Estrutura de Dados I

Estrutura de dados: lista duplamente encadeada

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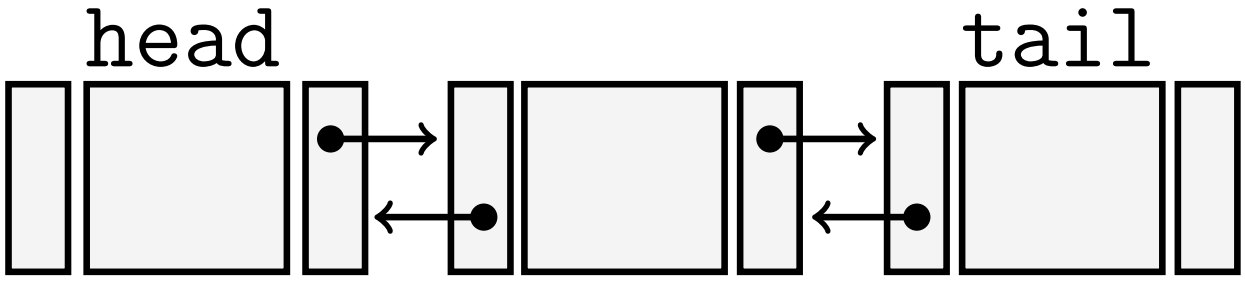
Universidade Tecnológica Federal do Paraná

Sumário

Introdução

A estrutura de dados **lista** com **encadeamento duplo** é excelente para construir diversas outras estrutura de dados.



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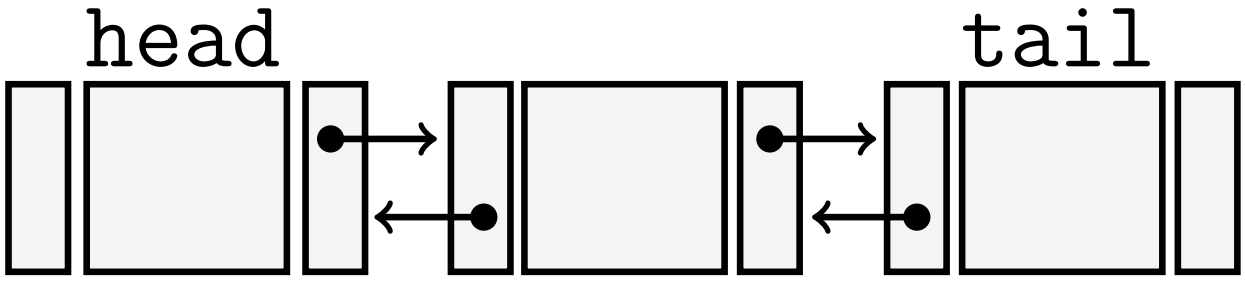

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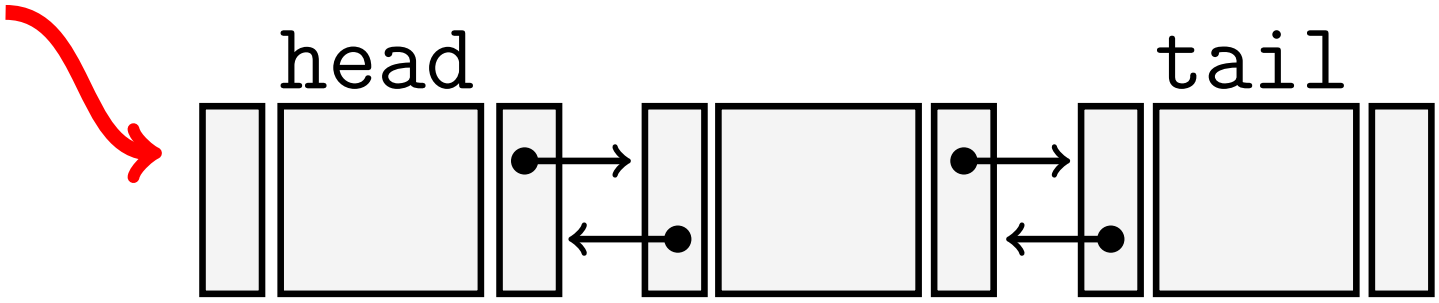
Pilha: **push** (cabeça da lista)



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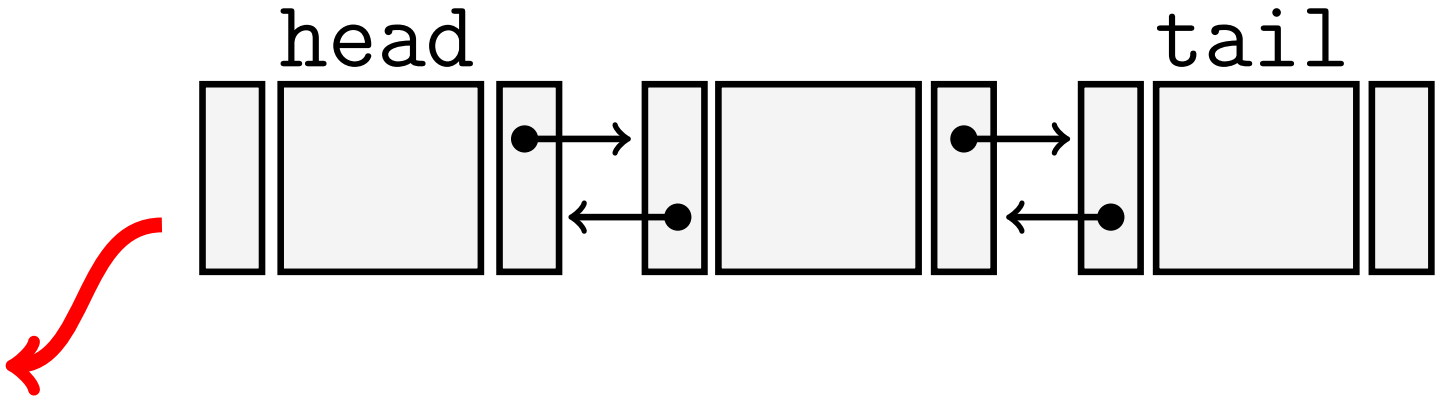
Pilha: **pop** (cabeça da lista)



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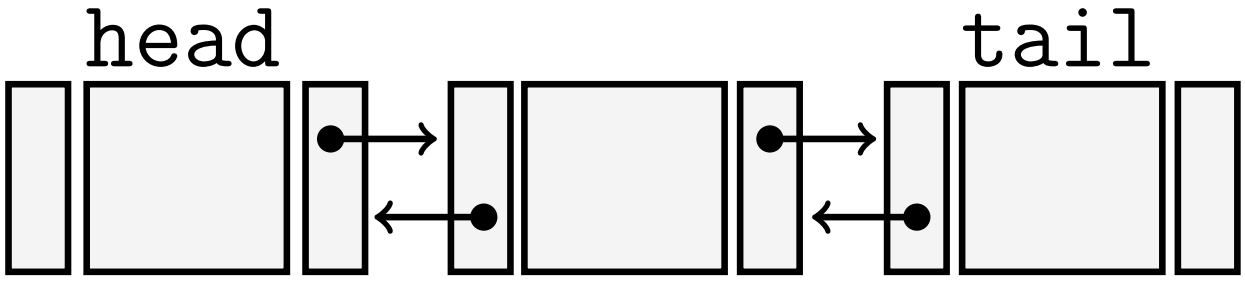

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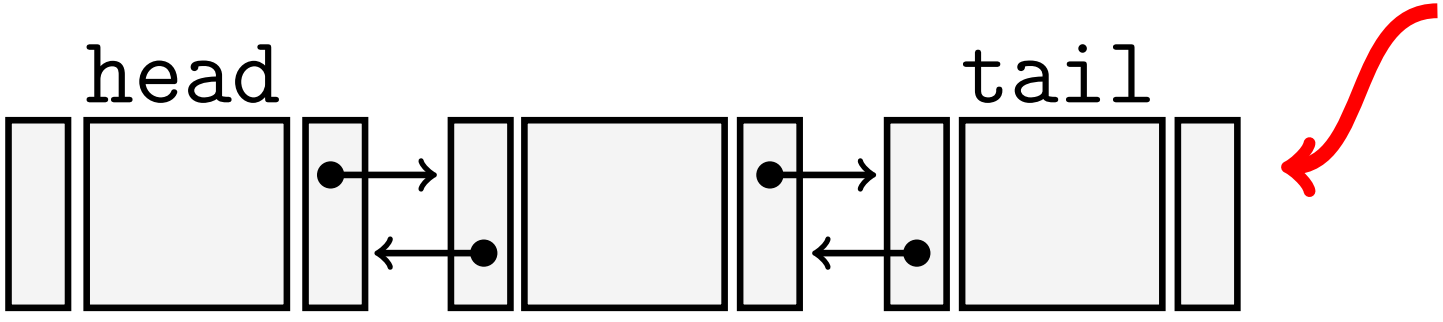
Fila: **enqueue** (cauda da lista)



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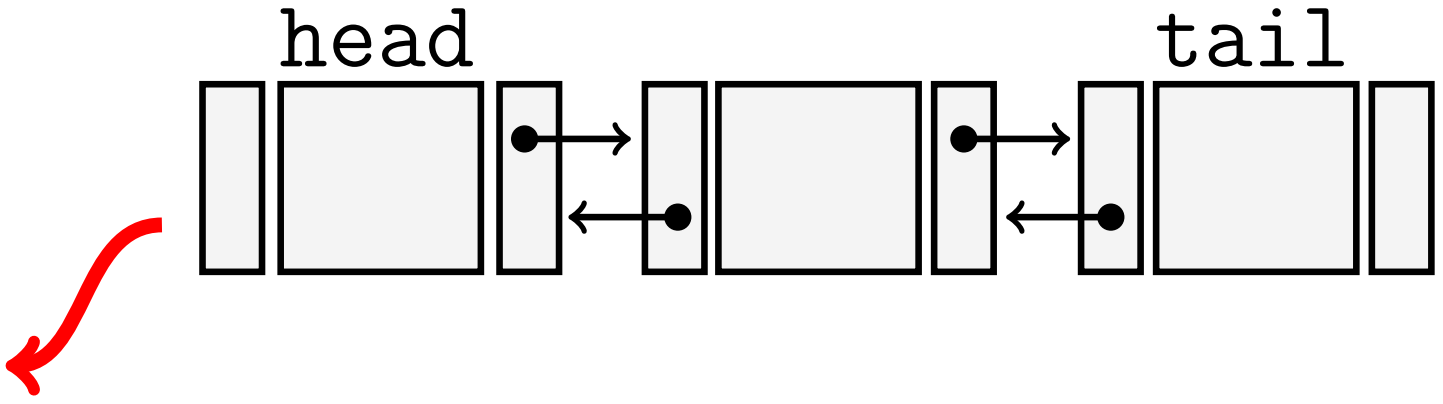
Fila: **dequeue** (cabeça da lista)



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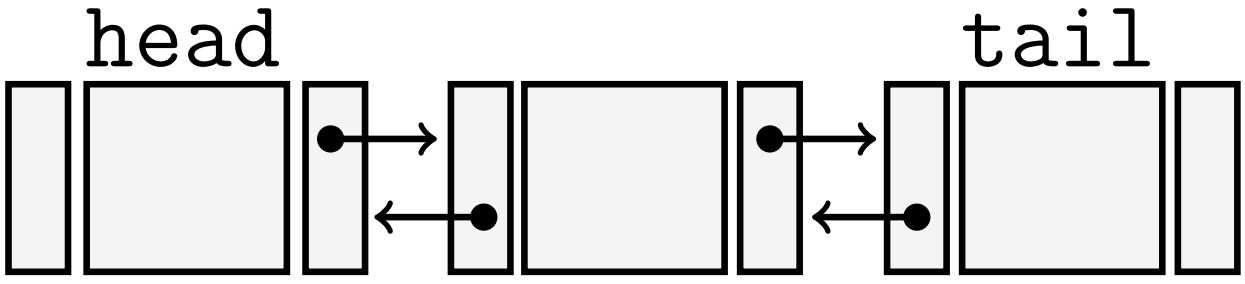
Deque:



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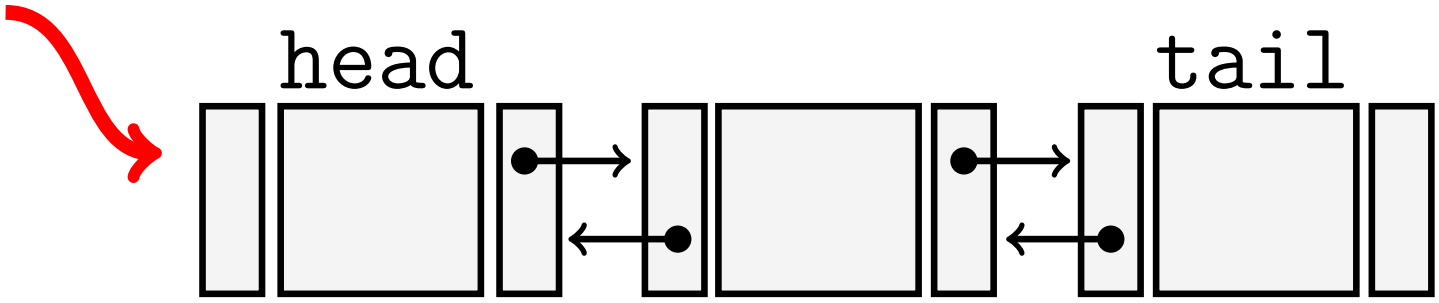

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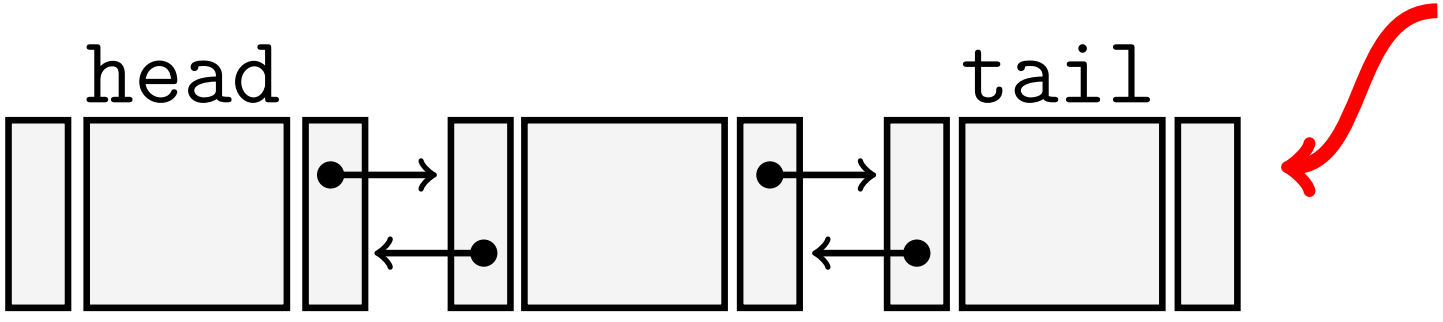

