The linked list

EECS 214, Fall 2018

A problem with vectors

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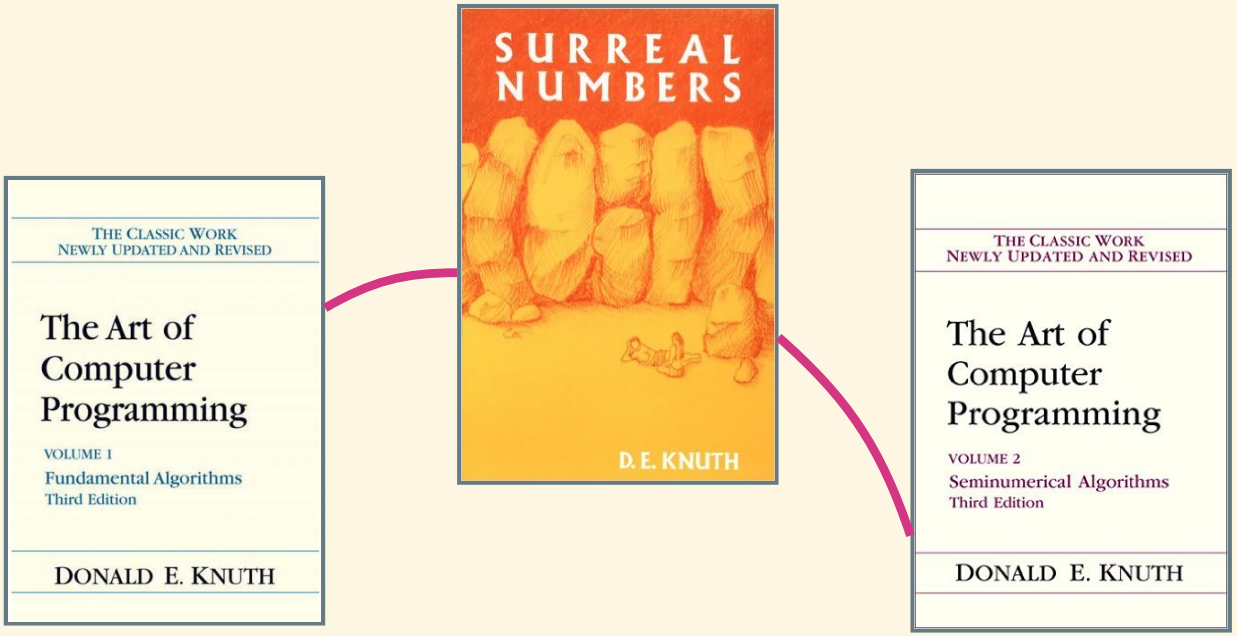
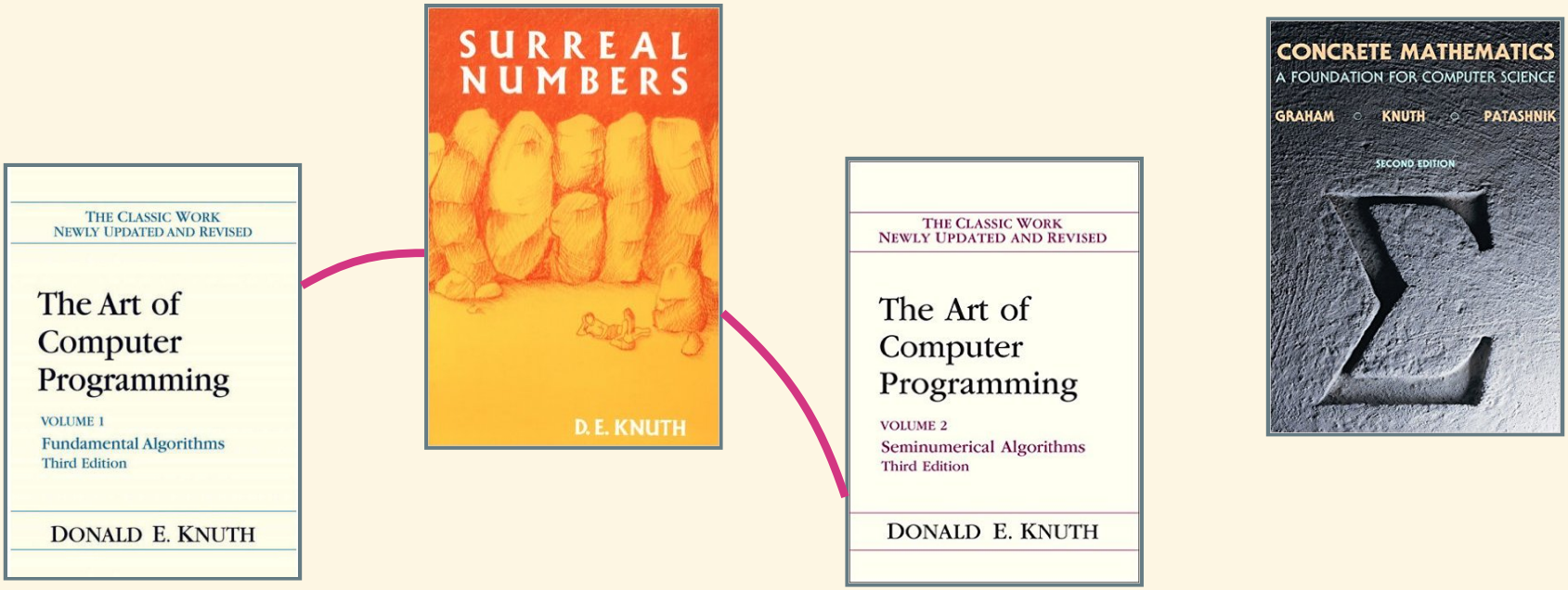
What if we want to add 6 between 5 and 7?

