Linked Lists

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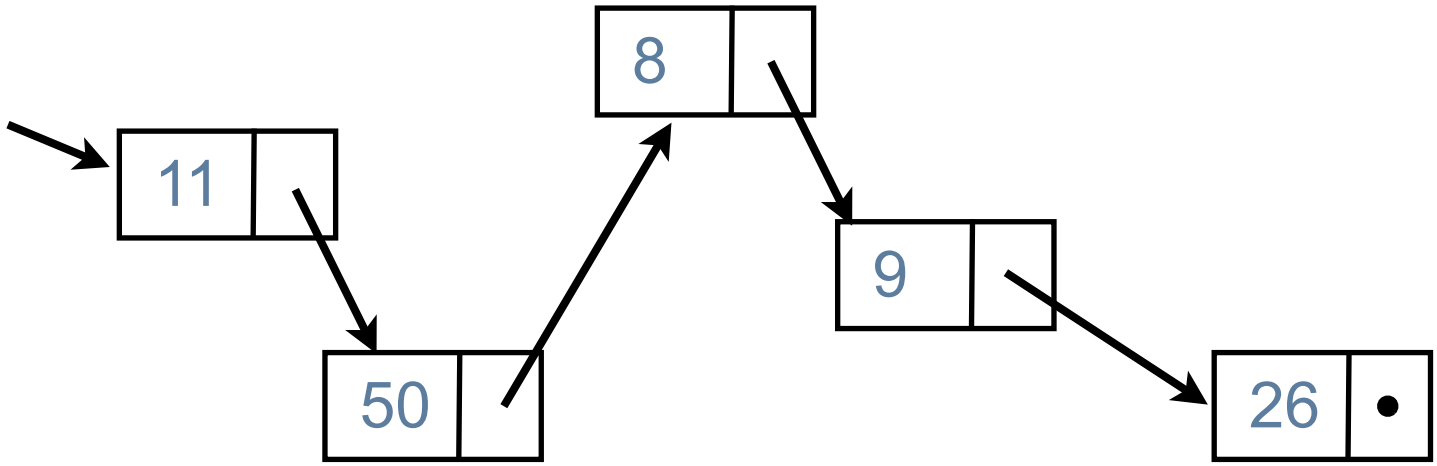
DCS50

Linked lists

- A linked list is a linear sequence of nodes.
- We keep a reference to the front or head of the sequence.



- The back of the sequence is also called the tail.
- Diagram vs what's in memory …

Ways of thinking about a linked list

- A linked list can be seen as
  - a value and a sub-list (the rest of the linked list), or
  - a sequence of nodes, each with a value and a reference to the next node.
- We'll take the second point of view.
- We'll define two classes:
  - LLNode to represent a single node, and
  - LinkedList to represent the linked list as a whole. It can be called a wrapper class.

Implications of having a wrapper class

- We can bundle together information about the overall linked list.
  - What might we want besides a reference to the front?
- An empty linked list is an instance of the class, with attribute values set to show it's empty.
  - Compare to our binary tree implementation.
  - We had BTNode, but no wrapper.
  - An empty tree was represented as `None`.

Traversing a linked list

A common pattern:

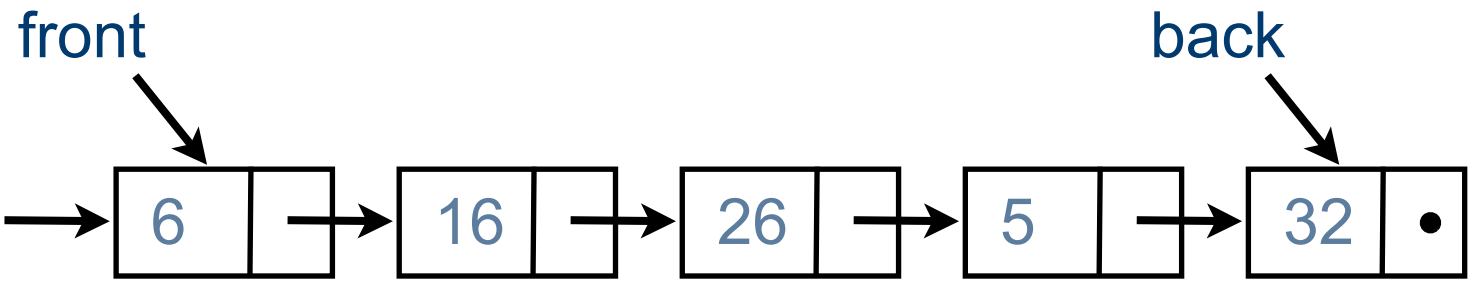
```
current = self.front
while <some condition holds>:
    <Do something with the current node.>
    # Advance to the next node.
    current = current.nxt
```

Mutating a linked structure

- So far, in all our tree and linked list code, we have only looked at an existing structure.
- Code that mutates an existing structure is easier to mess up.
- Hint: draw pictures.
- Our first mutating code will be with linked lists.
- Then we'll revisit trees and mutate them (trickier!).

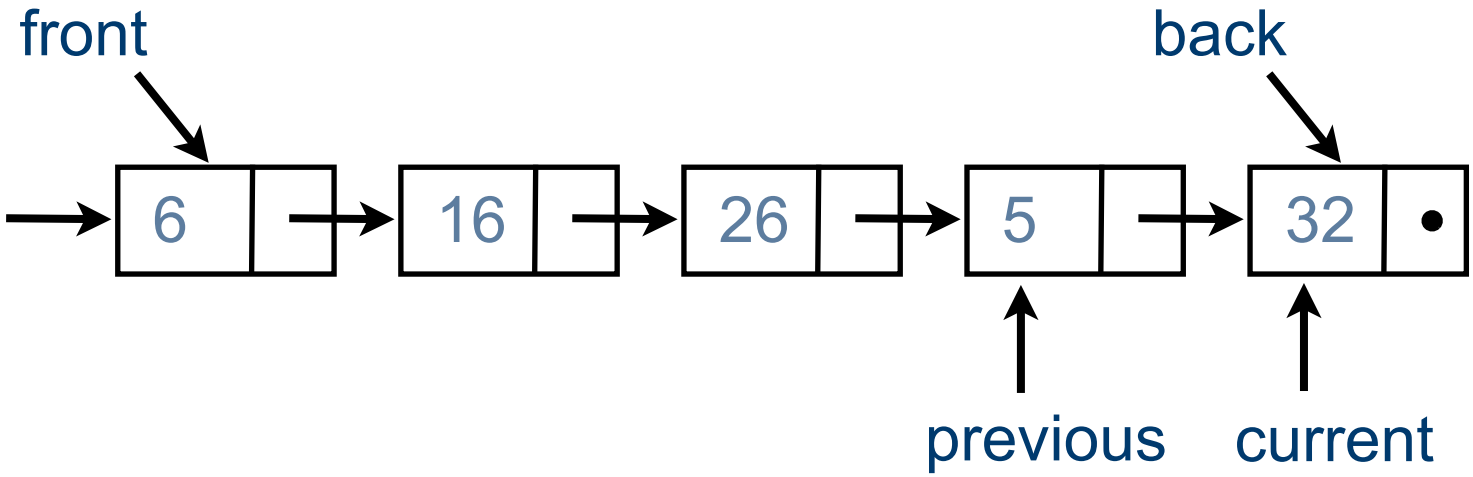
Going too far

- For some methods, once we've found what we're looking for, we have gone too far to make the changes we want.
- Example: delete_back
  - Once we've found the back, we can't make the necessary changes.
  - They must happen in the *previous* node.



Walking two references along a list

- Solution: walk two references along the list, with one trailing behind a step.



- This is a common pattern with linked lists.