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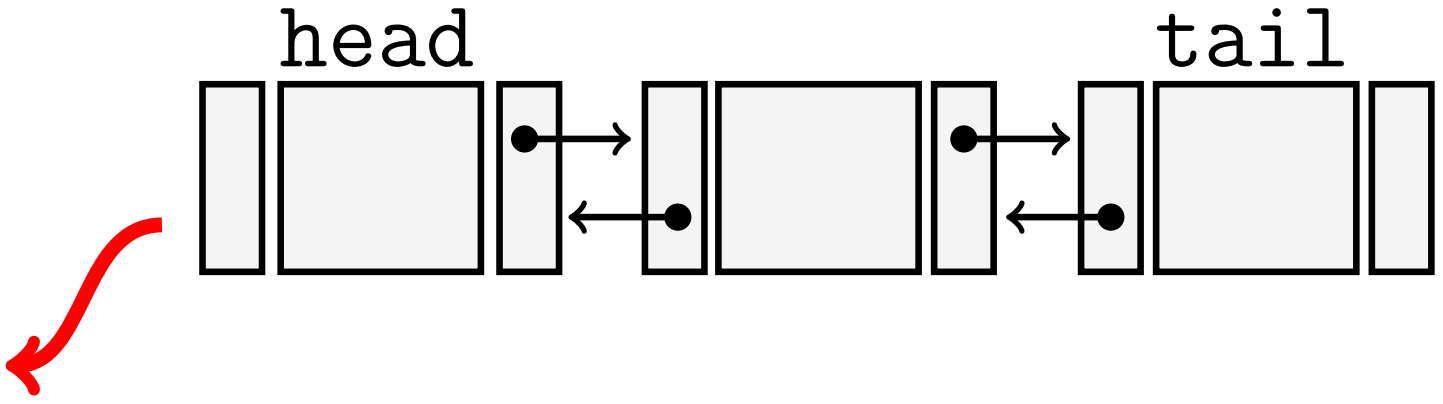
Deque: **remove** (cabeça da lista)



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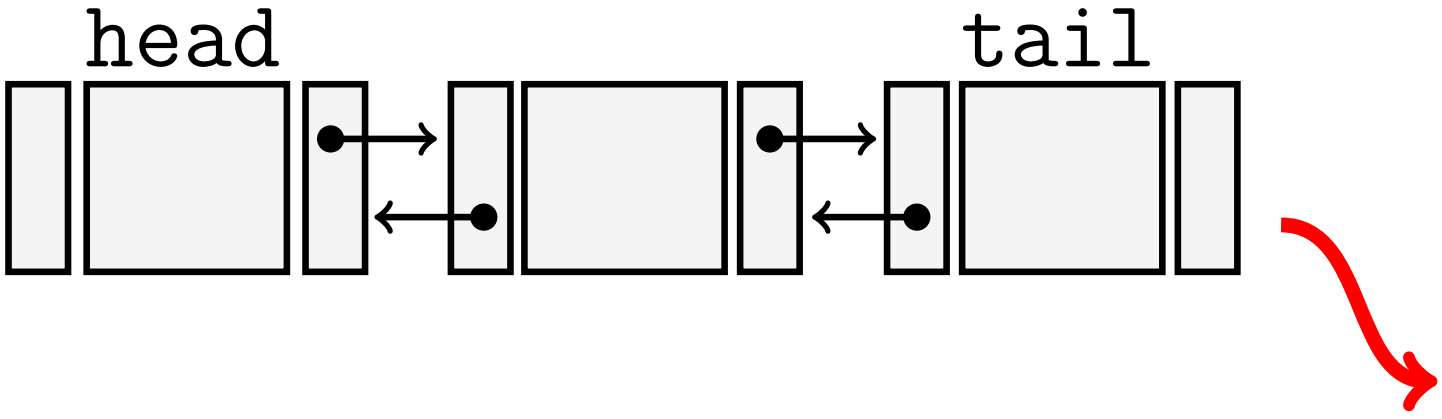
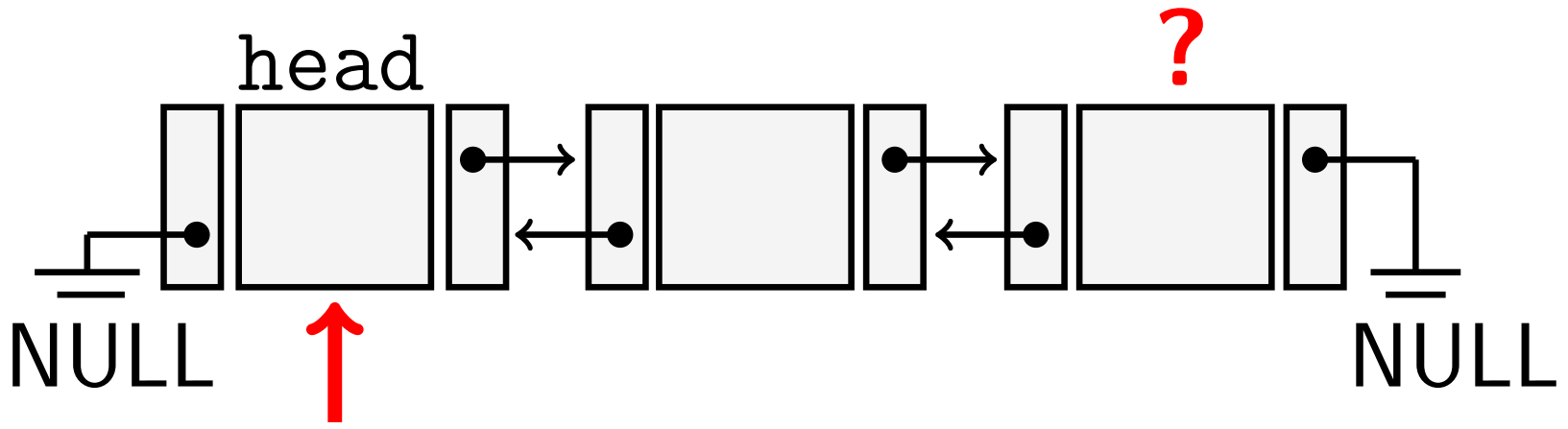
Deque: **remove** (cauda da lista)



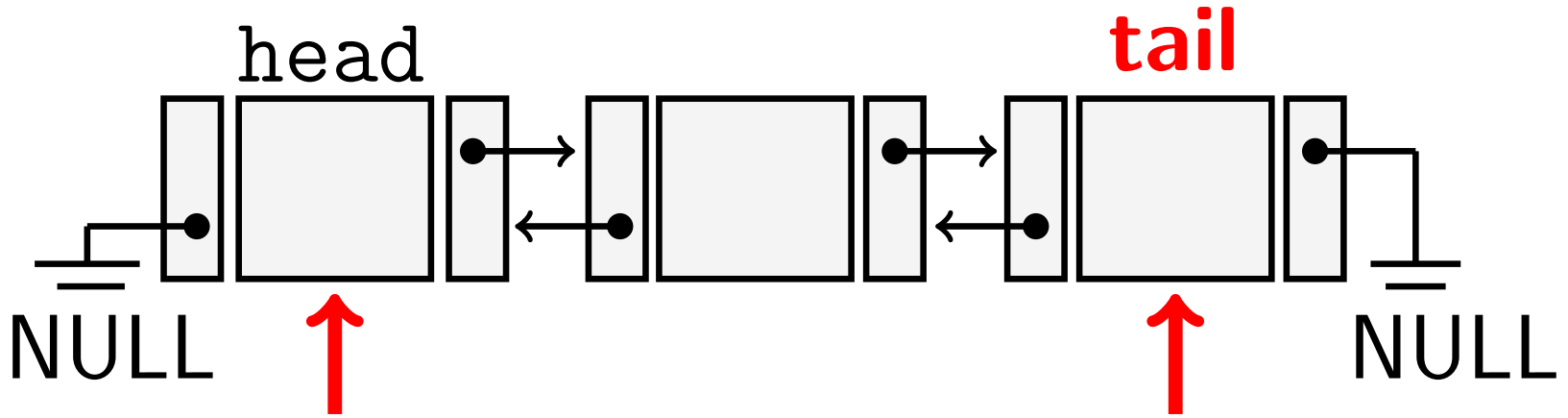
Introdução

No entanto, a lista com duplo encadeamento vista aula passada **não é eficiente** por exemplo para operações de cauda (complexidade $\mathcal{O}(n)$). Observe que o único ponteiro direto é para a cabeça da lista (**sem acesso direto a cauda**):



Introdução

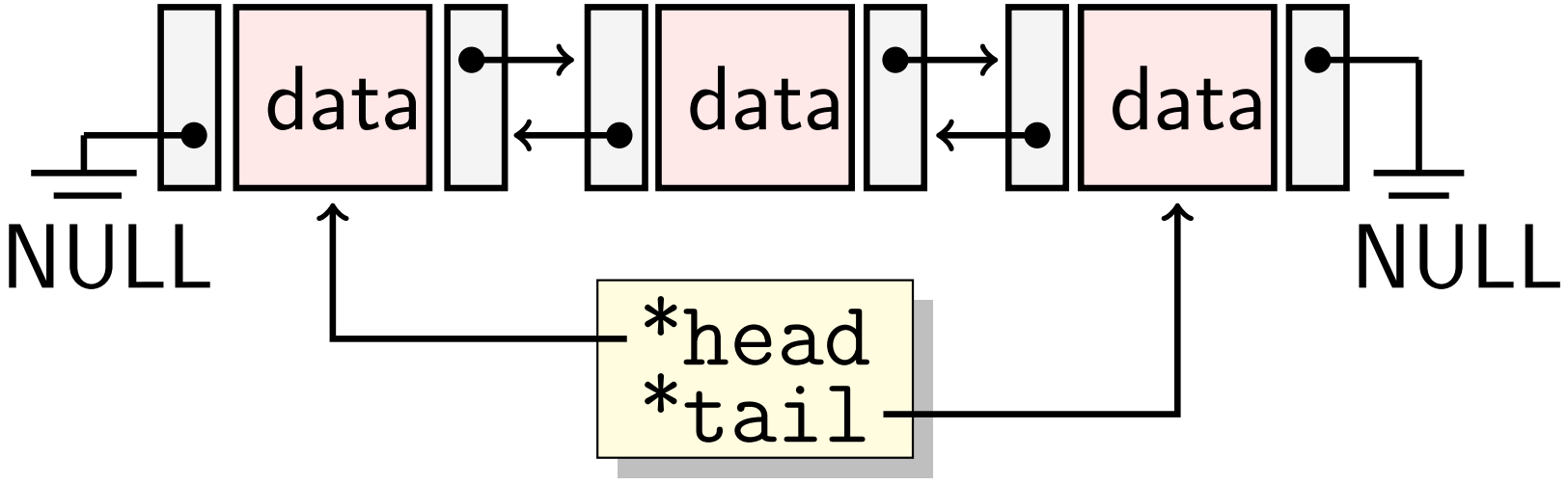
Solução: acrescentar e manipular um ponteiro com **acesso direto a cauda da lista**. A complexidade para operações de cauda (inserção, busca, remoção de elementos, ...) com esta otimização é $\mathcal{O}(1)$.



Estrutura

```
typedef struct node {
  int data;
  struct node* next;
  struct node* prev;
} Node;
```

```
typedef struct {
  Node *head;
  Node *tail;
} List;
```



Tipo abstrato de dados

Lista duplamente encadeada (**interface**)

create: inicializa uma estrutura de dados lista

insert-front: adiciona um nó no início

insert-back: adiciona um nó no fim

remove-front: retira um nó do início

remove-back: retira um nó do fim

print-front-back: imprime nós do início p/ fim

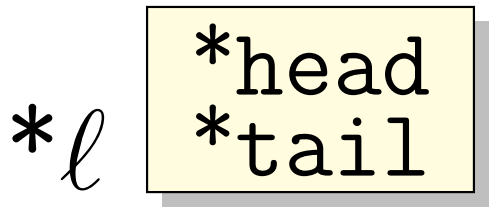
print-back-front: imprime nós do fim p/início

Sumário

Criar

```
1: List* create (void)
---
2:     List* ℓ = (List*)malloc(sizeof(List));
3:     ℓ →head = NULL;
4:     ℓ →tail = NULL;
5:     return ℓ;
```

Criar



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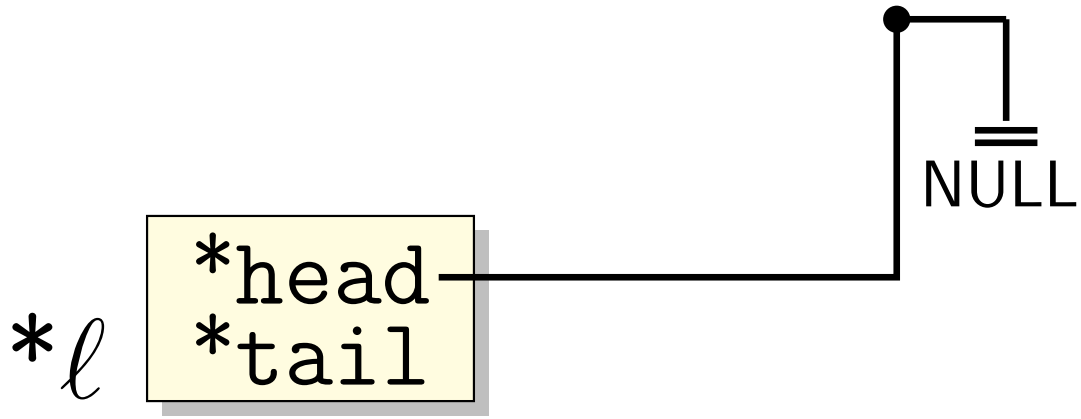

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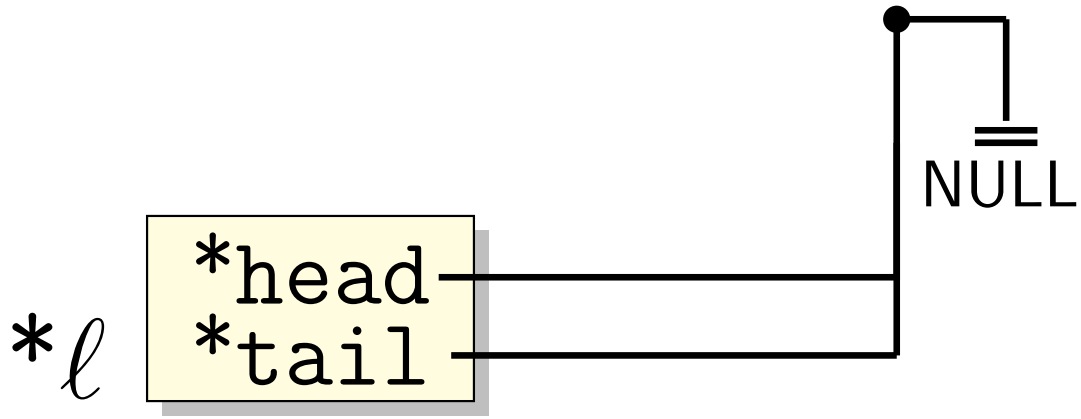

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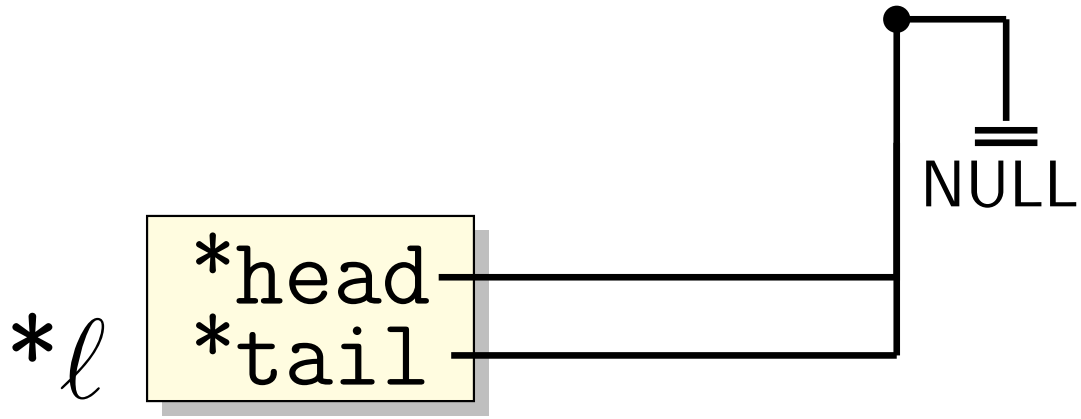

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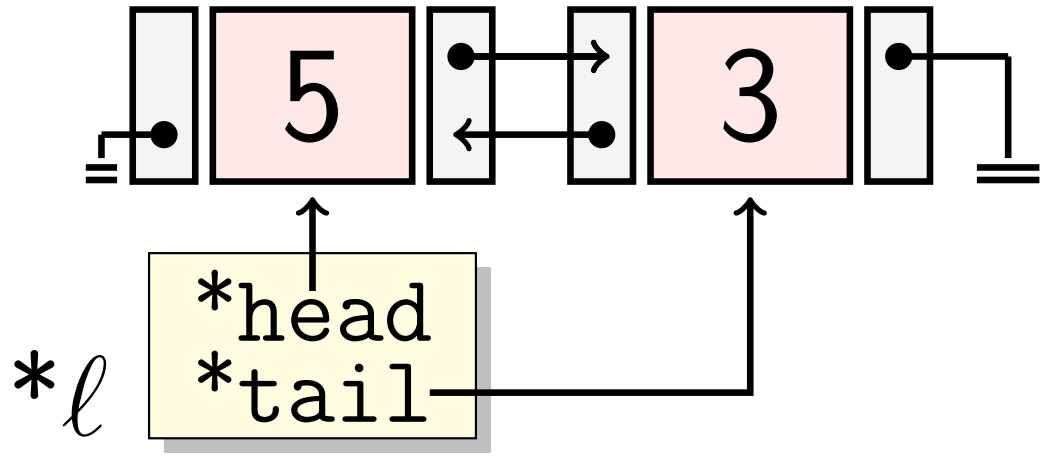

1: **void insert-front** (List *ℓ, int elem)

2: Node* node = (Node*)malloc(sizeof(Node));
3: node→data = elem;
4: node→prev = NULL;
5: ...