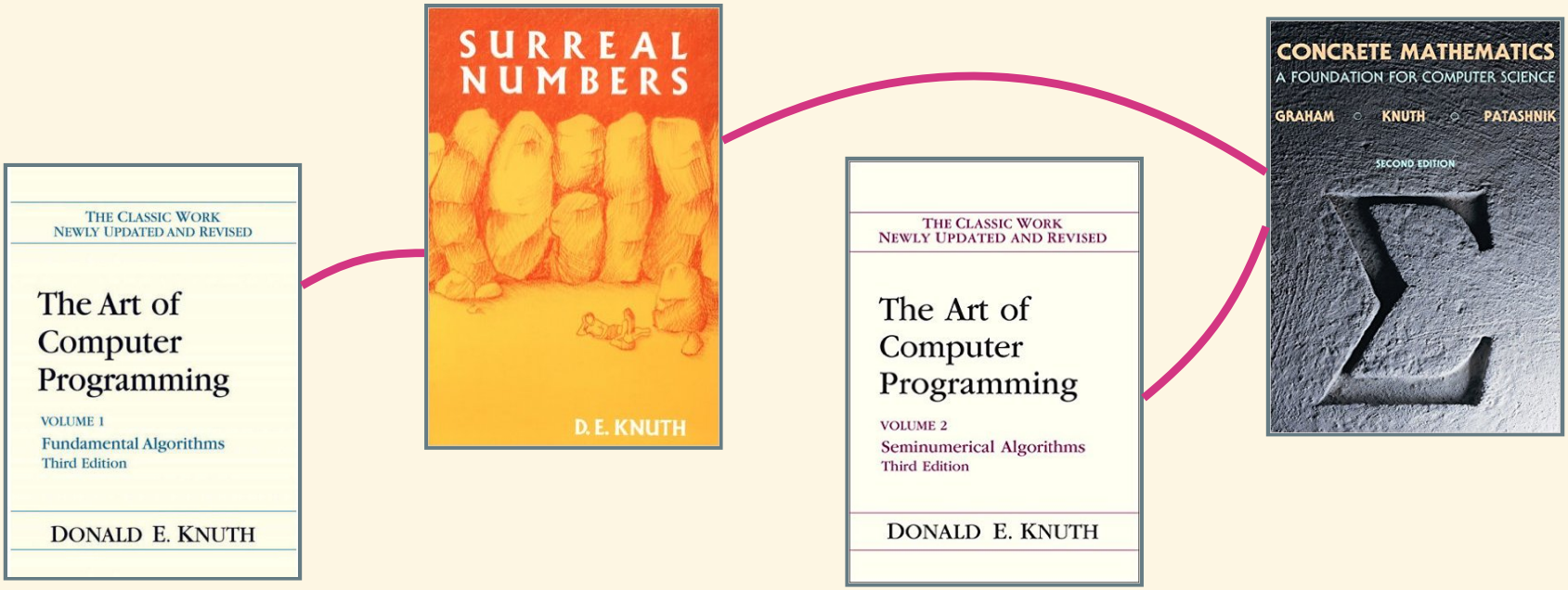
Books on a string



Books on a string



Books on a string



Nodes and pointers

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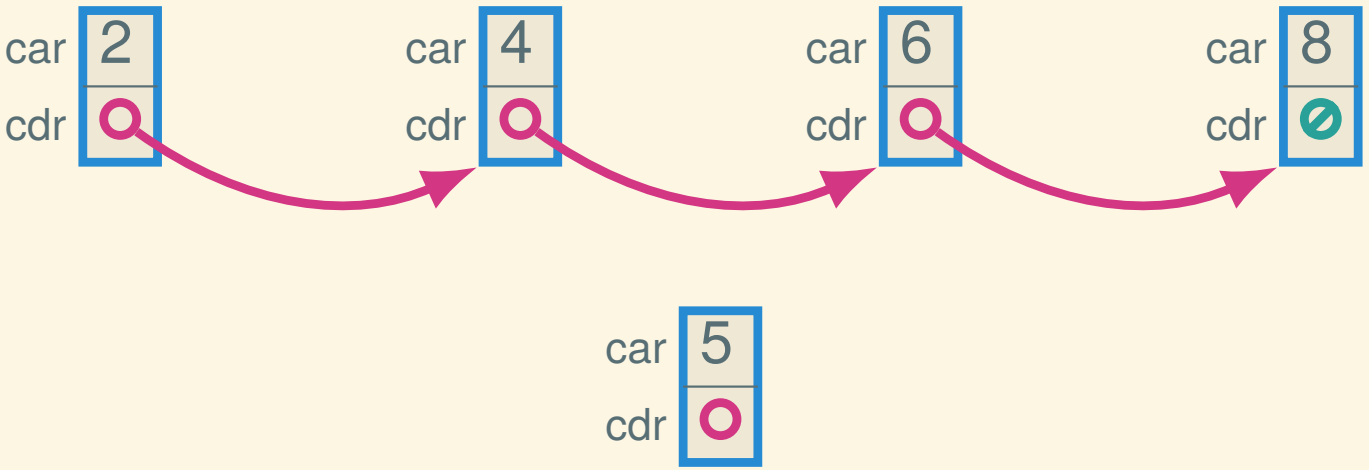
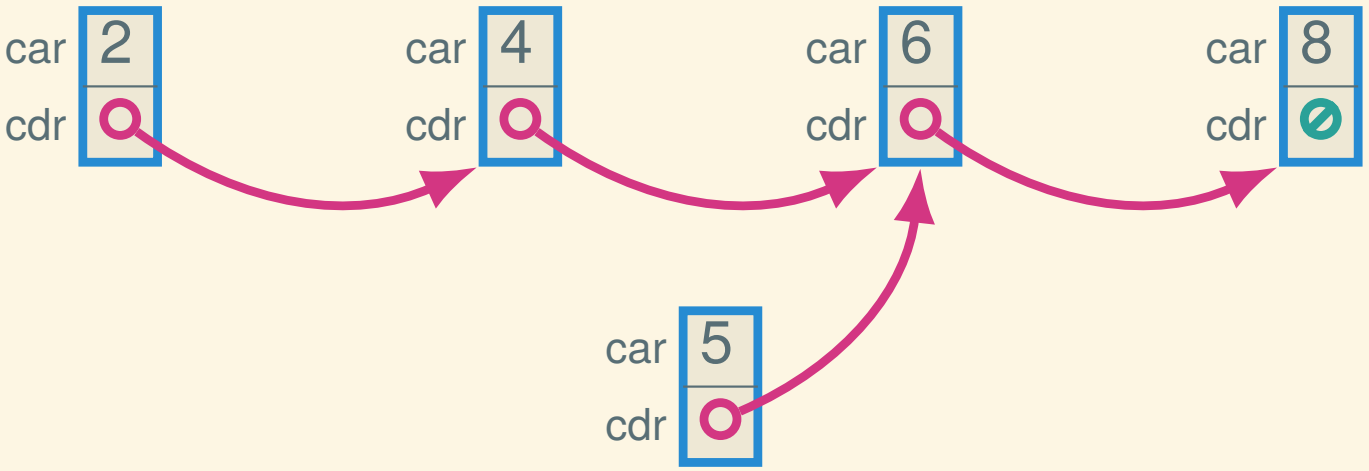
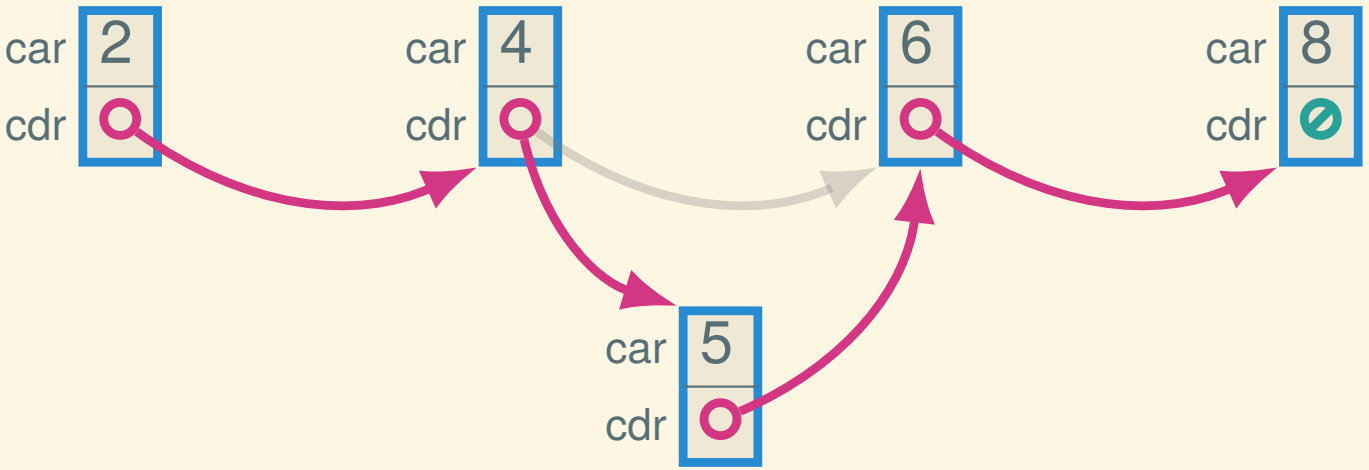


Nodes and pointers



Nodes and pointers



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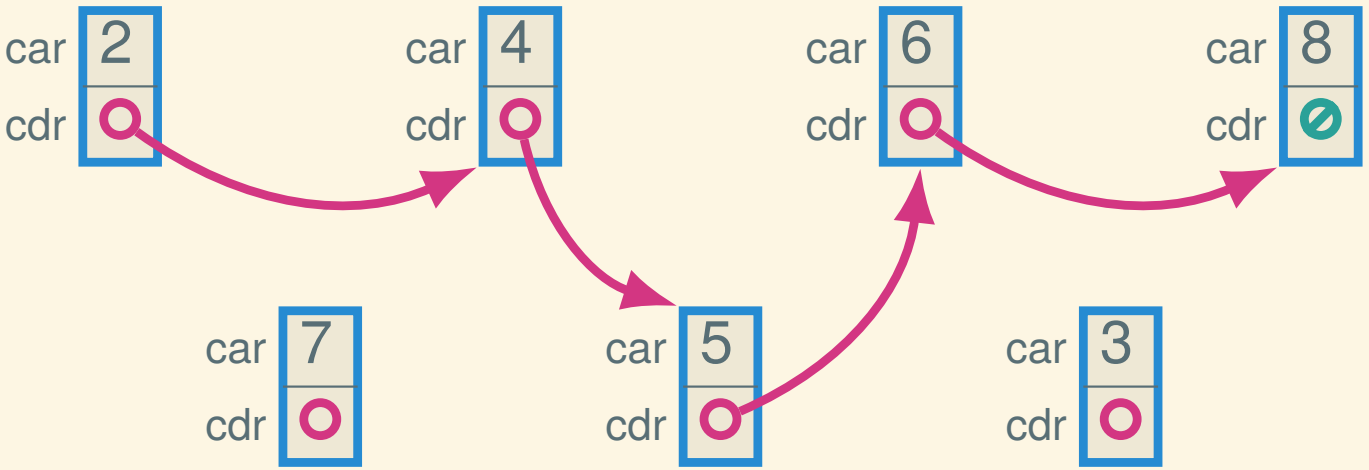

