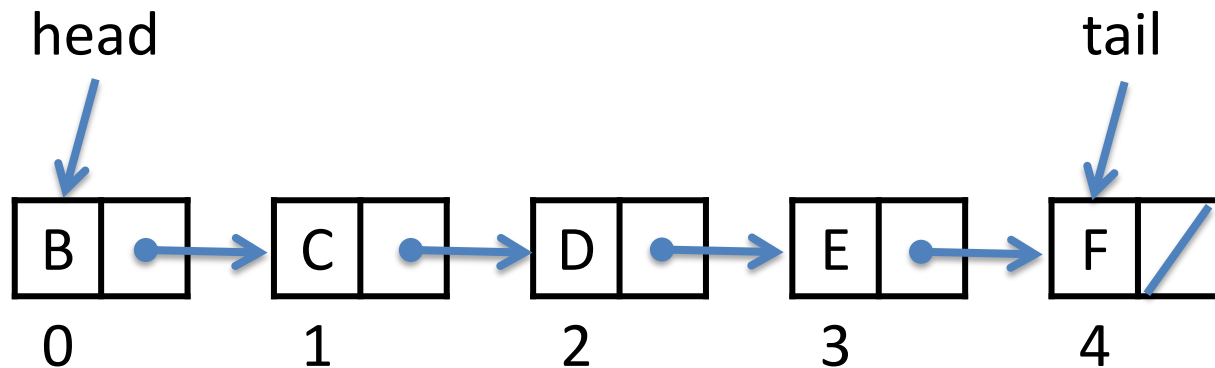
```
head = new Node(A, head)
```

Singly-Linked Lists



How do we remove from the end of the list?

Singly-Linked Lists

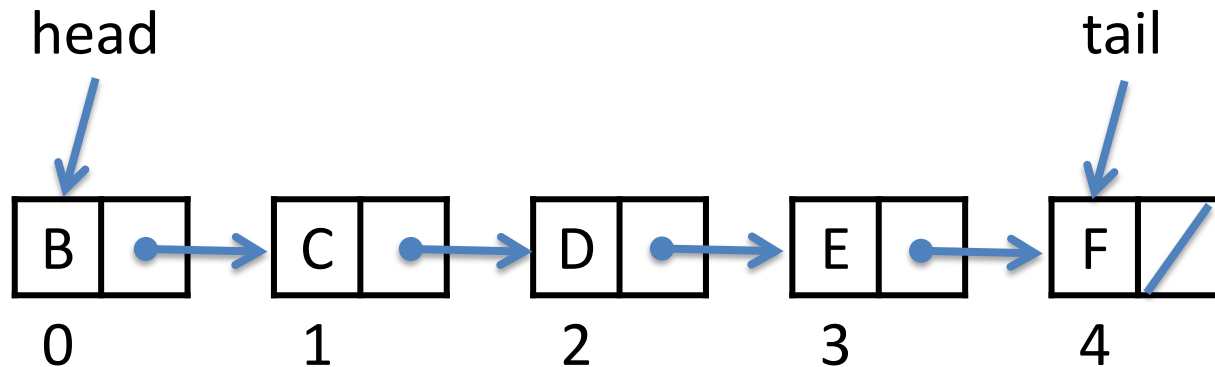


How do we remove from the end of the list?

We have to walk from the front (head) to the second last node in order to set its **next** field to **null**