Inserir: 7

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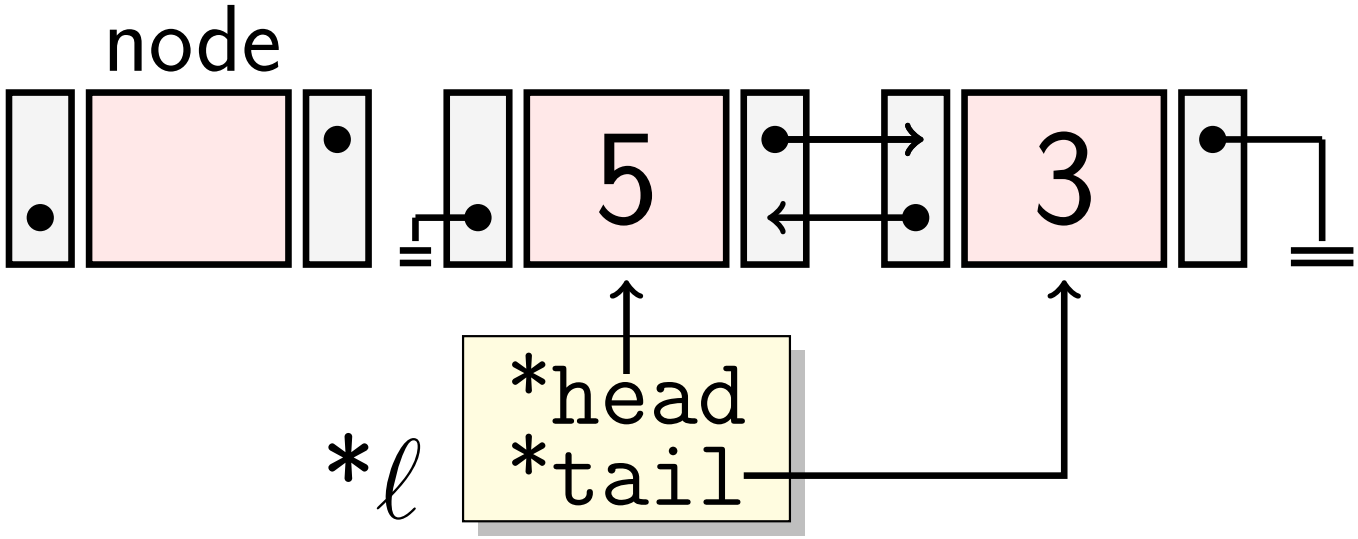

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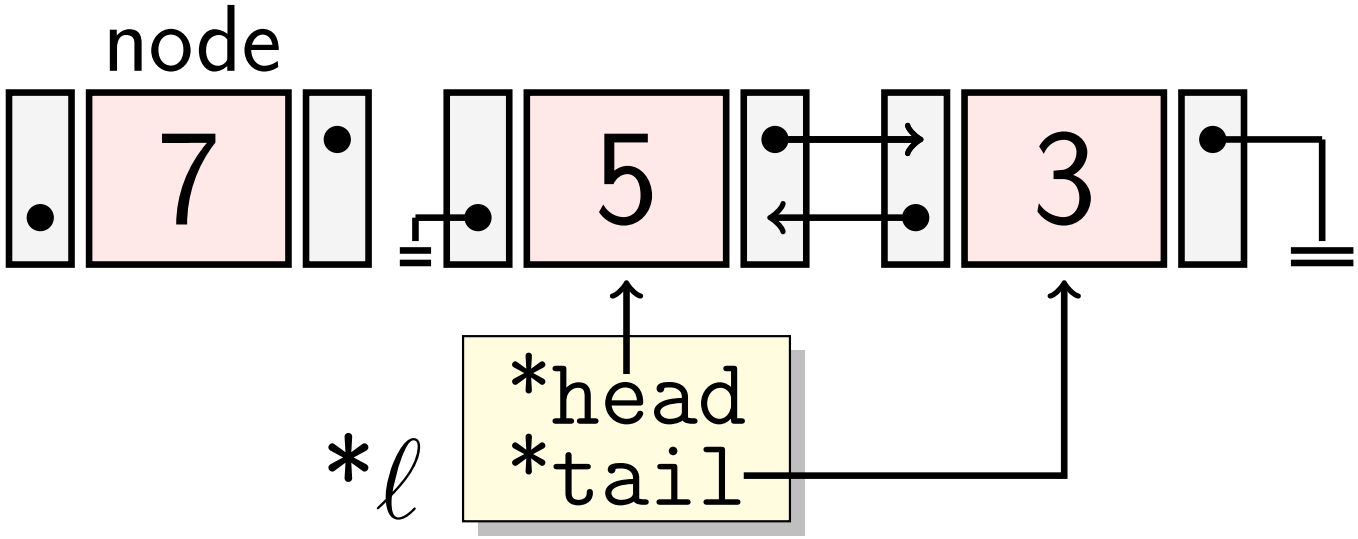

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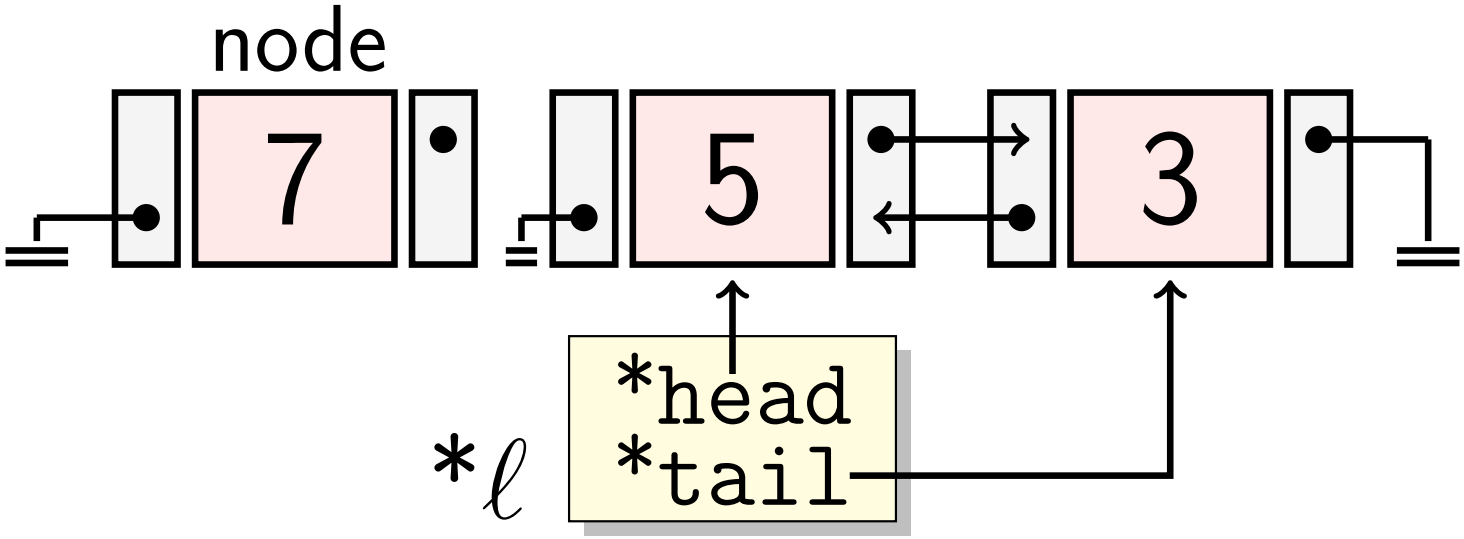

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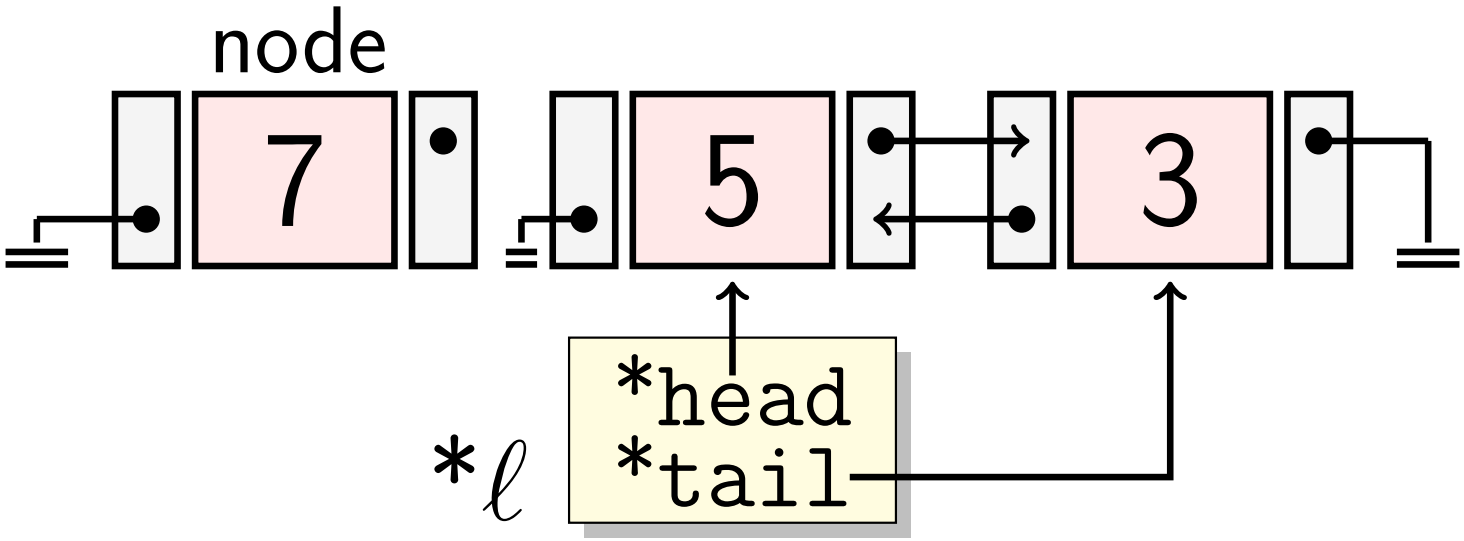

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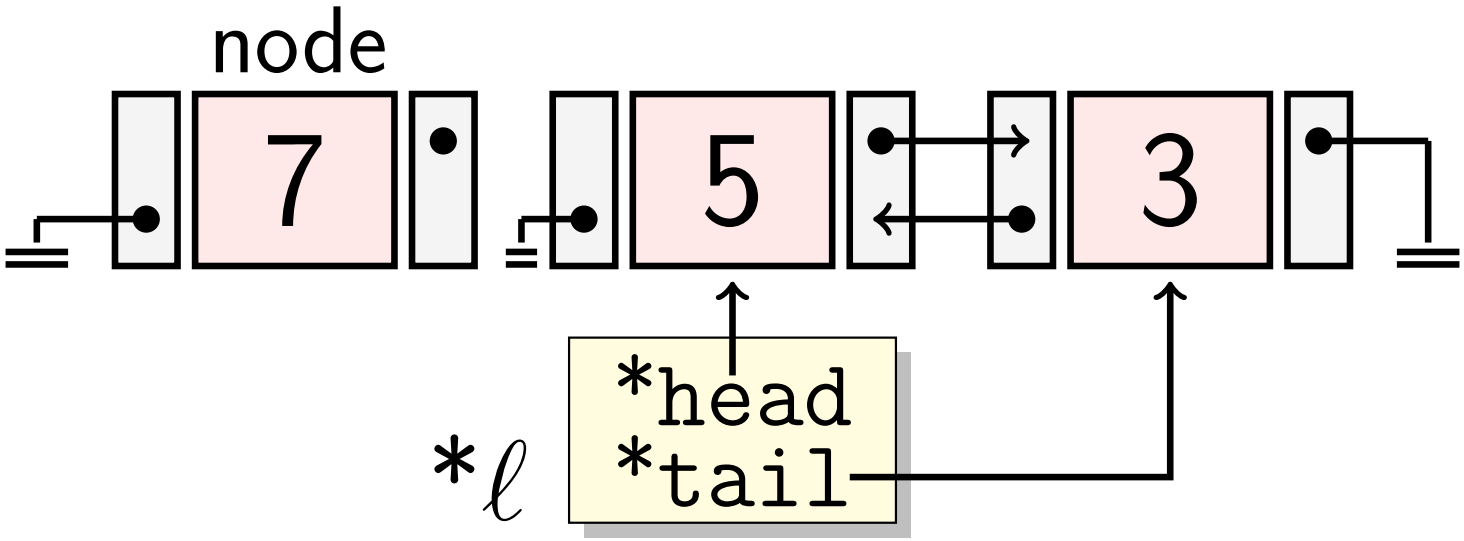