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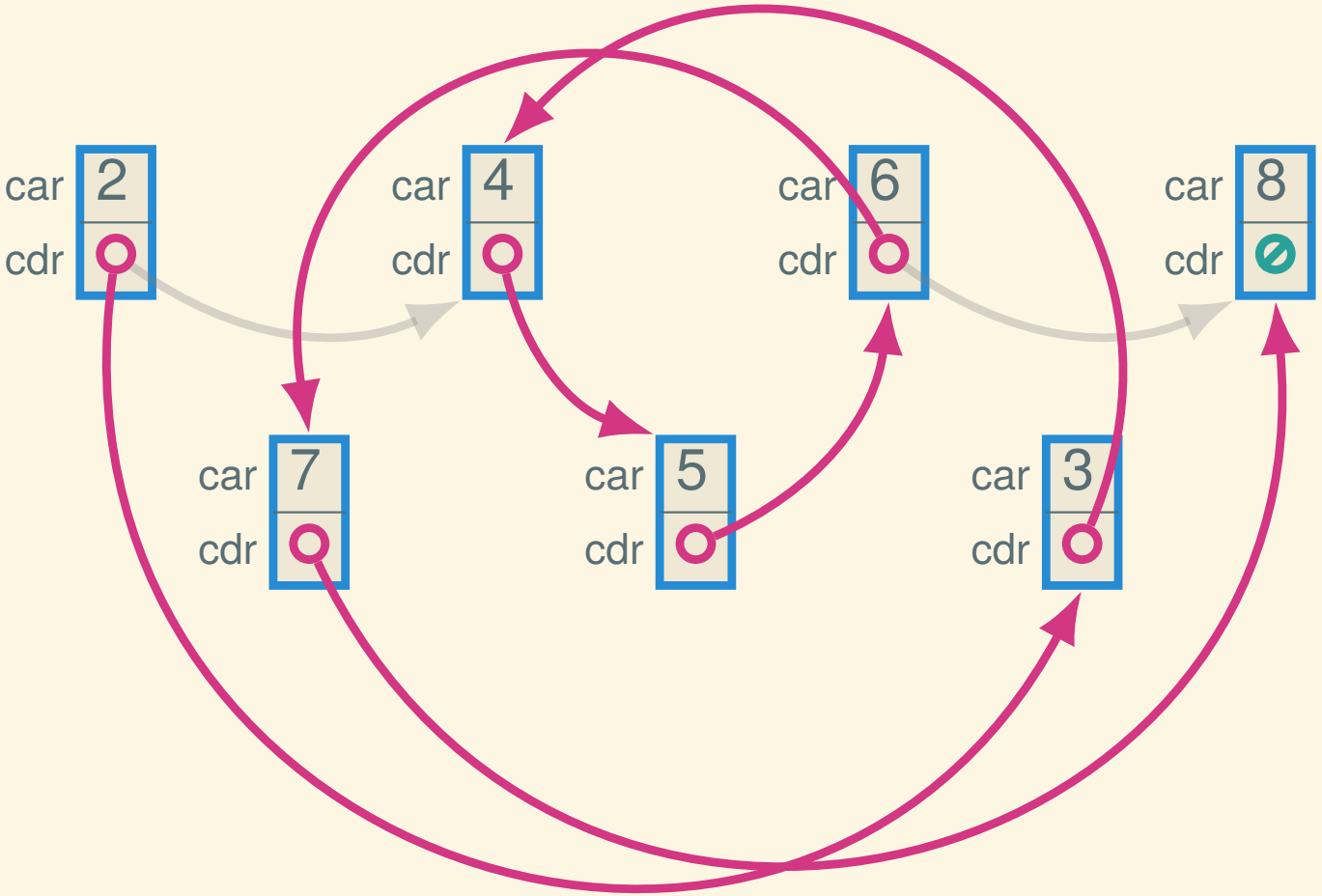
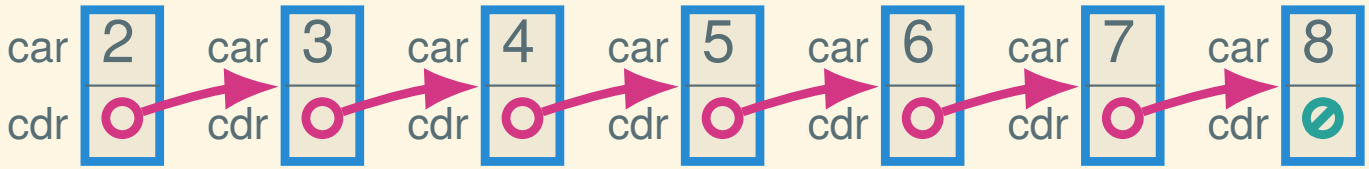


Inserting at the beginning



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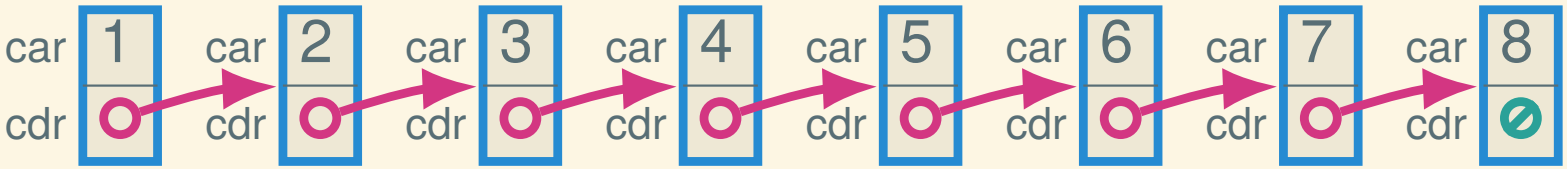

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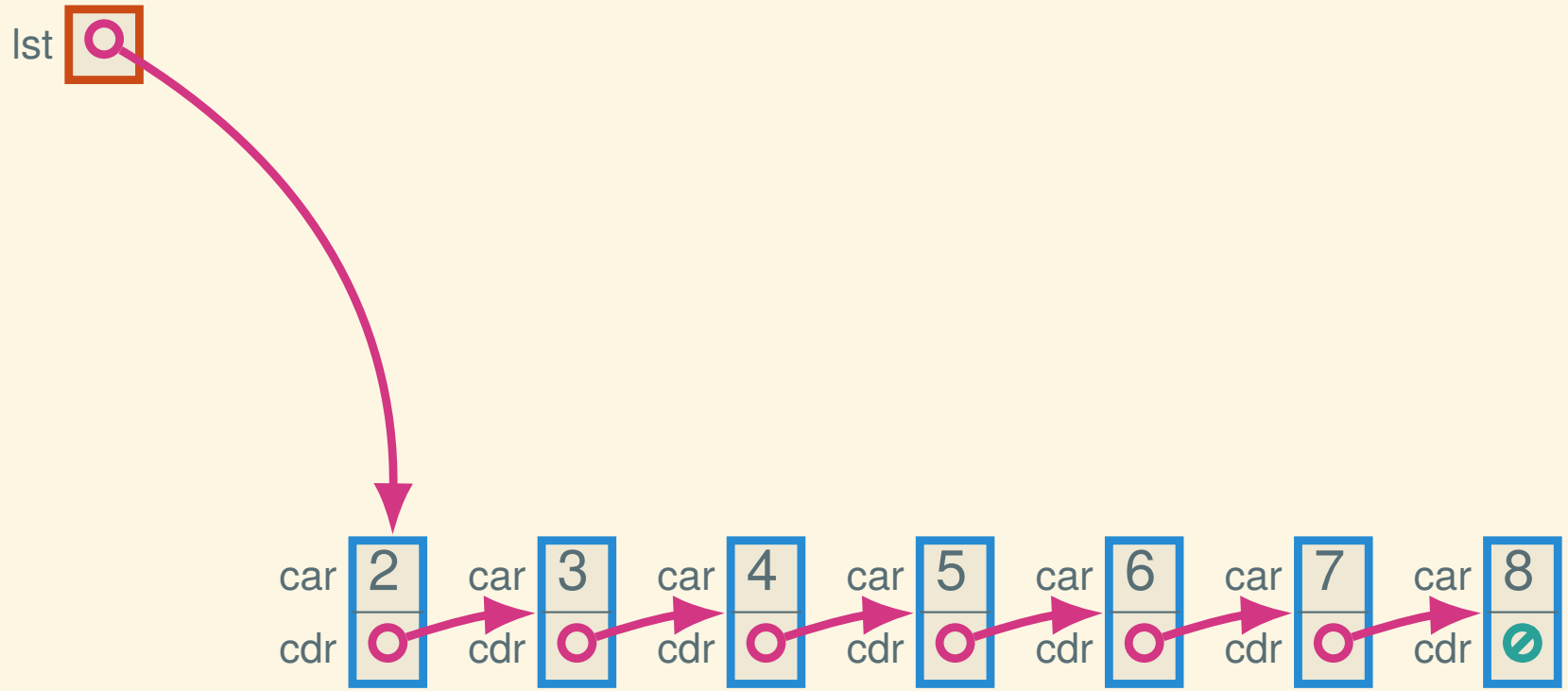