the longer the list the more costly this is! $O(n)$

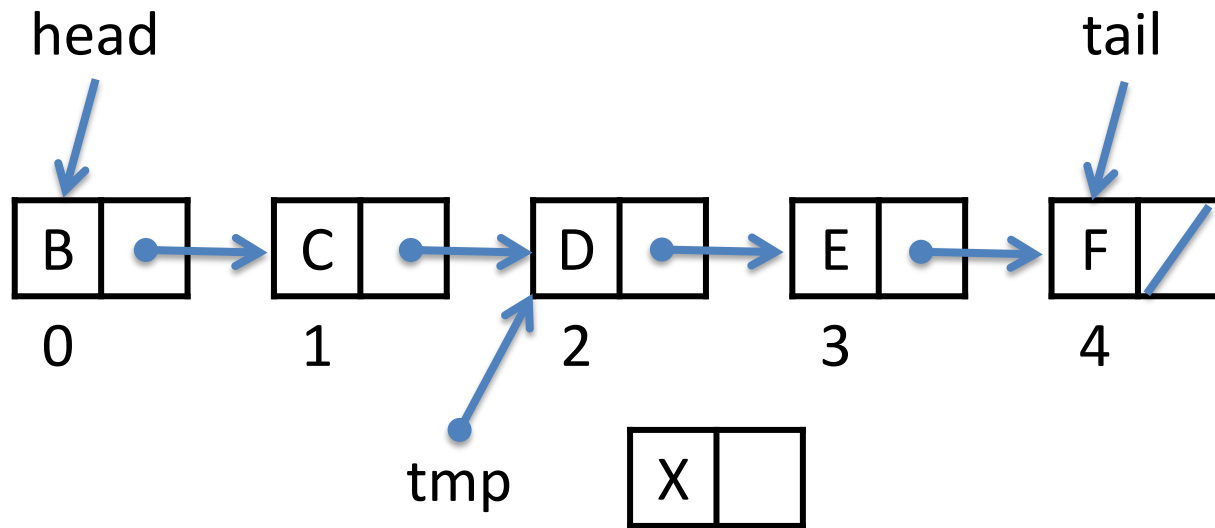
Singly-Linked Lists



How do we add/remove from everywhere else in the list?