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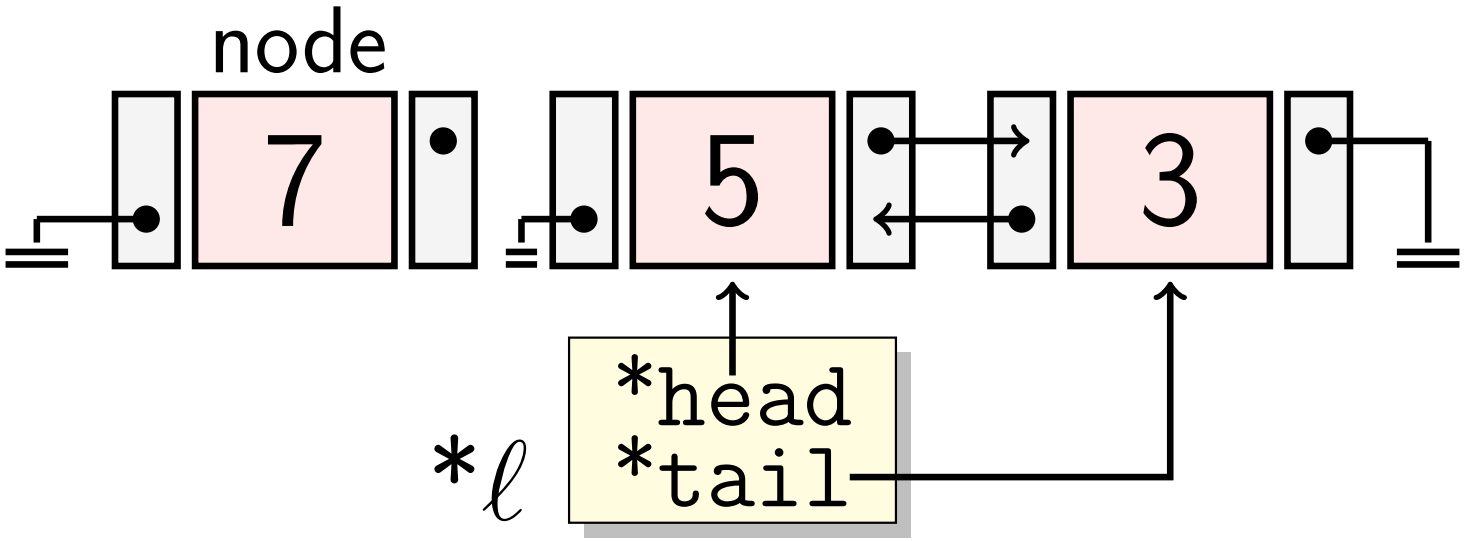

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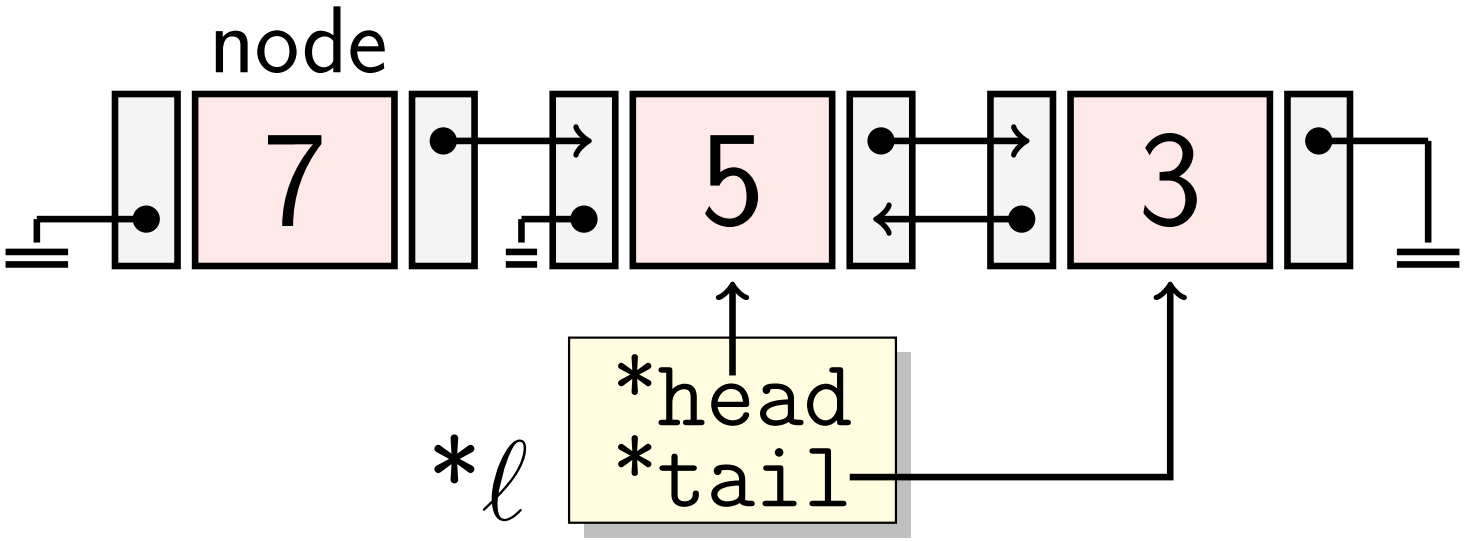

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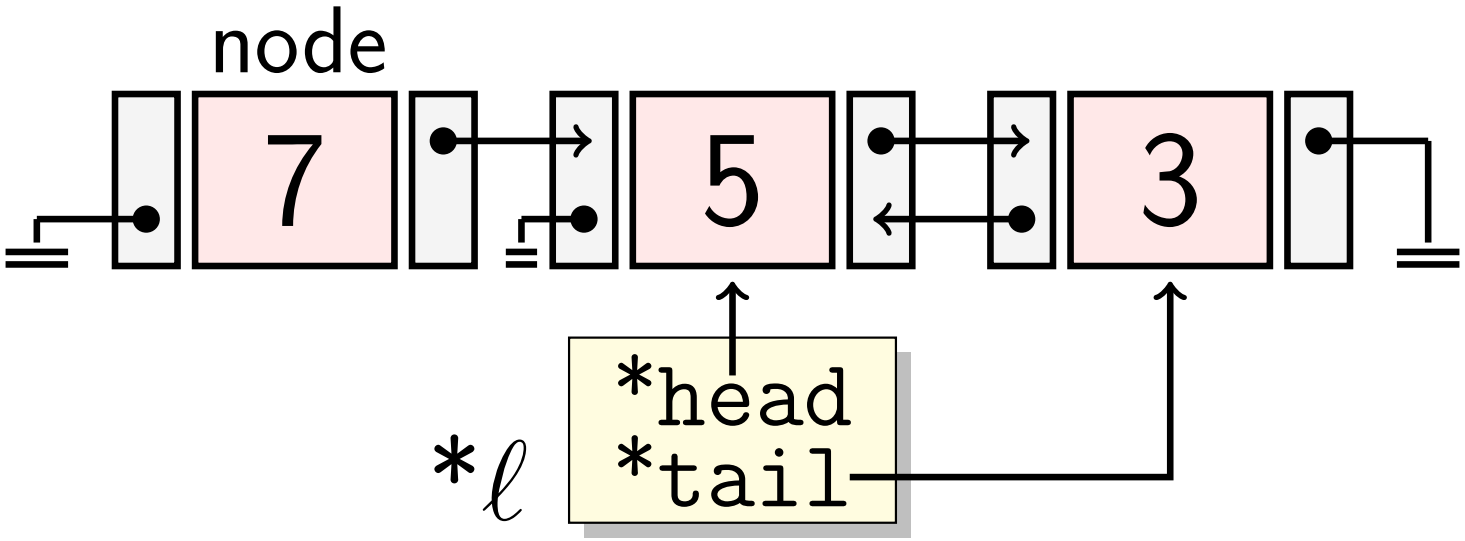

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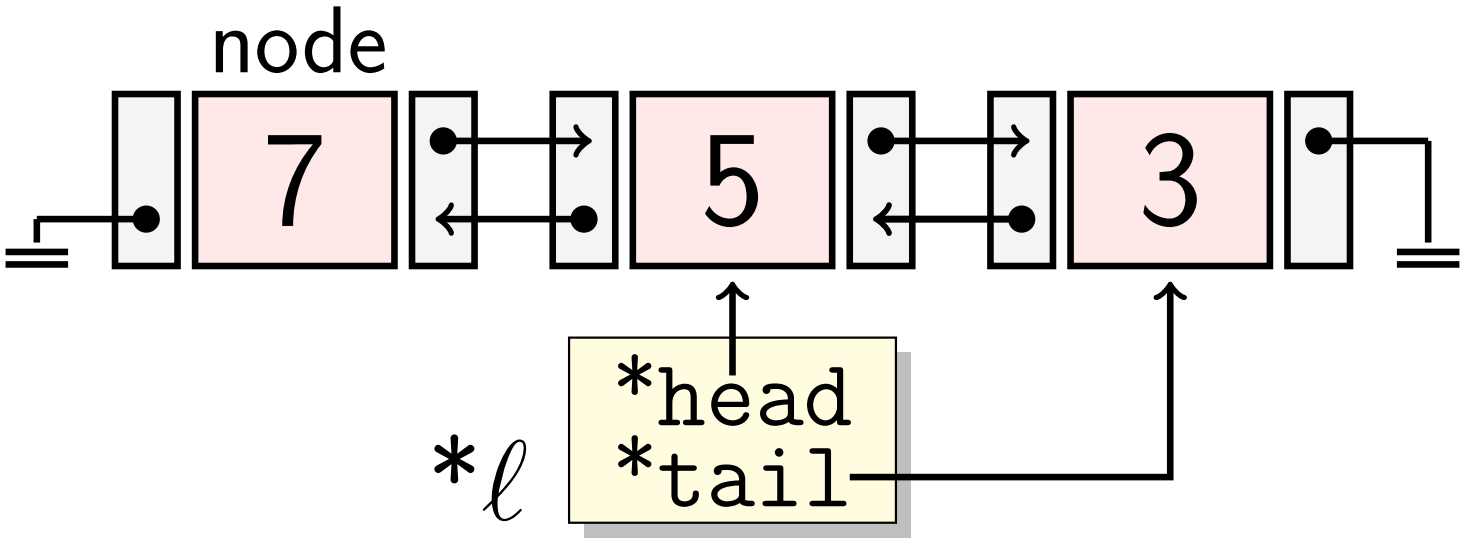

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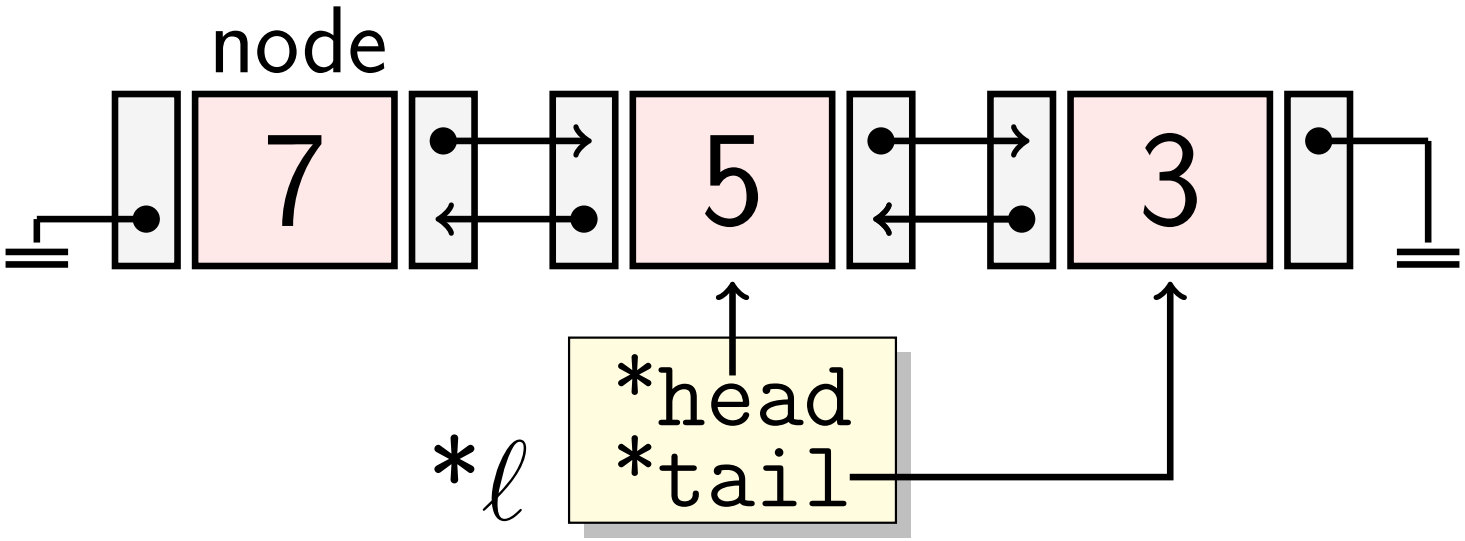

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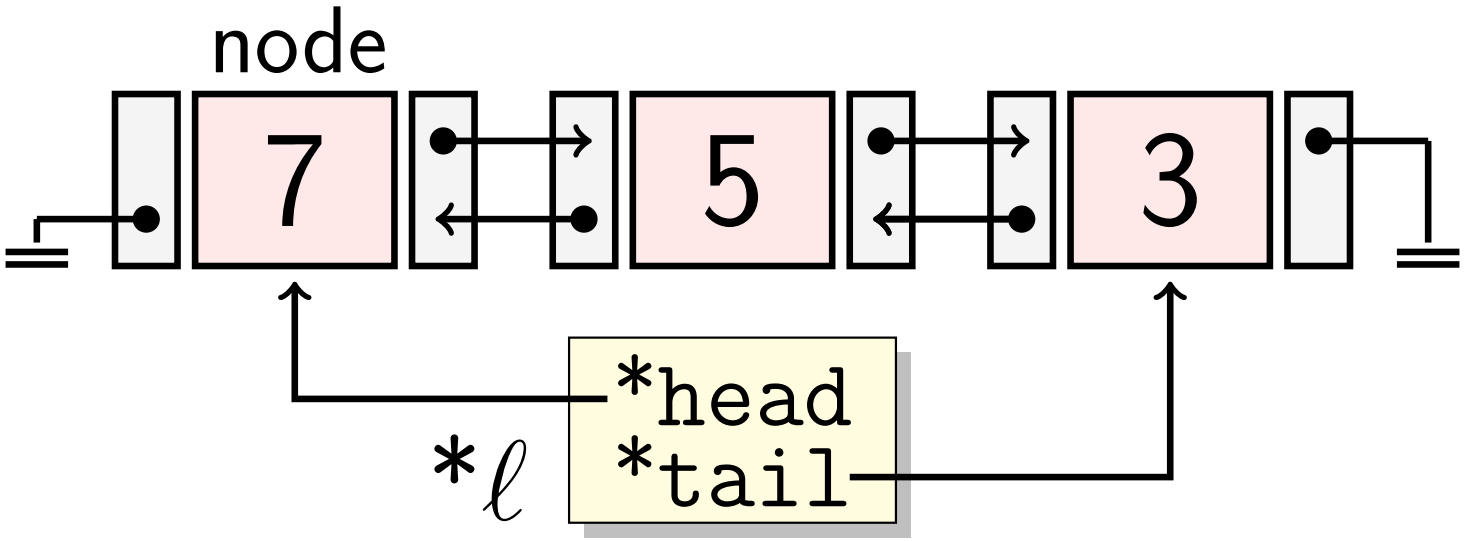

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Sumário

Inserir-front (funcionamento)