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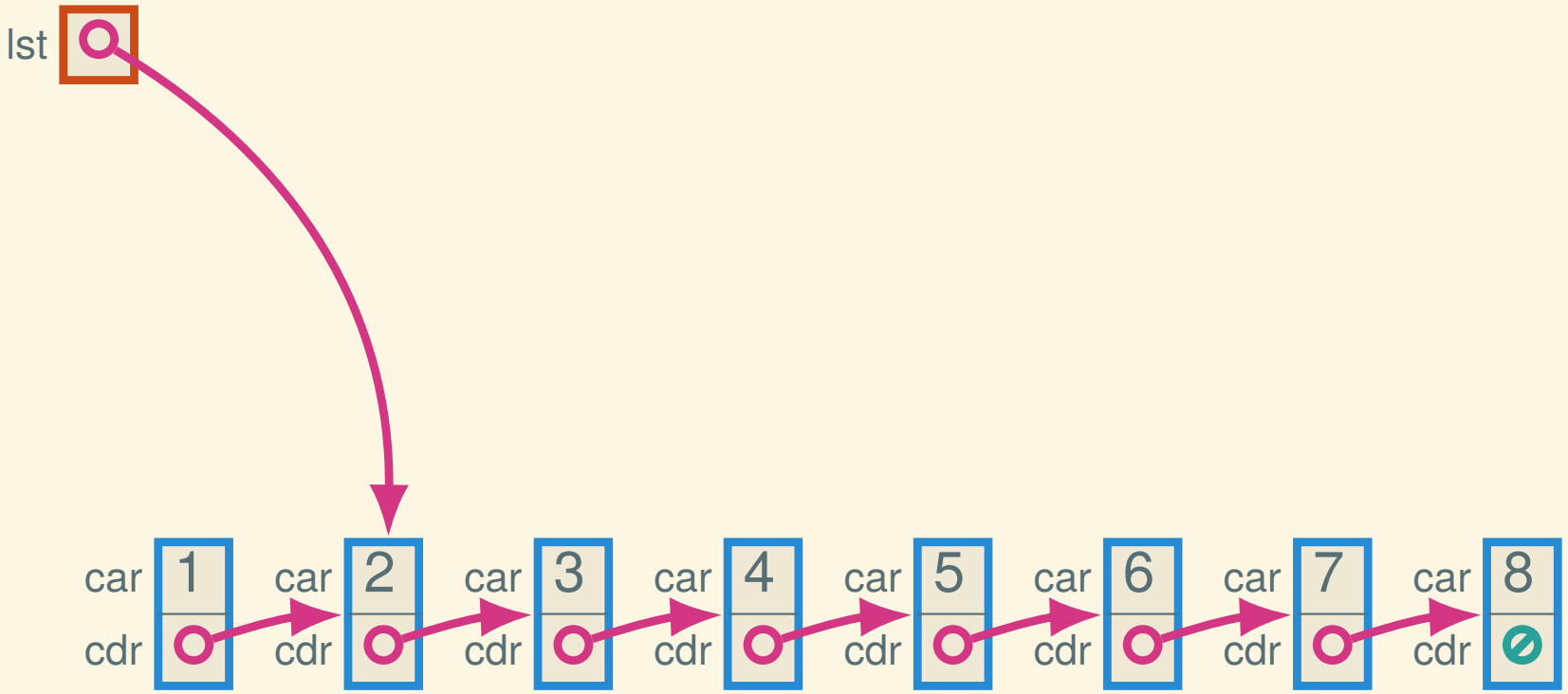

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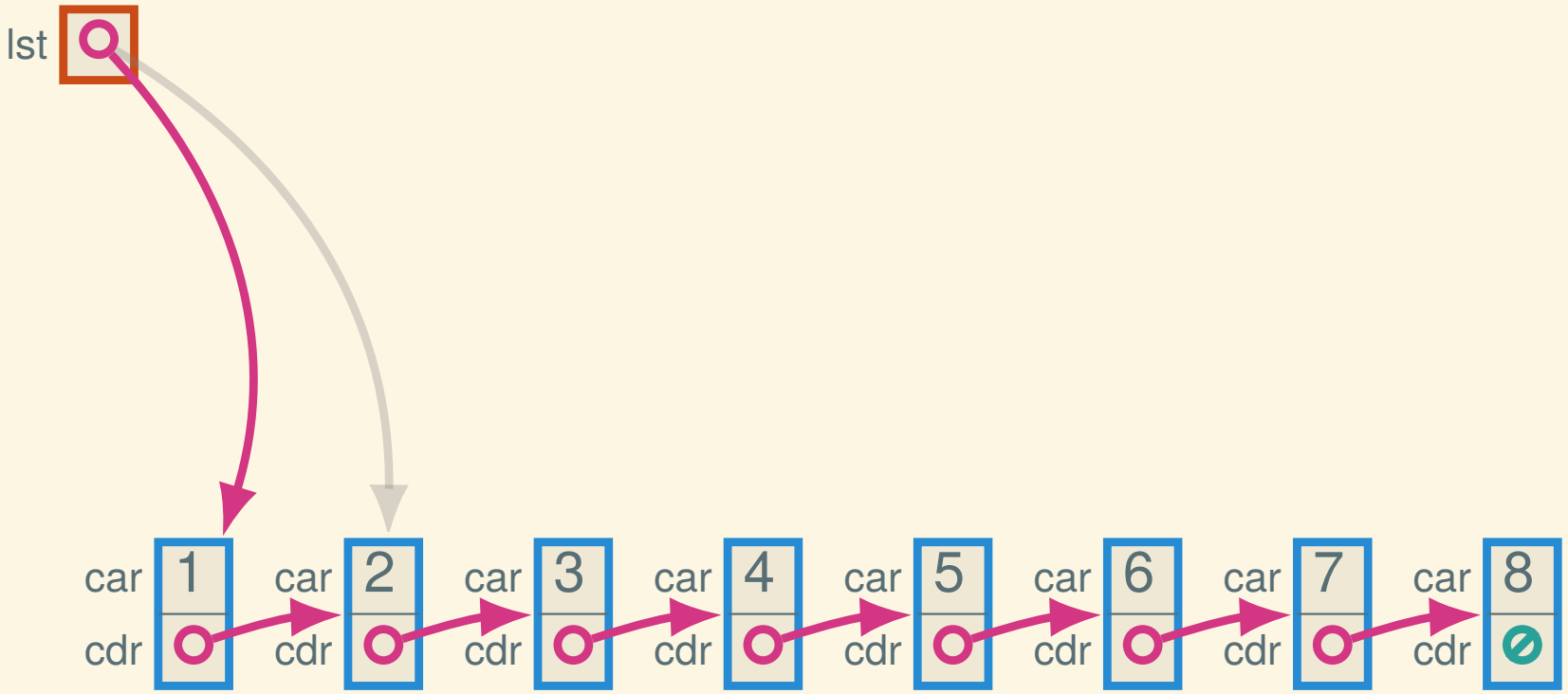
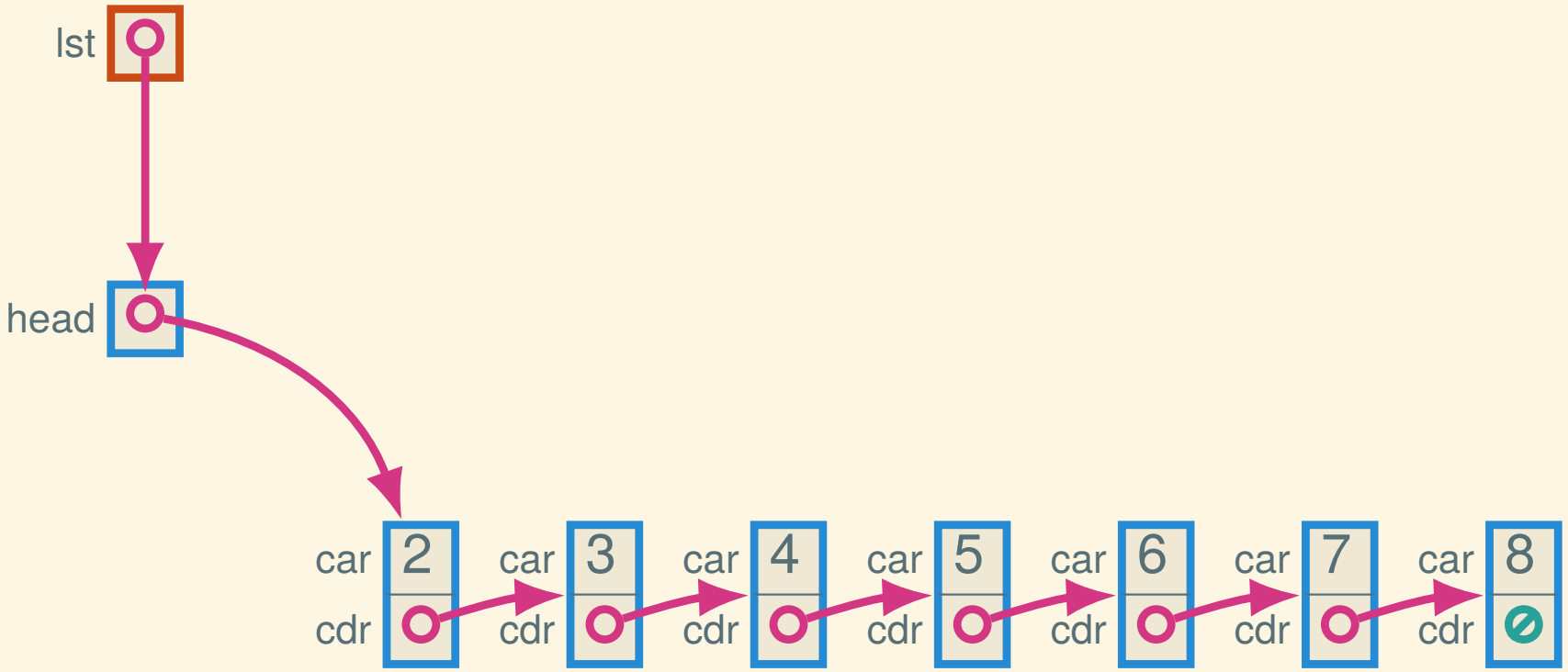