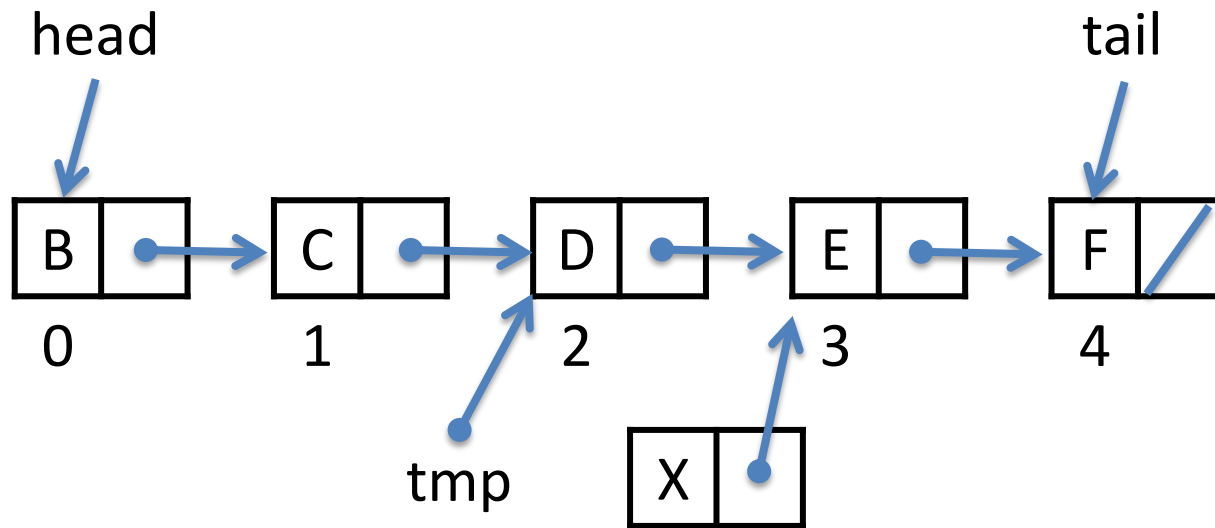
consider `add(3, X)`

Singly-Linked Lists



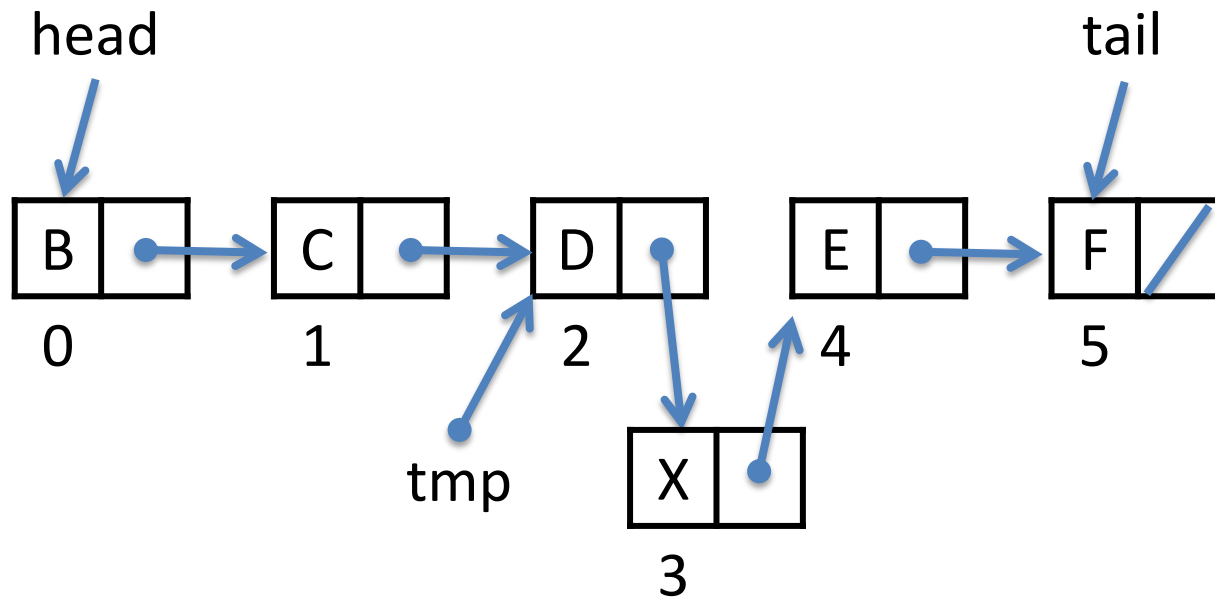
new node(X, null)

Singly-Linked Lists

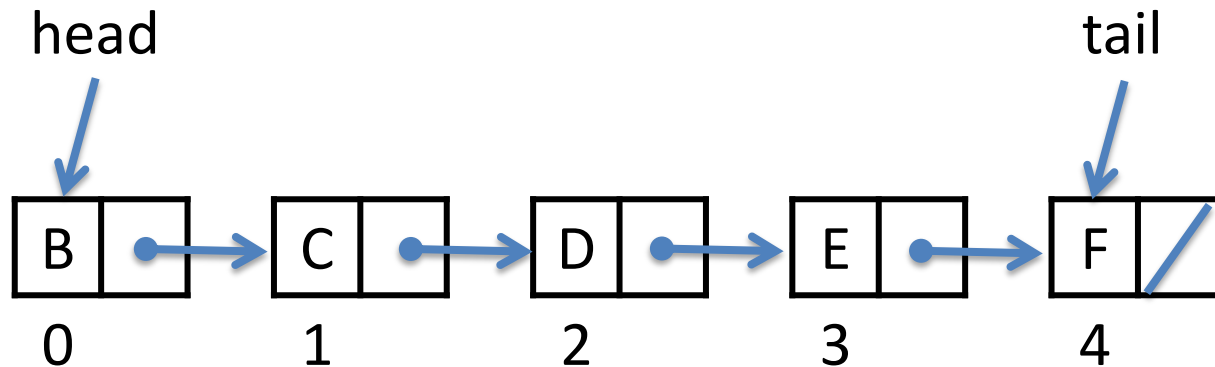


`new node(X, tmp.next)`

Singly-Linked Lists



Singly-Linked Lists



How do we add/remove from everywhere else in the list?

consider `remove(3, X)`