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1: int main (void)
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2:     List *ℓ = create ();
3:     insert-front (ℓ, 3);
4:     insert-front (ℓ, 5);
5:     insert-front (ℓ, 7);
6: return 0
```

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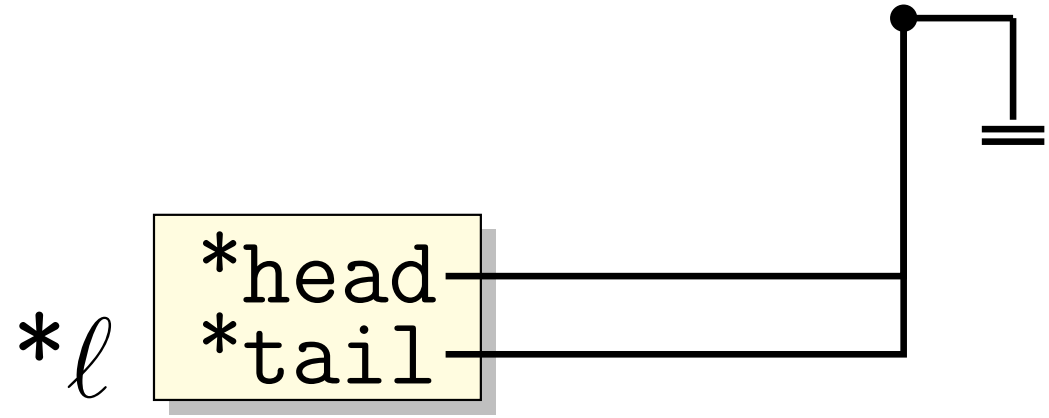


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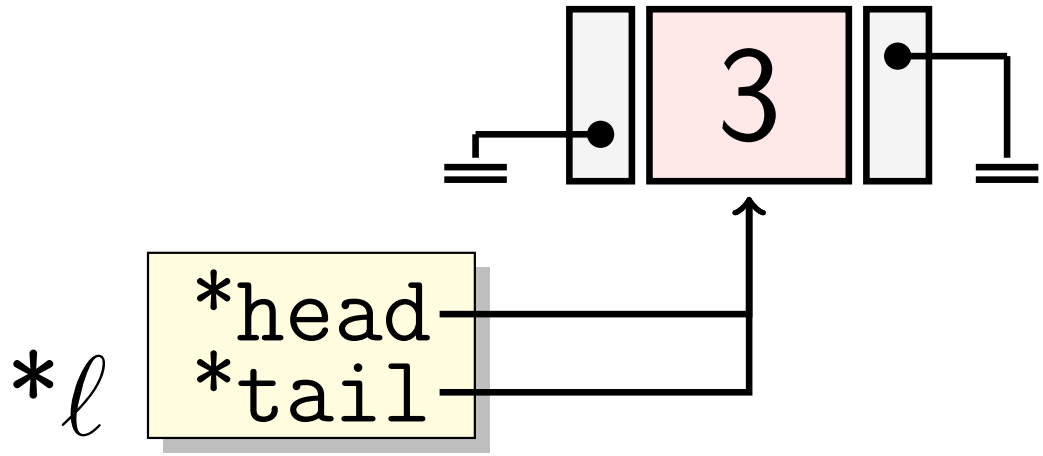


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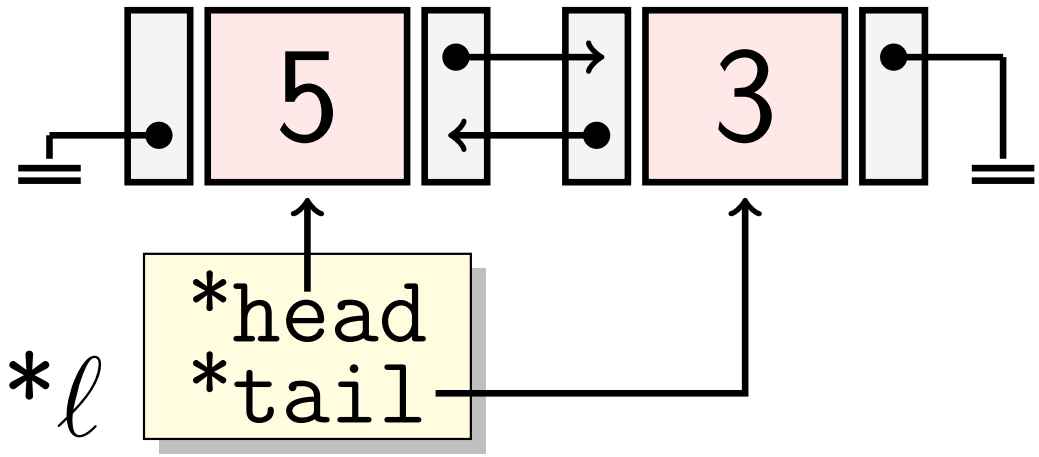


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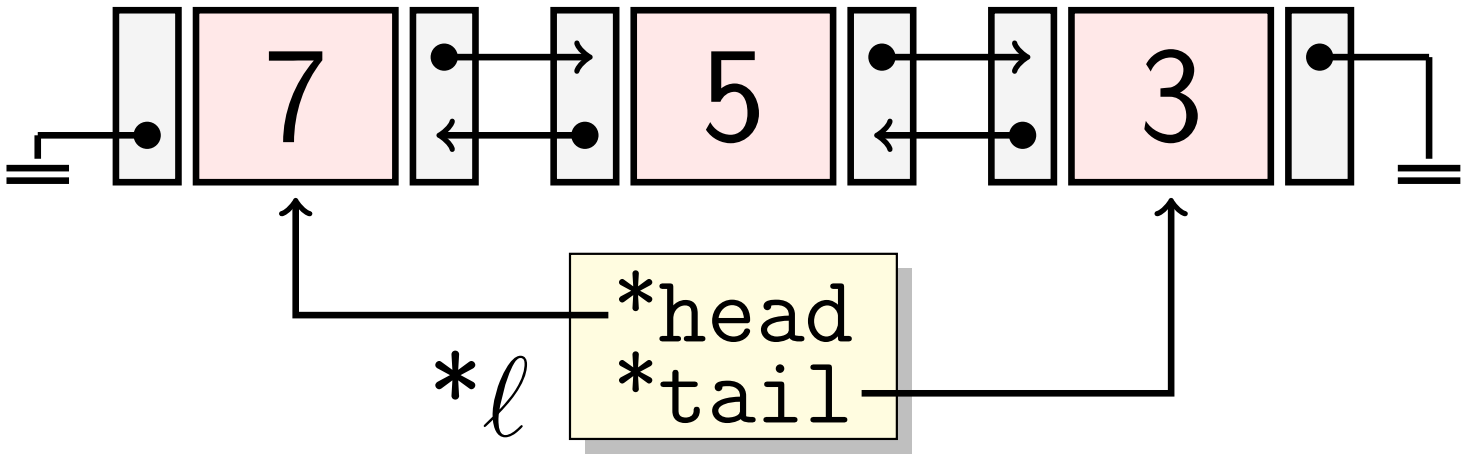


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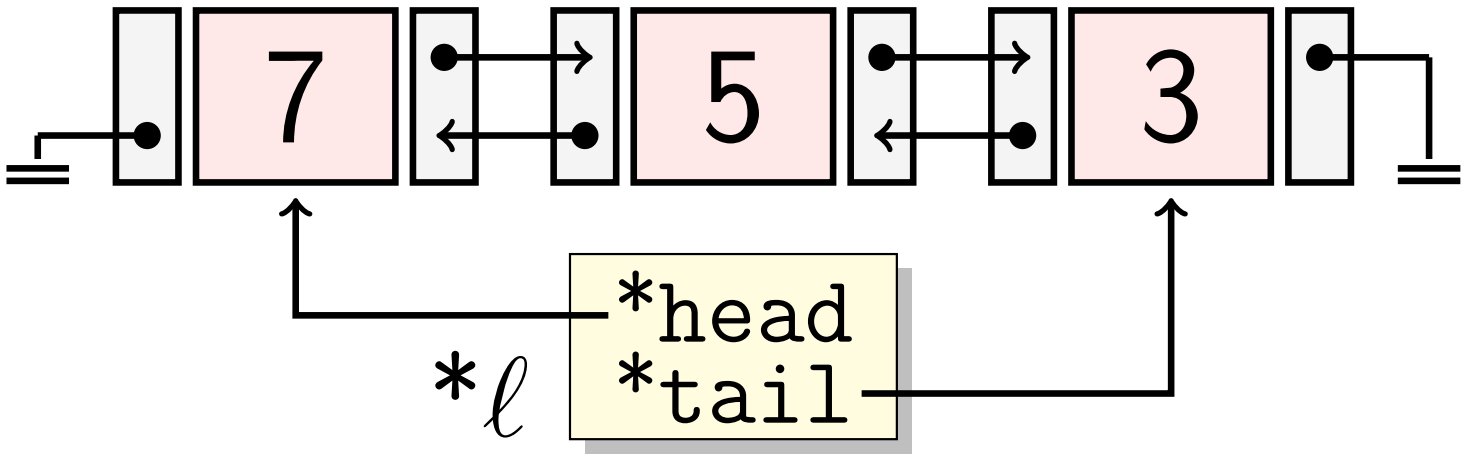
Sumário

Remover (início)

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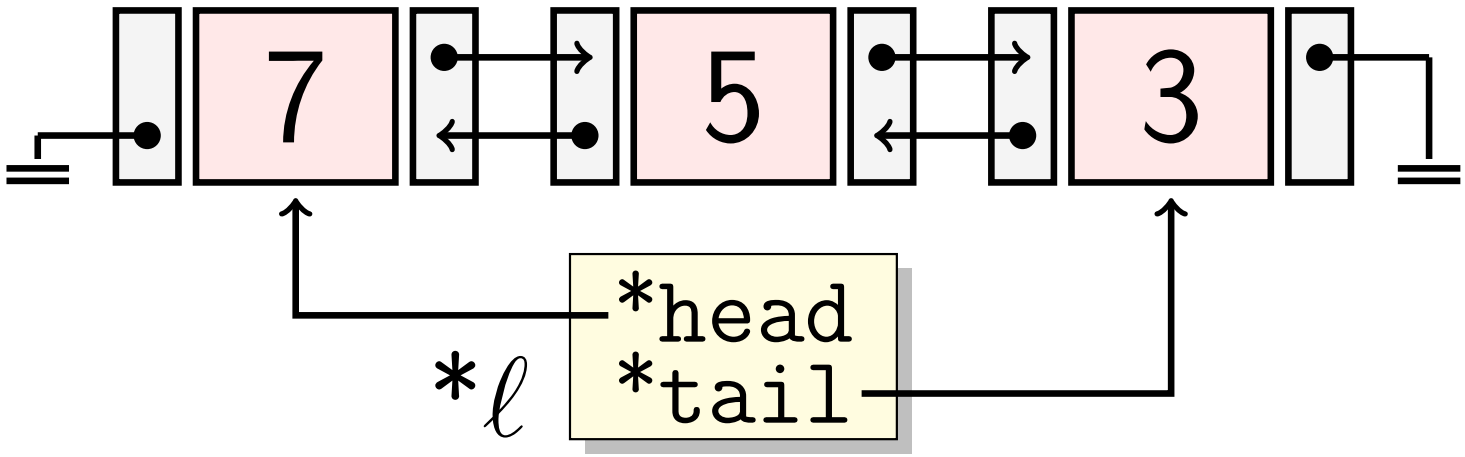