Indirection



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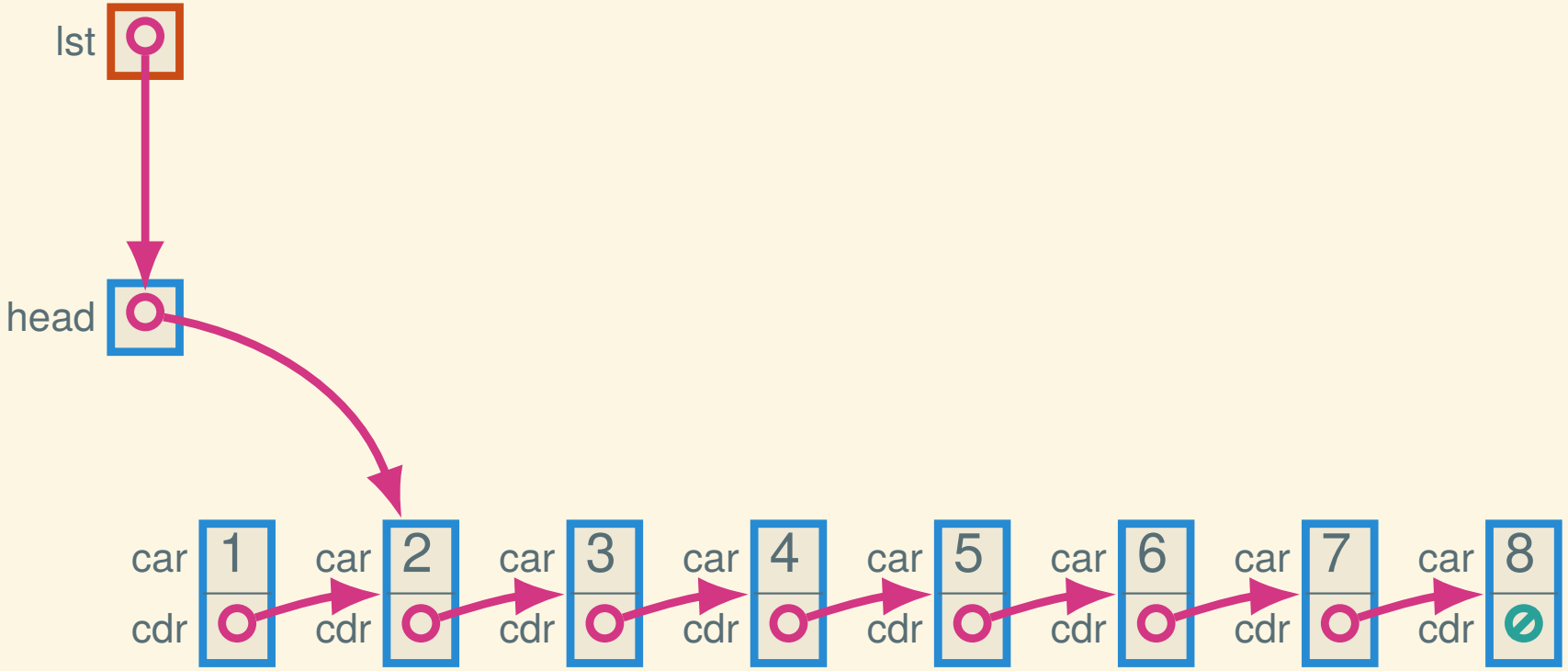

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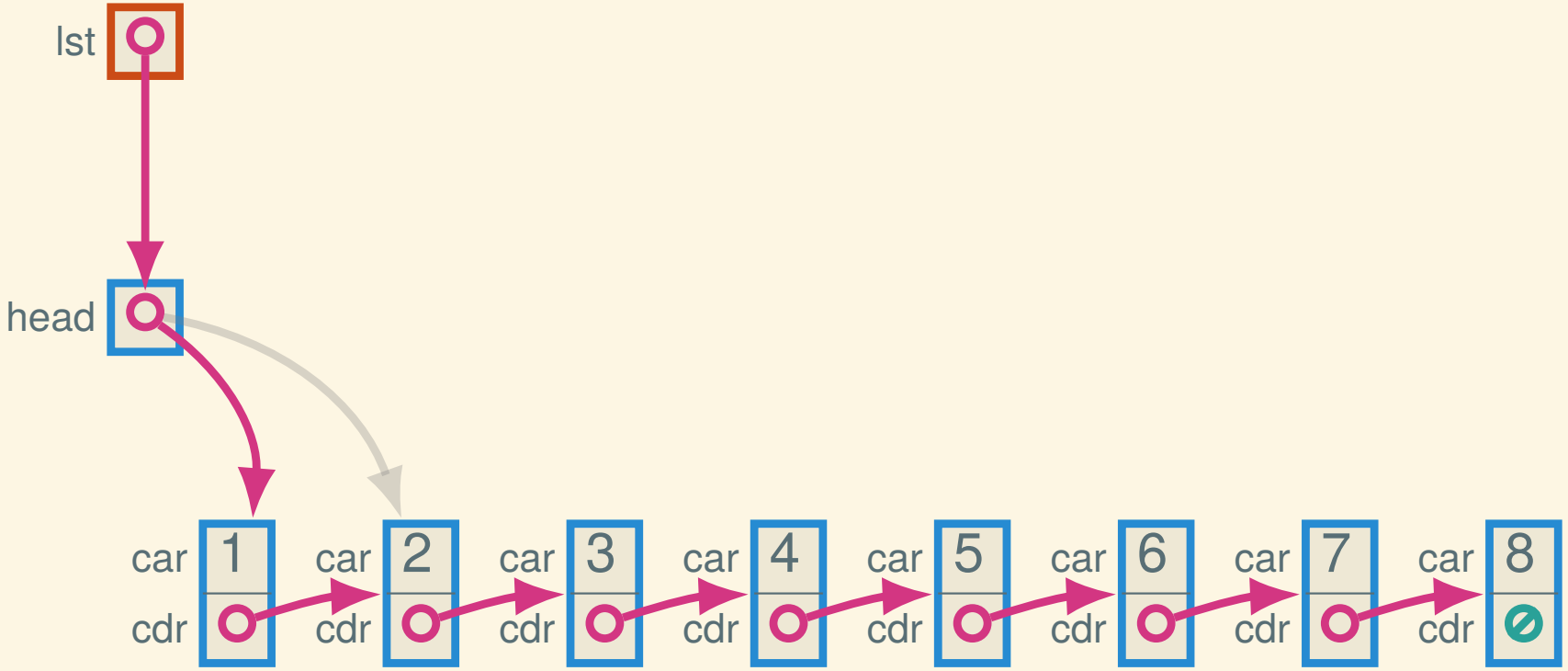

Now in DSSL2

Linked lists in DSSL2

```
# Link is one of:
# - node { data: Number, next: Link }
# - nil()
struct node:
    let data
    let next
struct nil: pass

class LL:
    let head

    def __init__(self):
        self.head = nil()
```

Linked lists in DSSL2

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# Link is one of:
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struct node:
    let data
    let next
struct nil: pass

class LL:
    let head

    def __init__(self):
        self.head = nil()

    def push_front(self, data):
        self.head = node(data, self.head)
```

List operations in DSSL2

```
class LL:
    …

    def get_front(self):
        if node?(self.head): self.head.data
        else: error('LL.get_front: got empty list')
```

List operations in DSSL2

```
class LL:
    …

    def get_front(self):
        if node?(self.head): self.head.data
        else: error('LL.get_front: got empty list')

    def get_nth(self, n):
        let curr = self.head
        while n > 0:
            if nil?(curr):
                error('get_nth: list too short')
            n    = n - 1
            curr = curr.next
        curr.data
```

More DSSL2 list operations

```
class LL:
    …

    def _find_nth_node(self, n):
        let curr = self.head
        while n > 0:
            if nil?(curr): error('list too short')
            n    = n - 1
            curr = curr.next
        curr

    def get_nth(self, n):
        self._find_nth_node(n).data

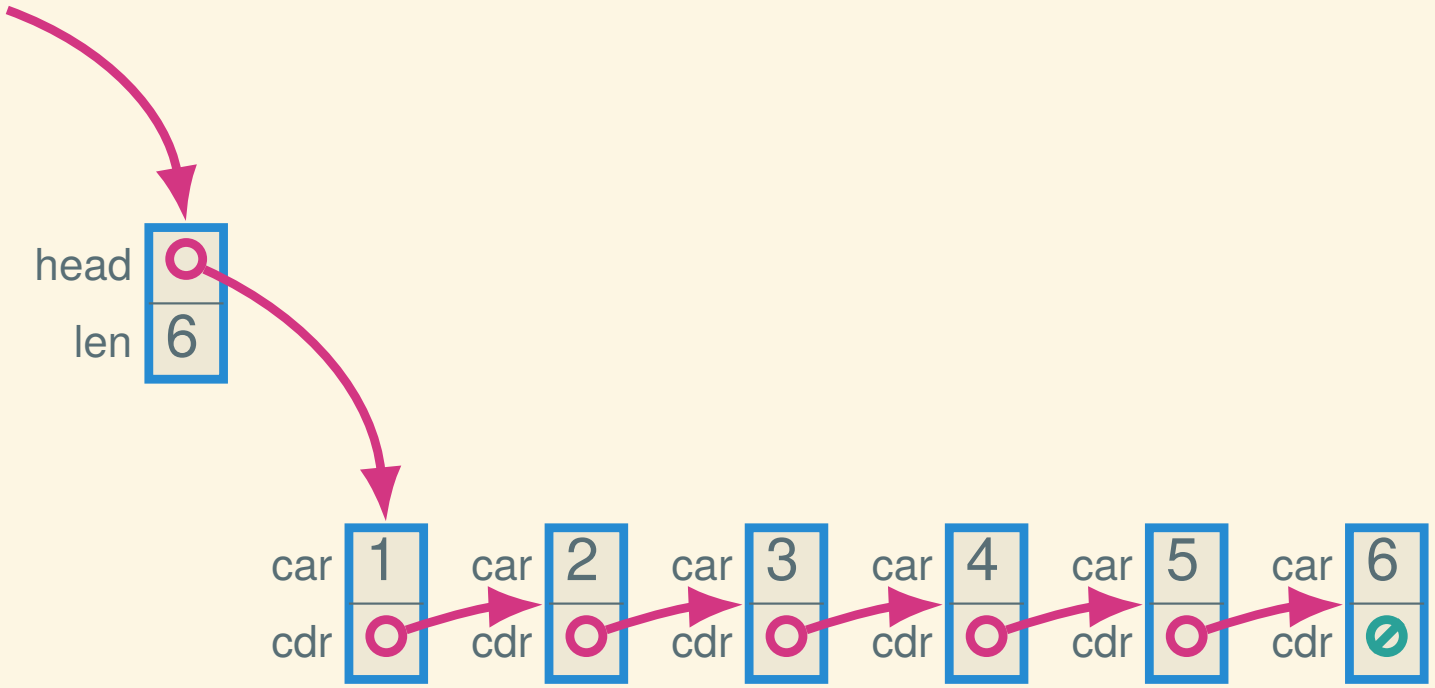
    def set_nth(self, n, val):
        self._find_nth_node(n).data = val
```