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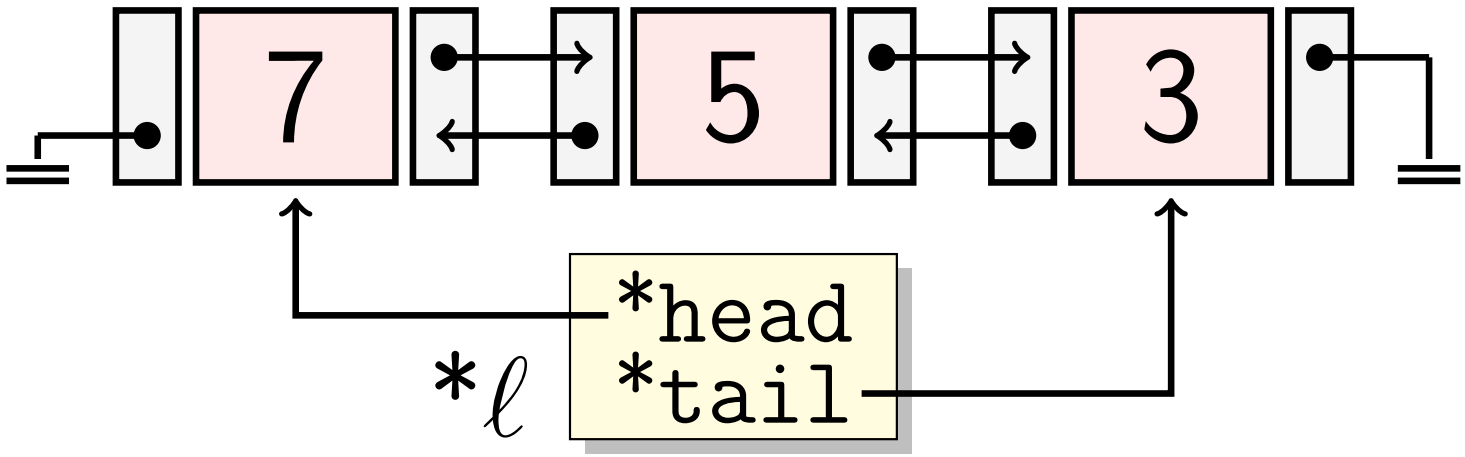


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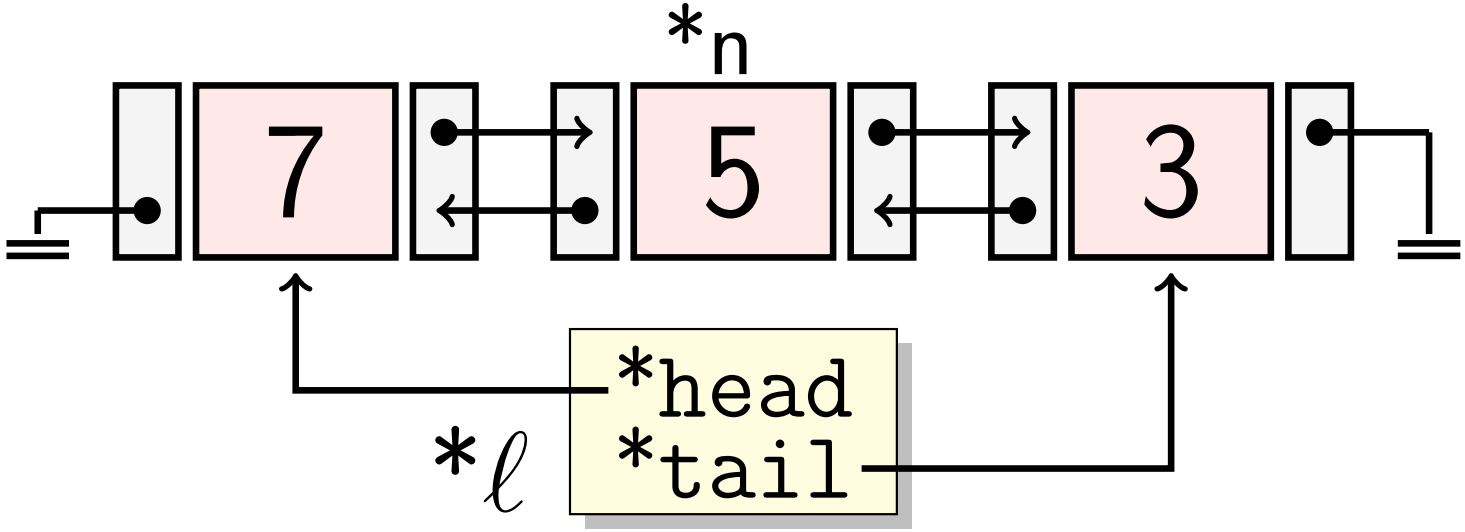


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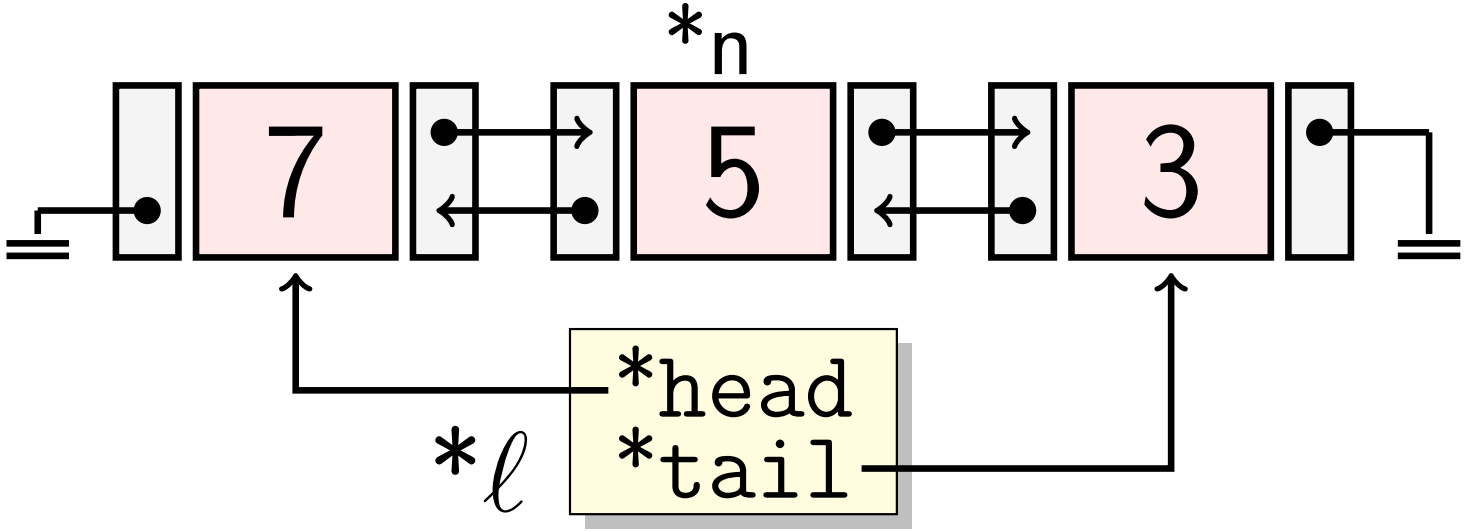


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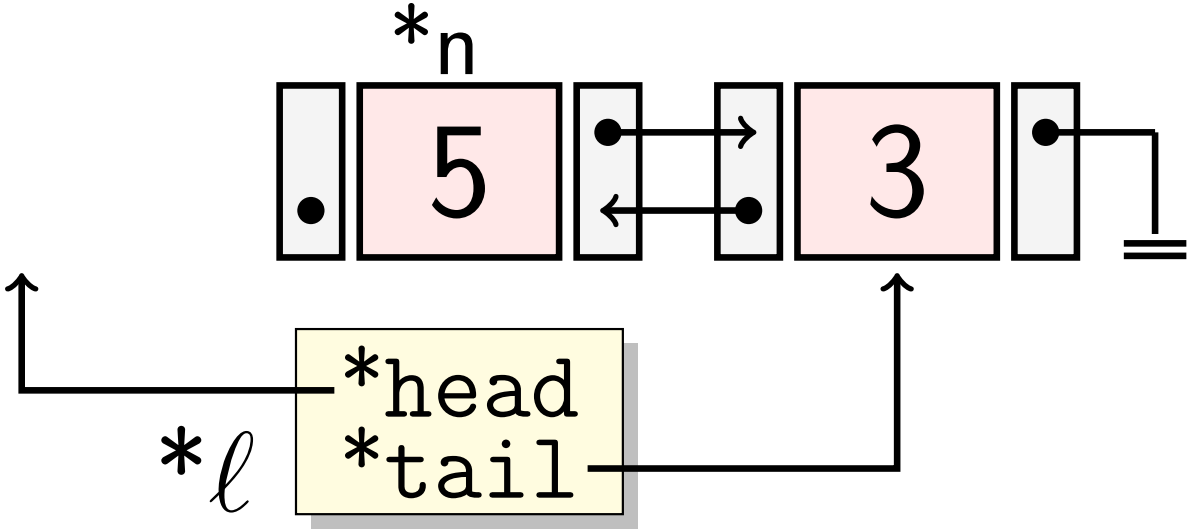


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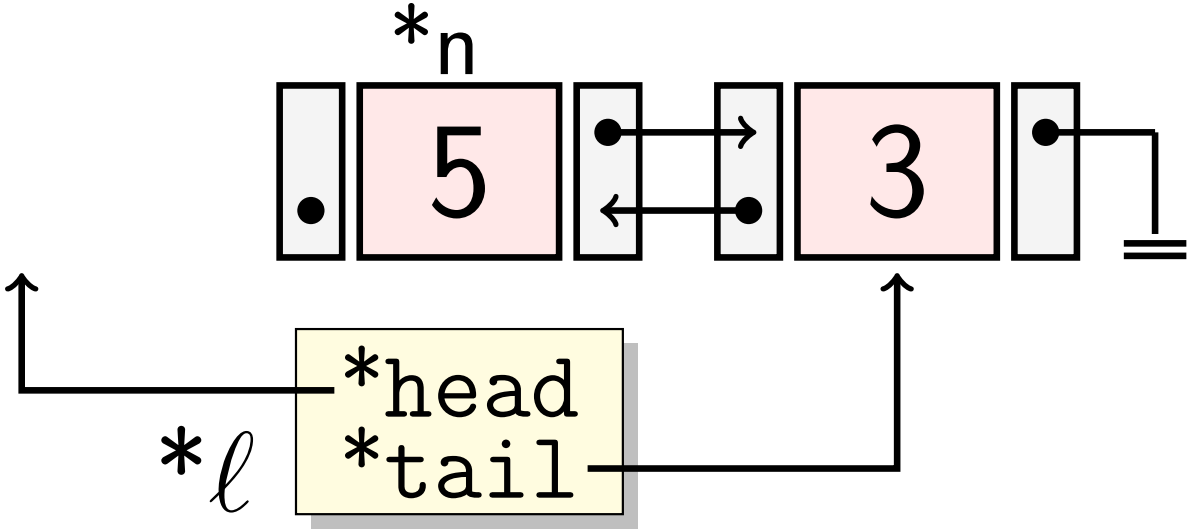


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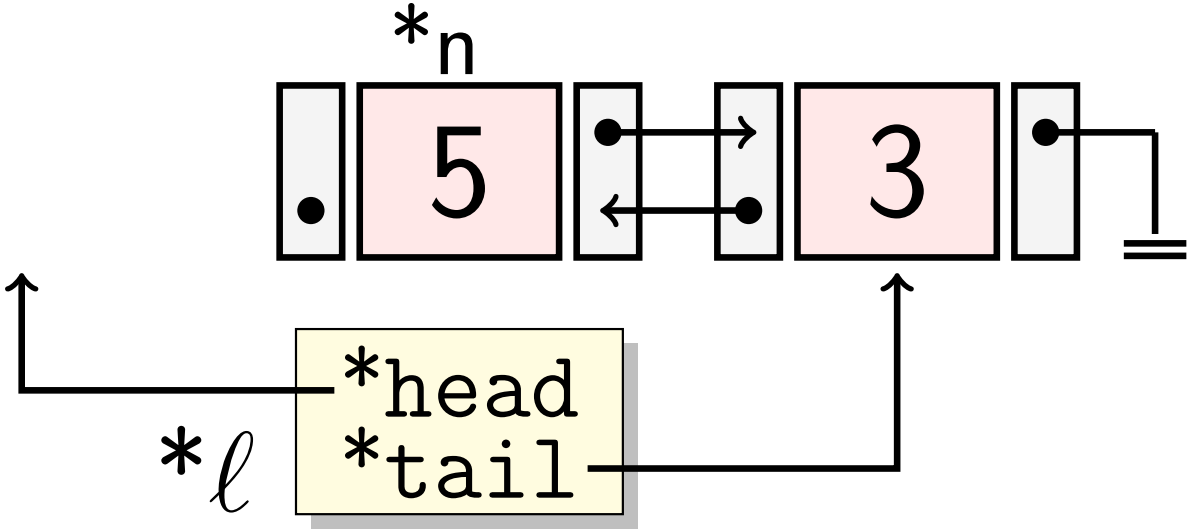


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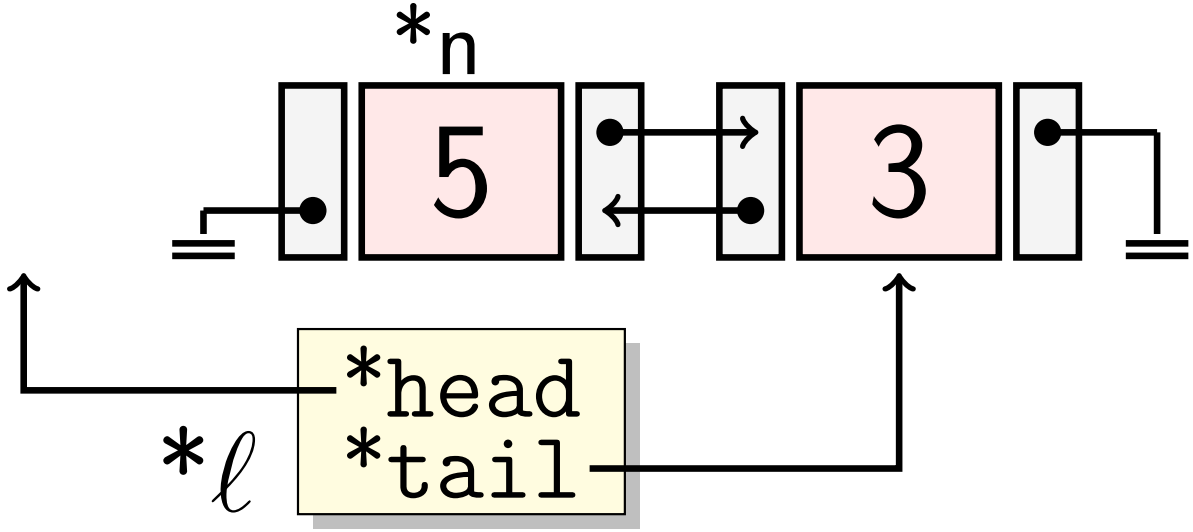


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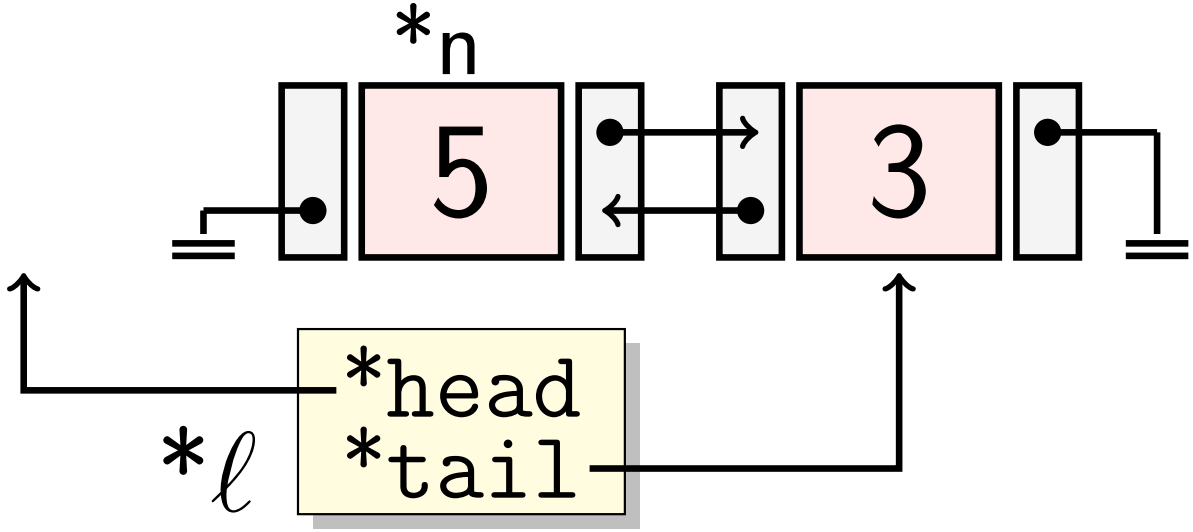


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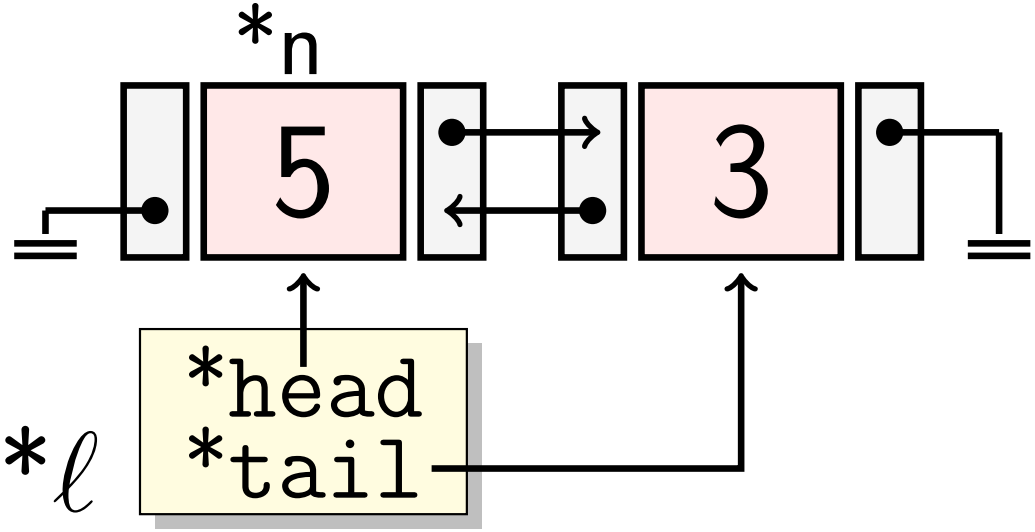


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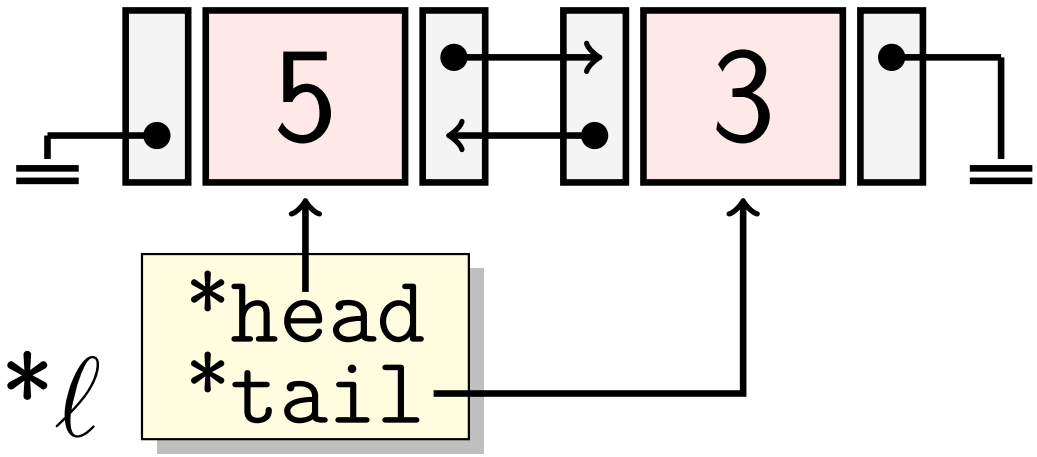