What else might we want to do?

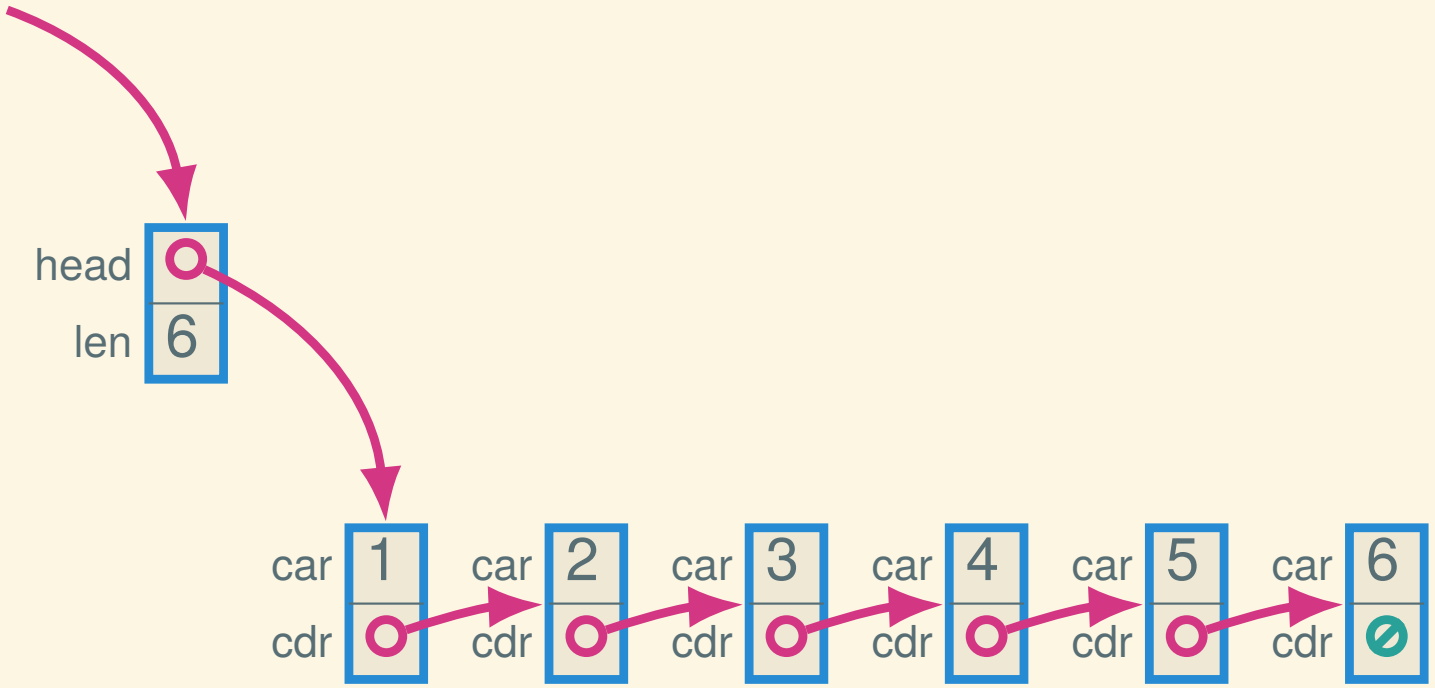
What else might we want to do?

- Insert or remove at the given position or the end.
- Split a list in two or splice two into one.
- Know how long the list is without counting.

Keeping the length

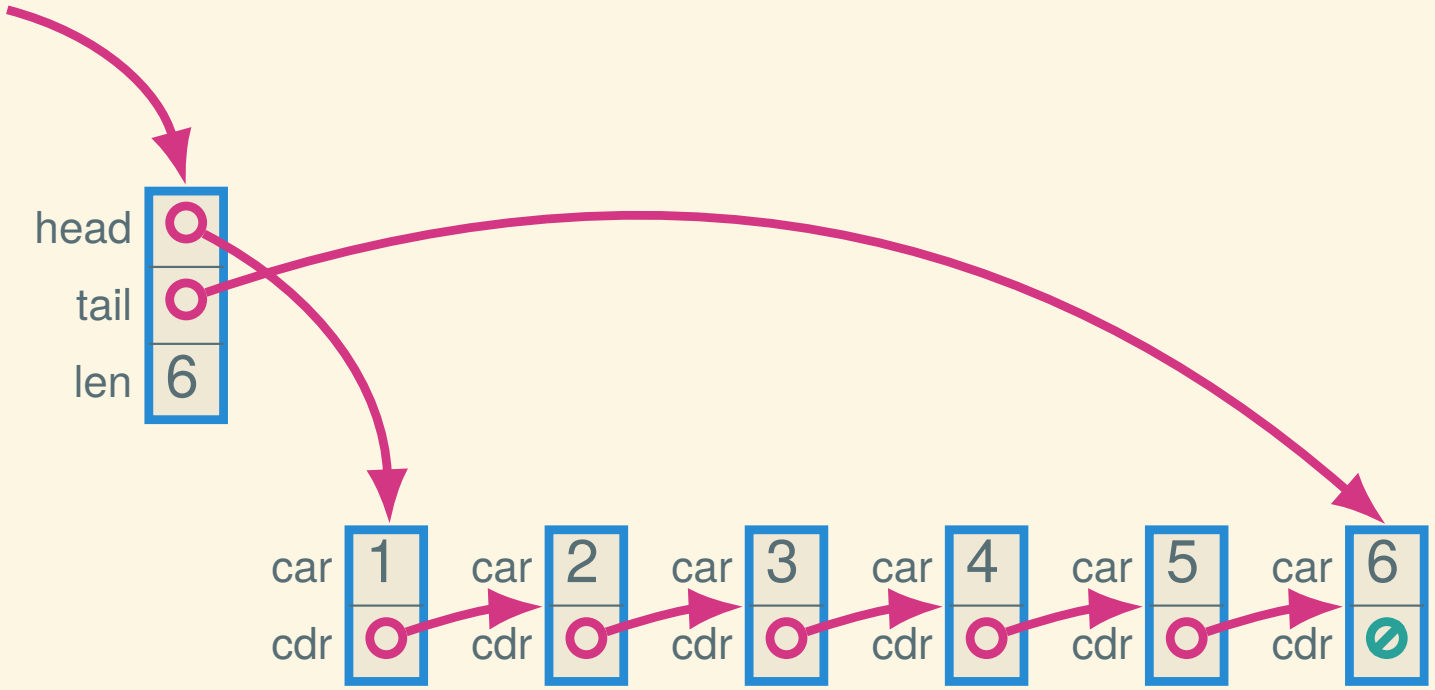


Keeping the length

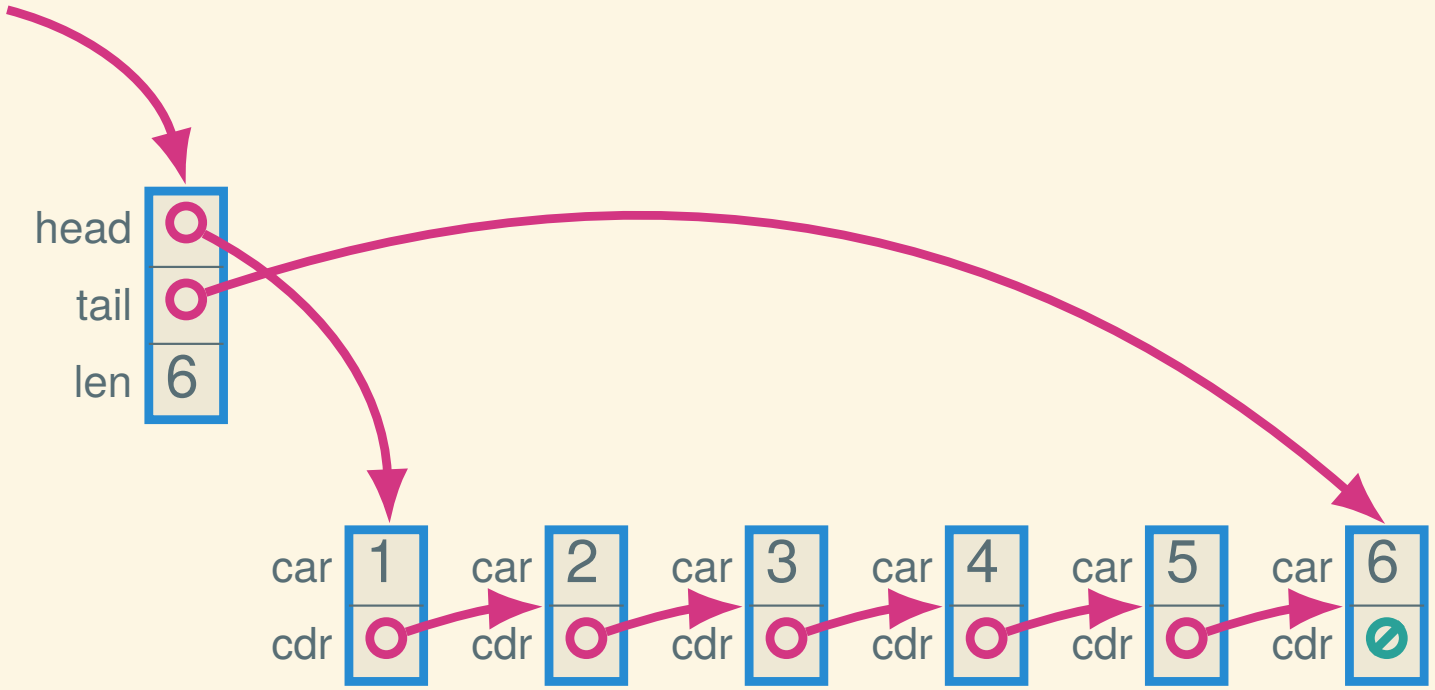


How can we make sure the `len` field is always right?

Quick access to the tail

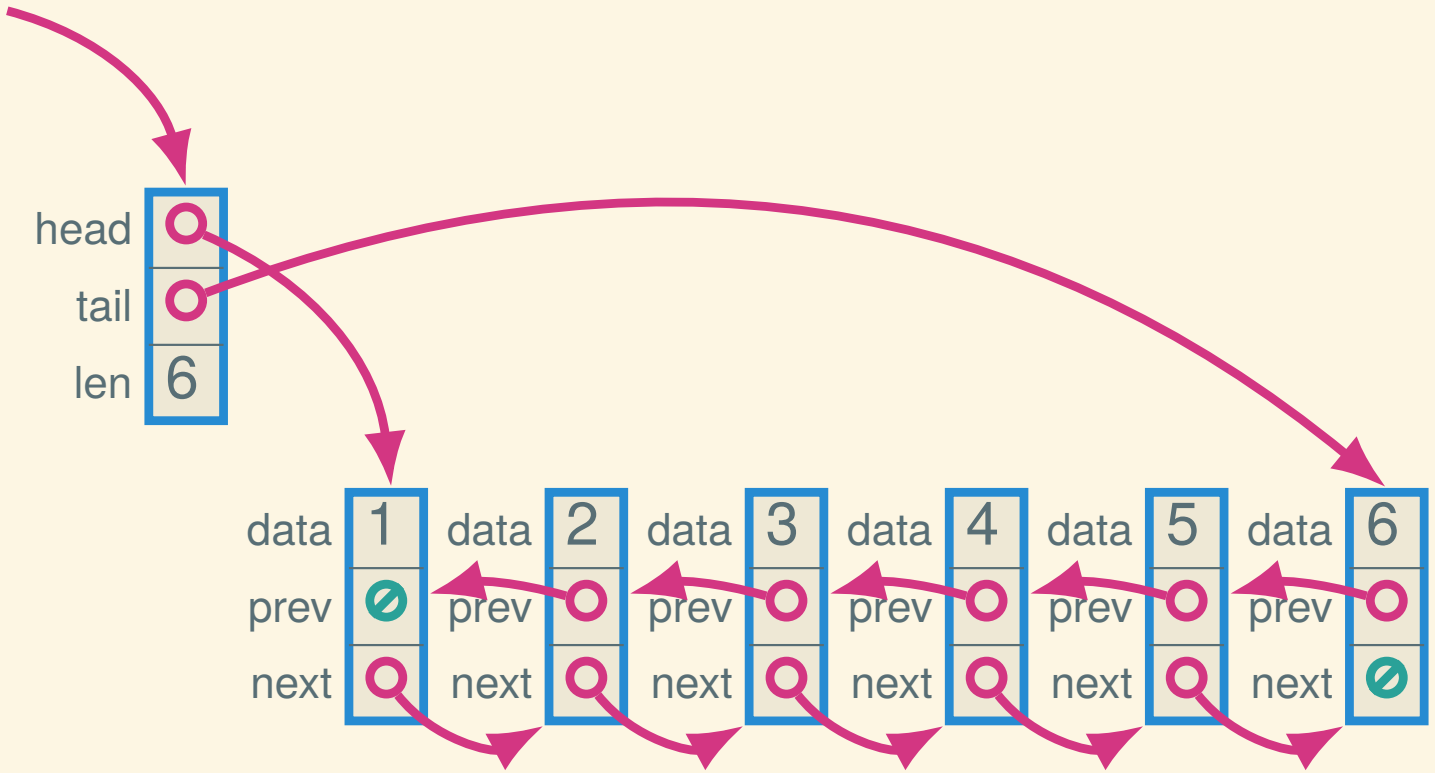


Quick access to the tail

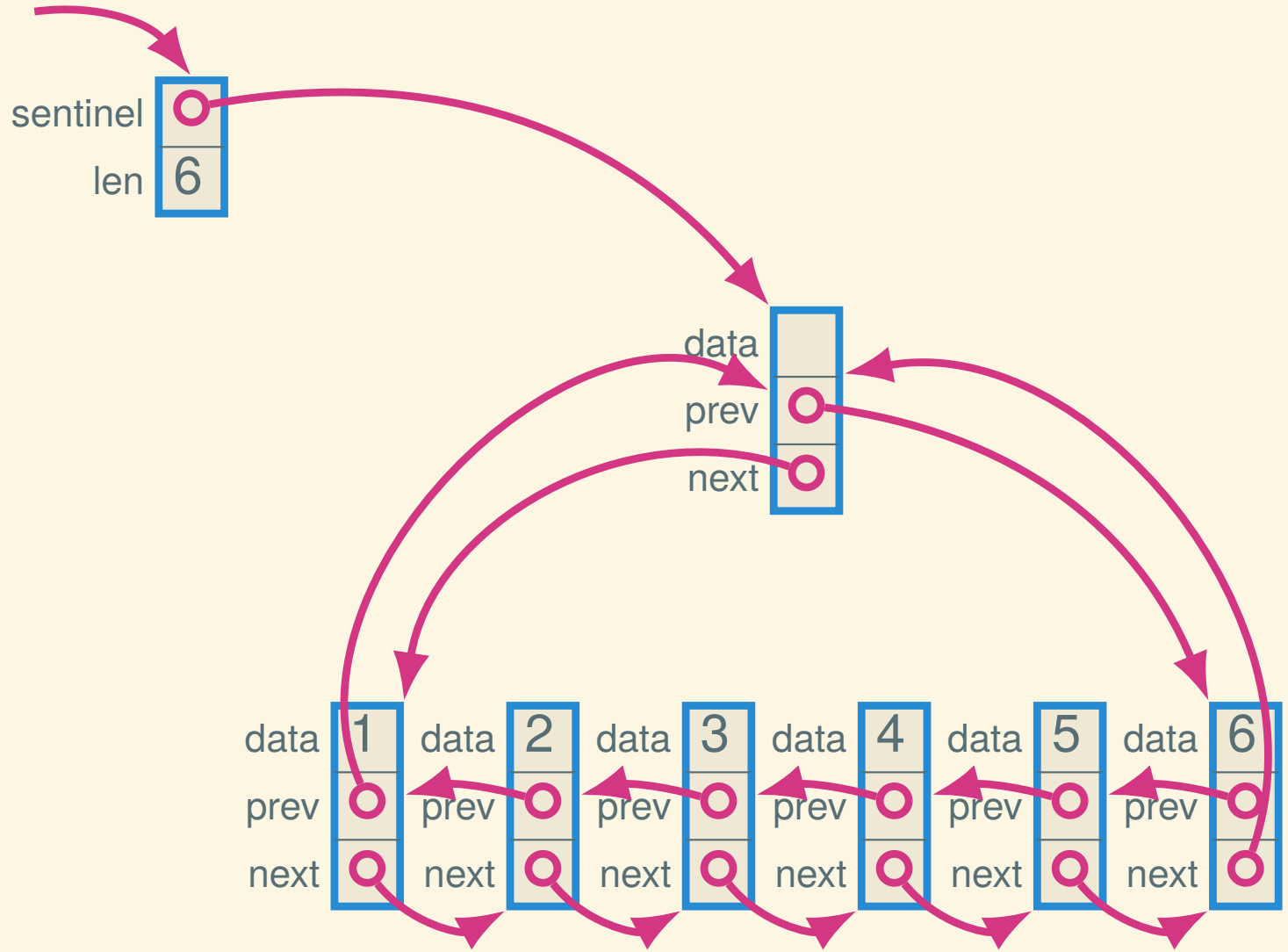


Which operations are simple now? Which are still more work?

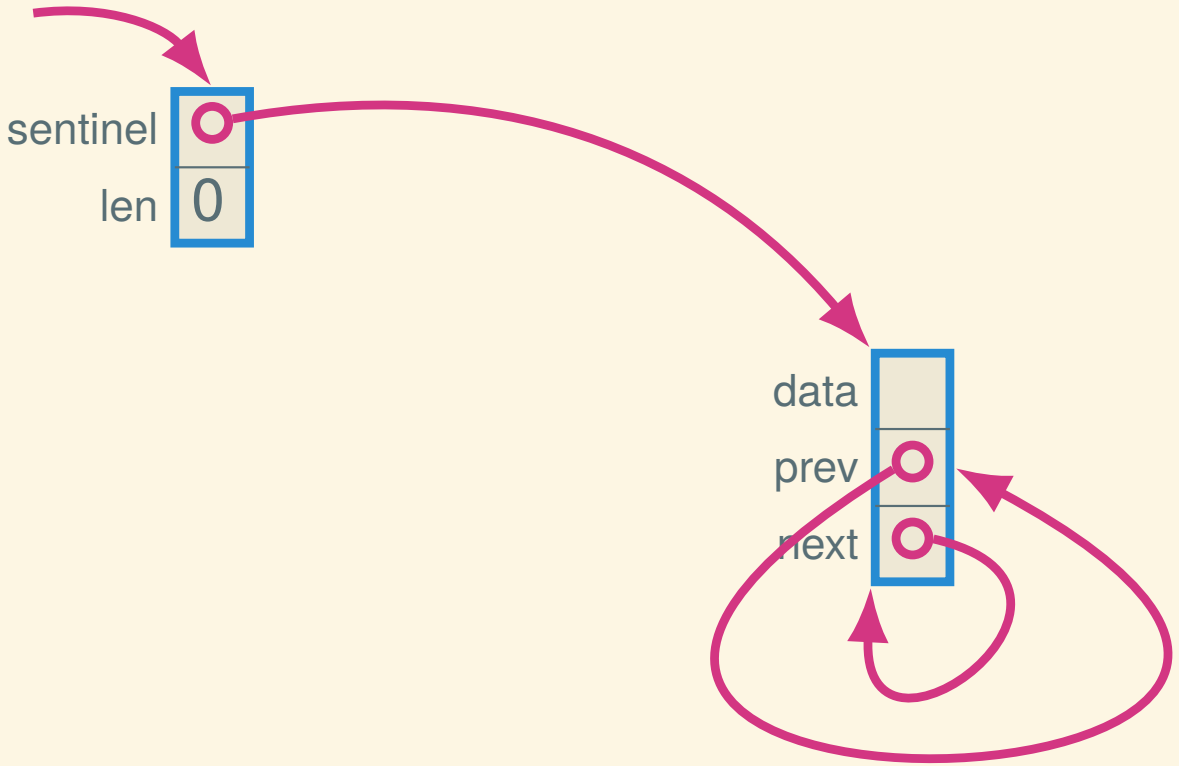
Doubly-linked



Circular, doubly-linked with sentinel



Empty (circular, doubly-linked w/sentinel)



Next time: asymptotic complexity