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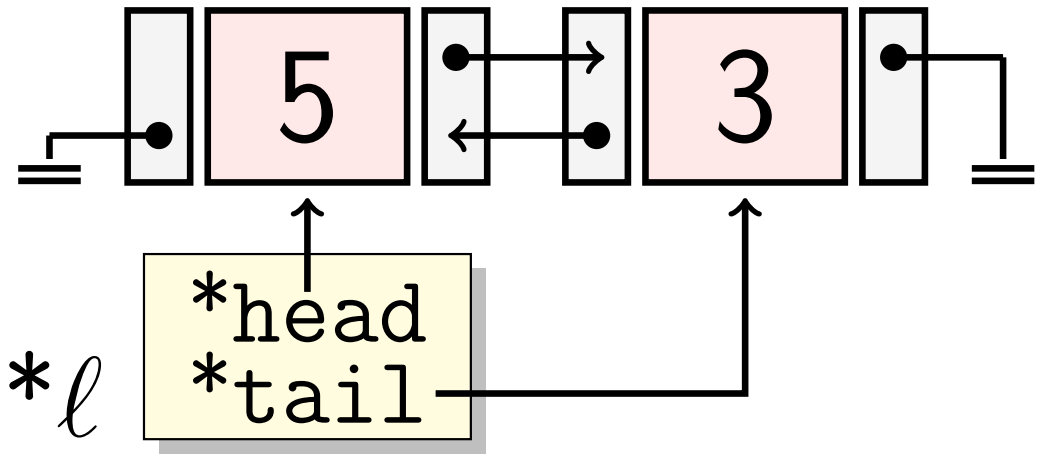


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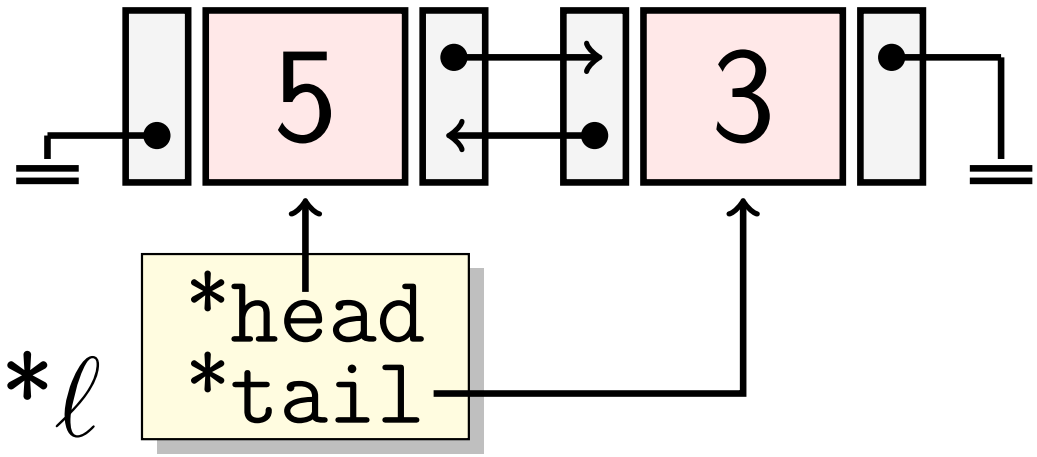


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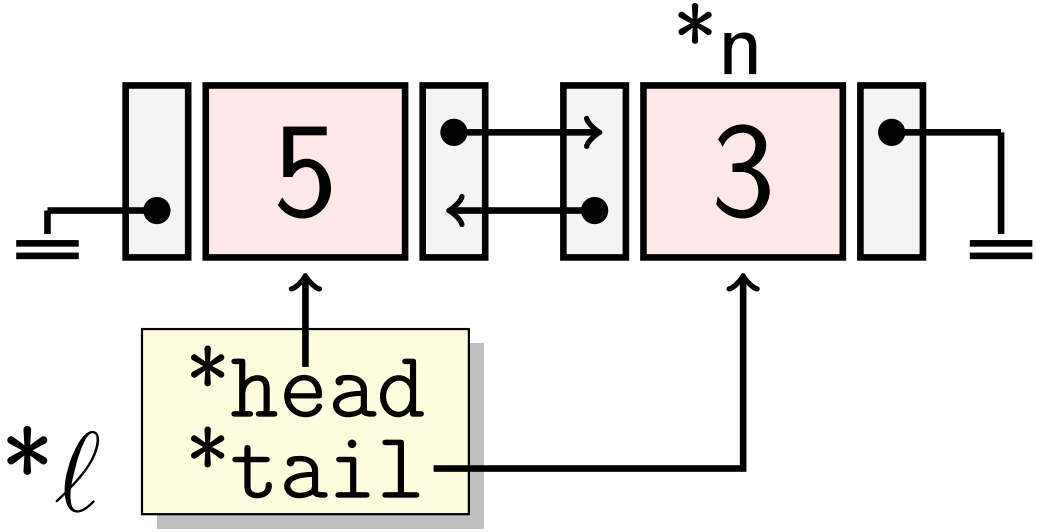


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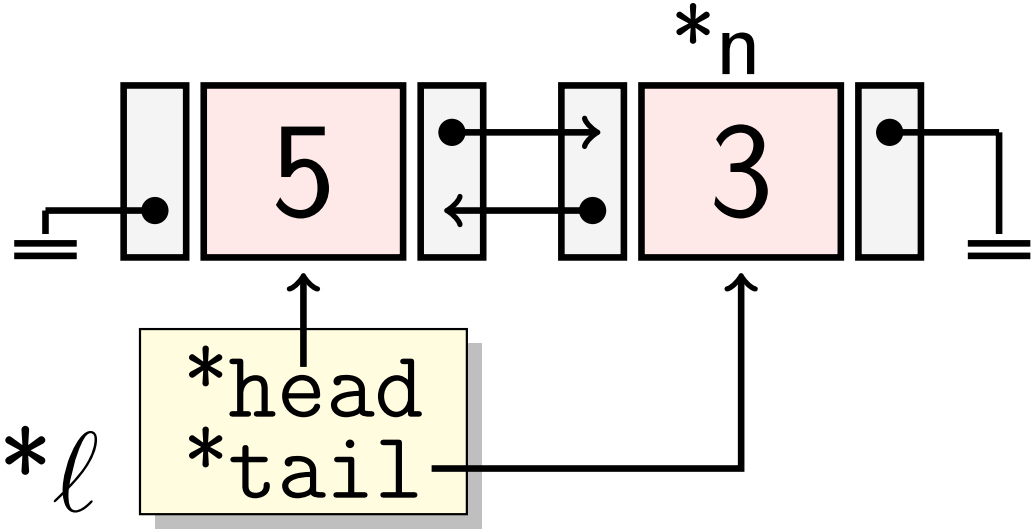


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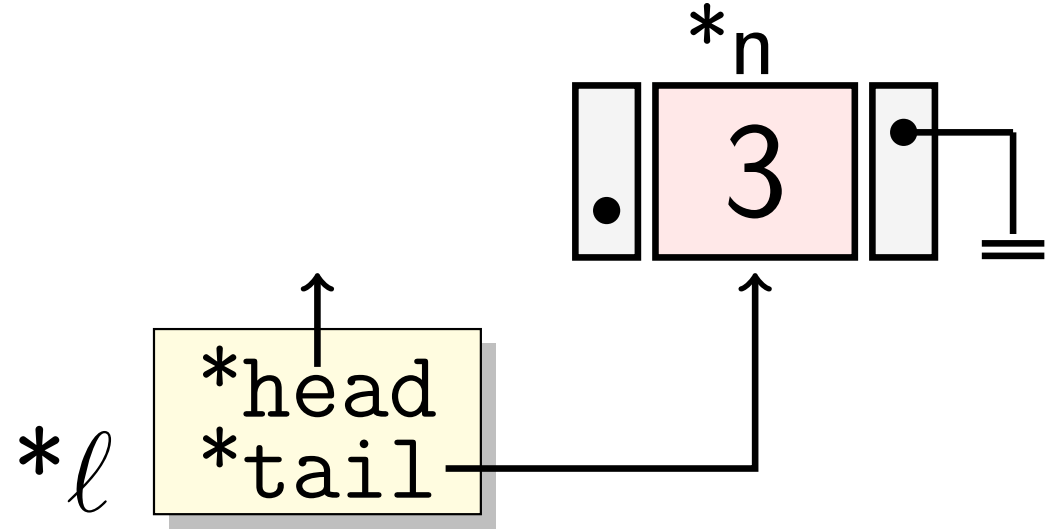


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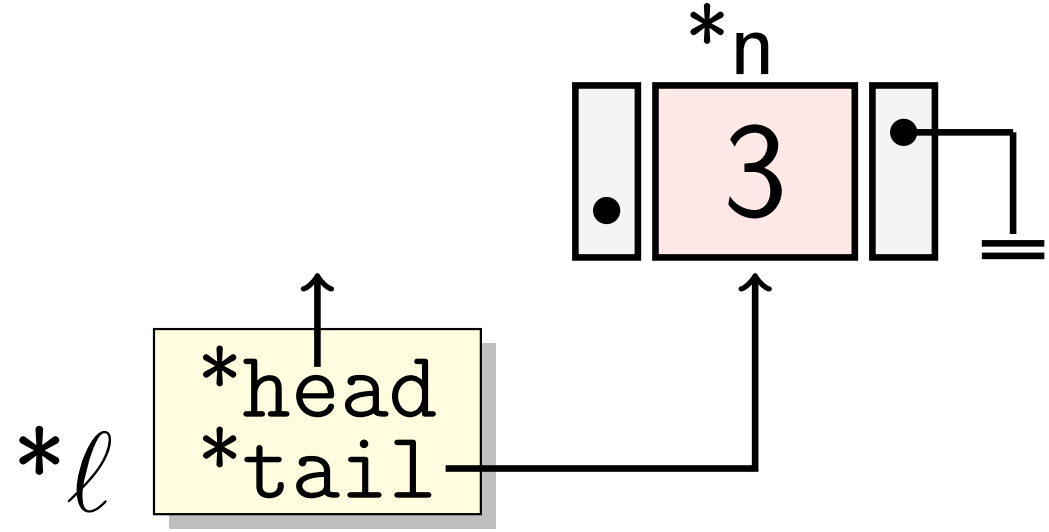


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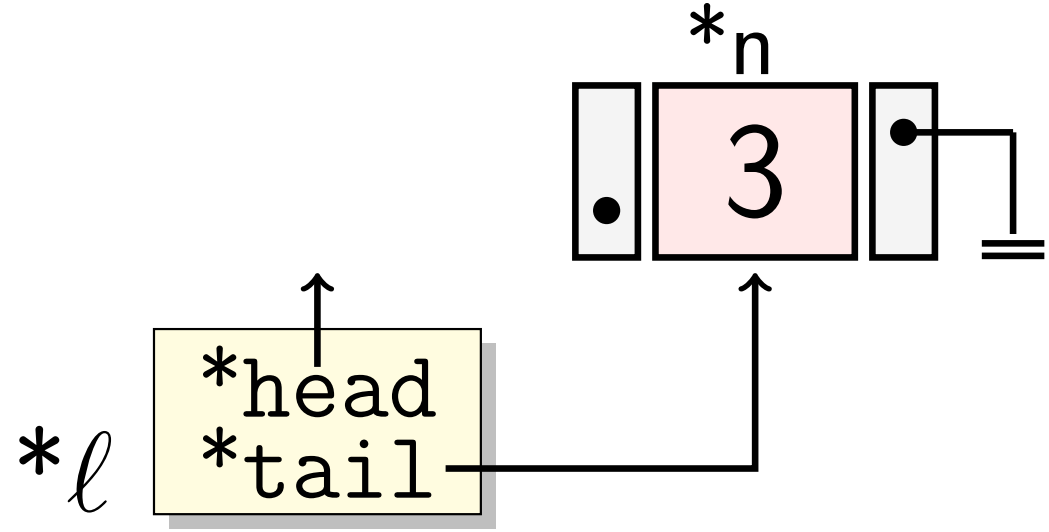


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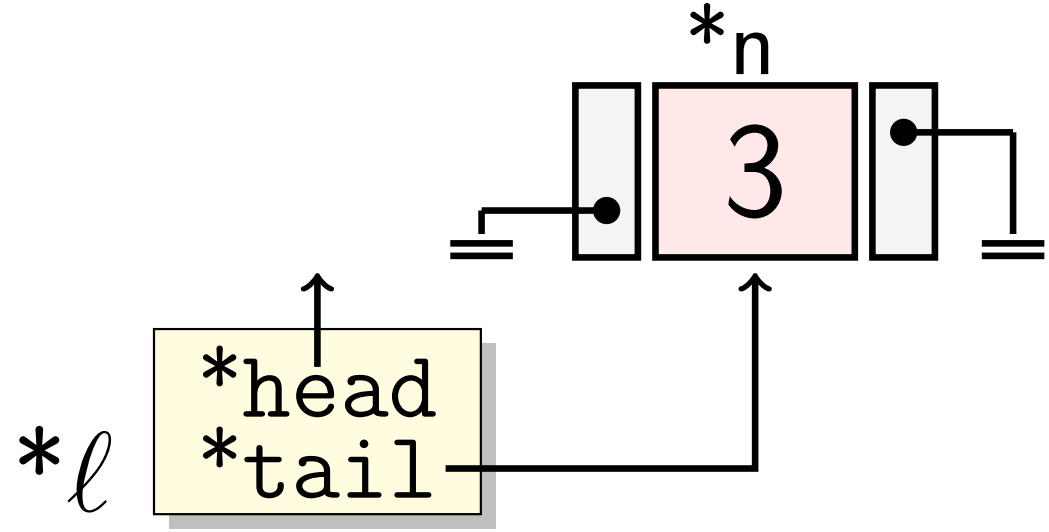


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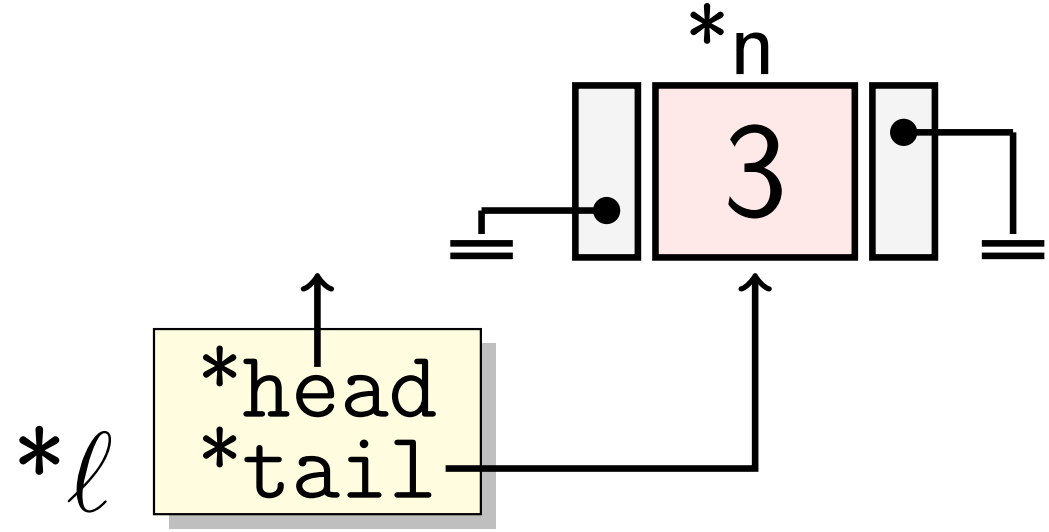


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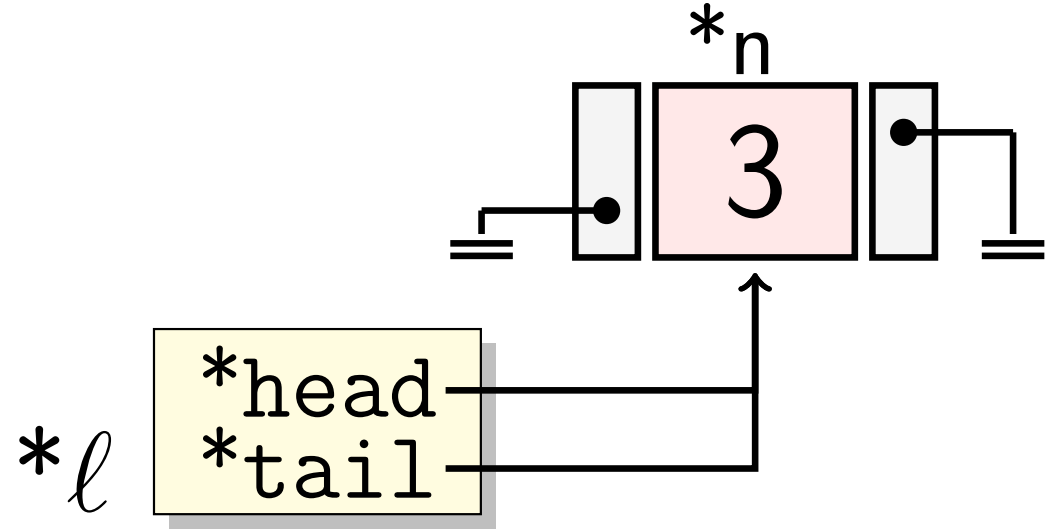


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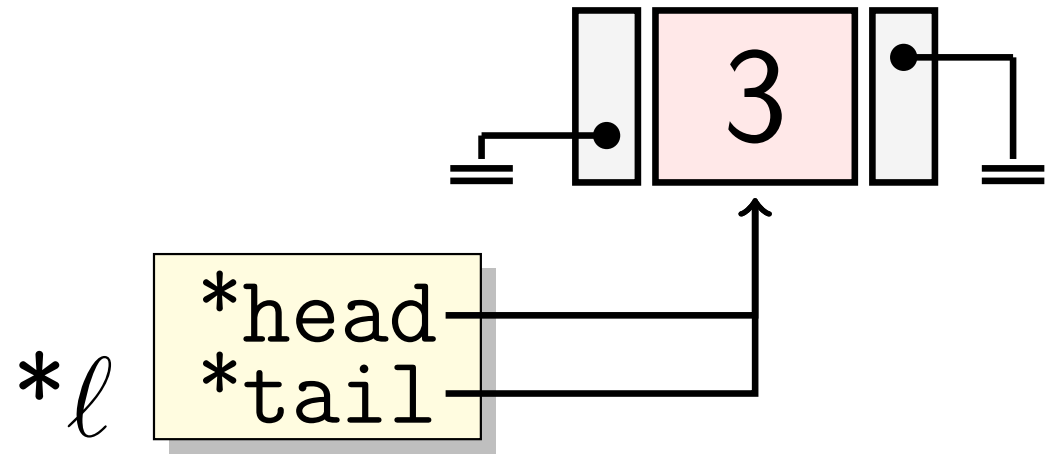


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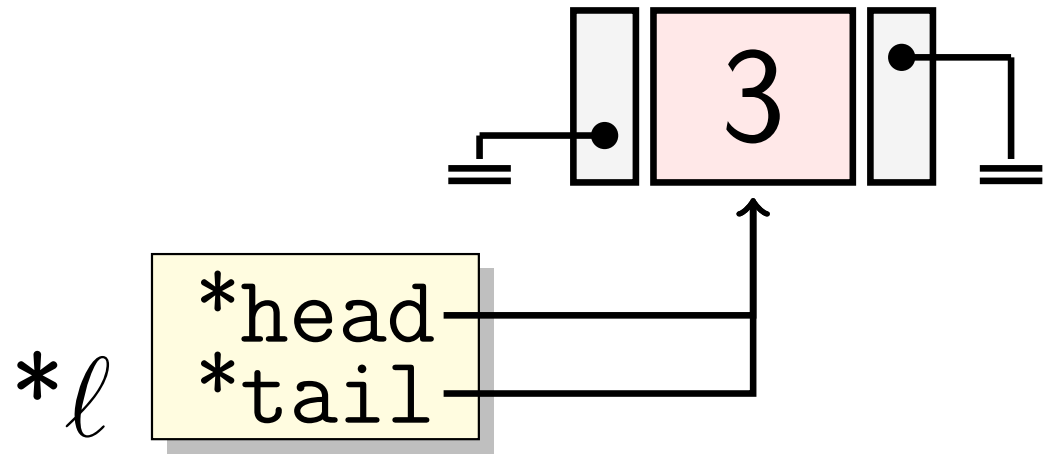


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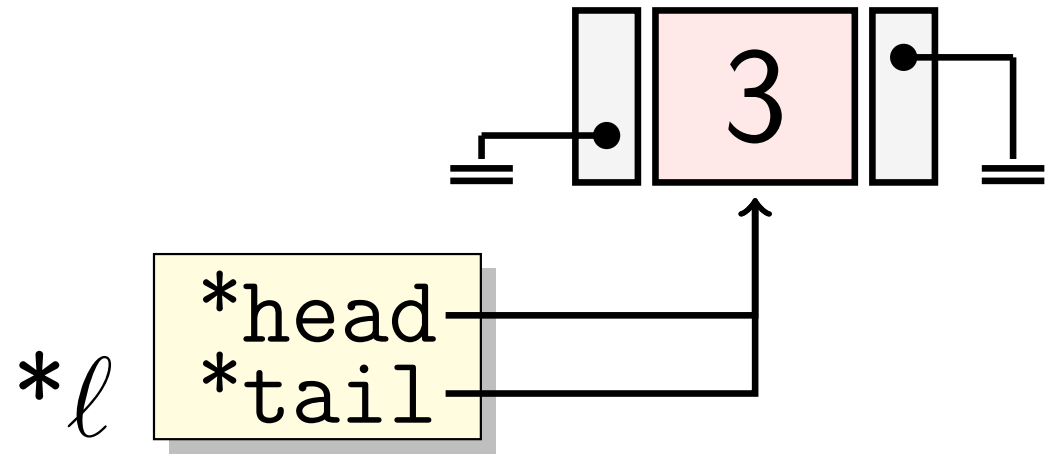


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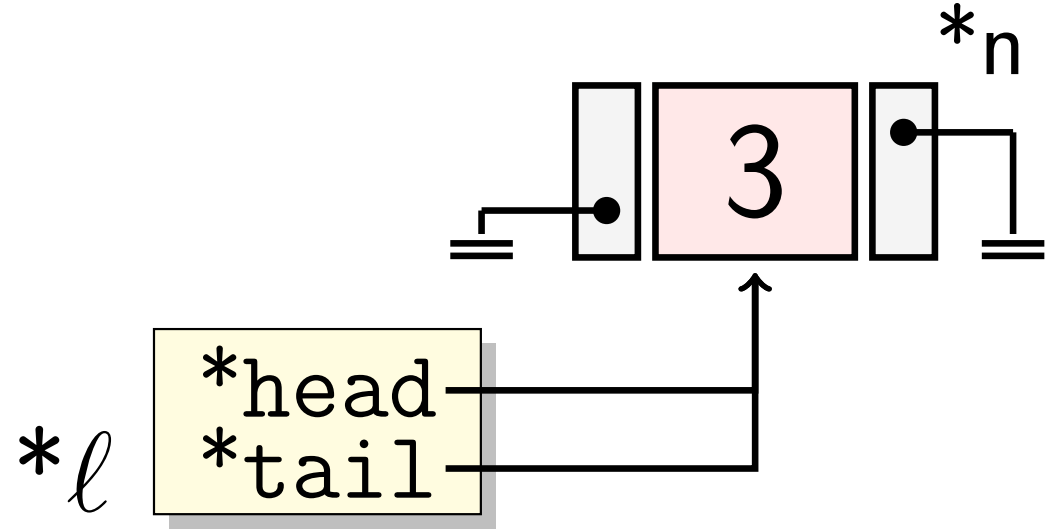


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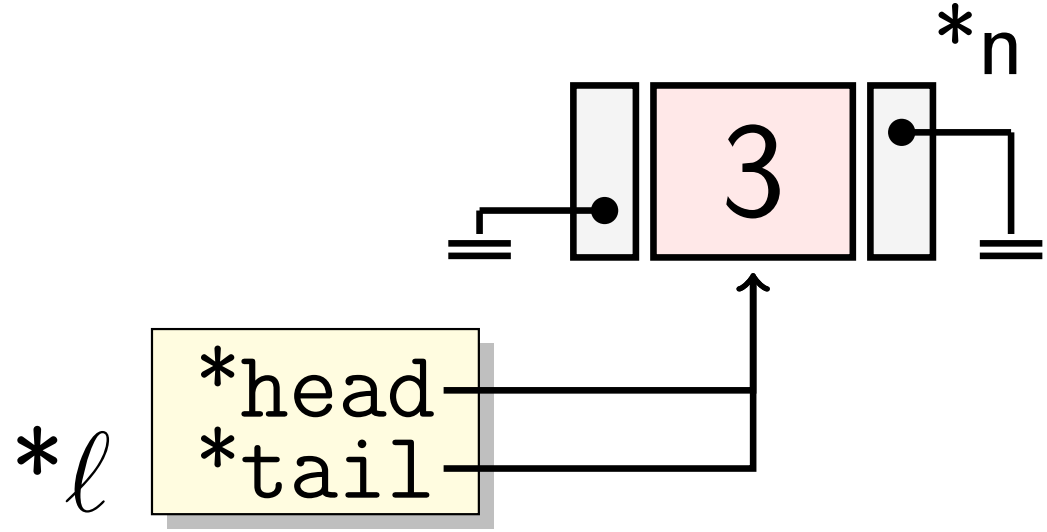


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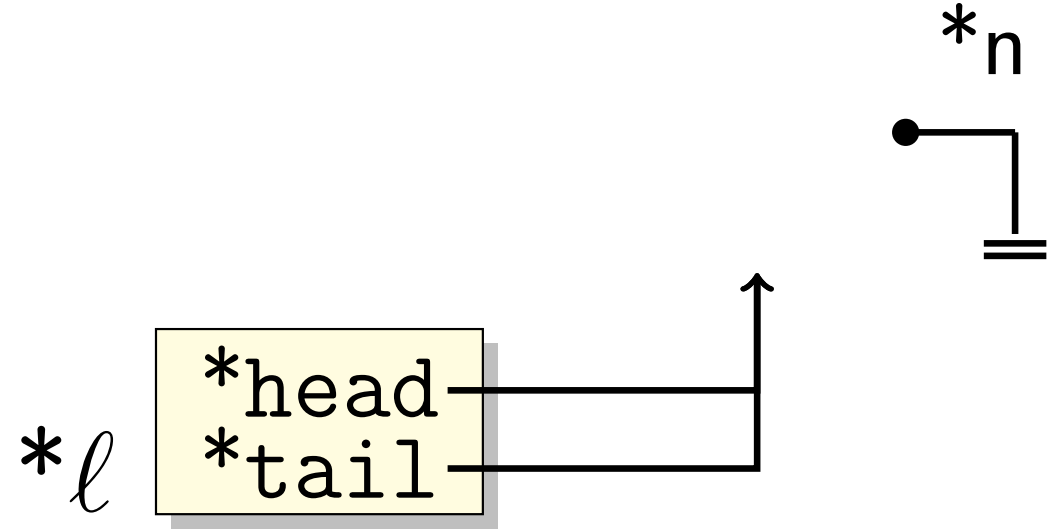


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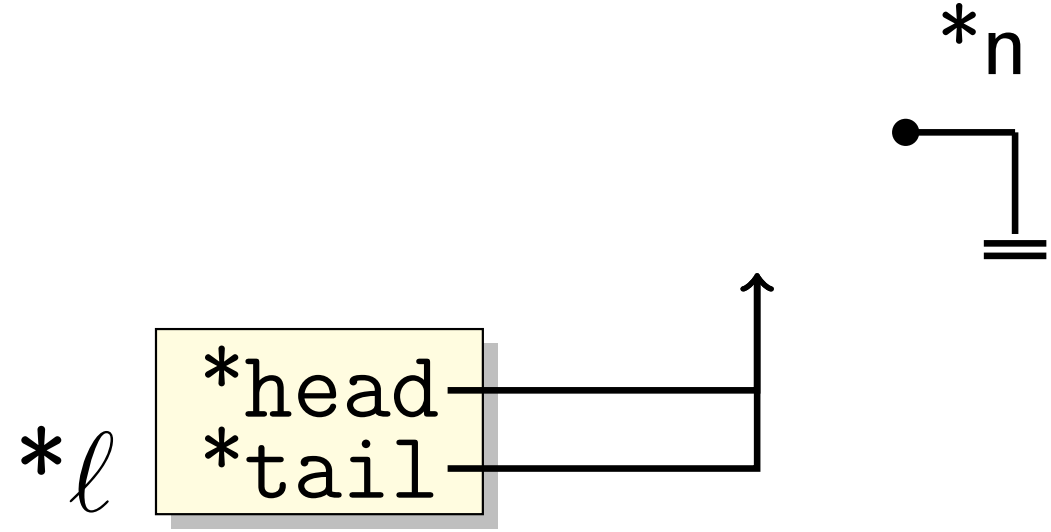


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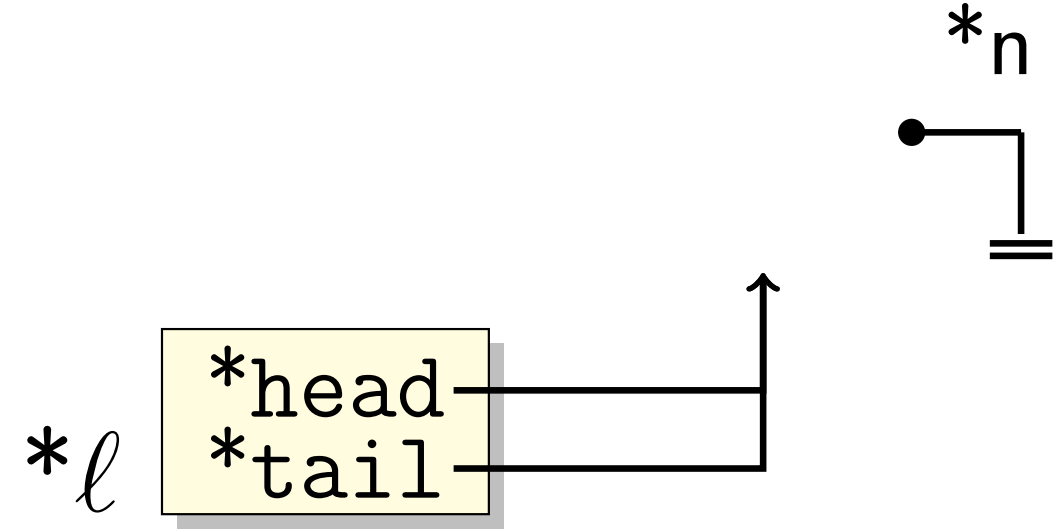


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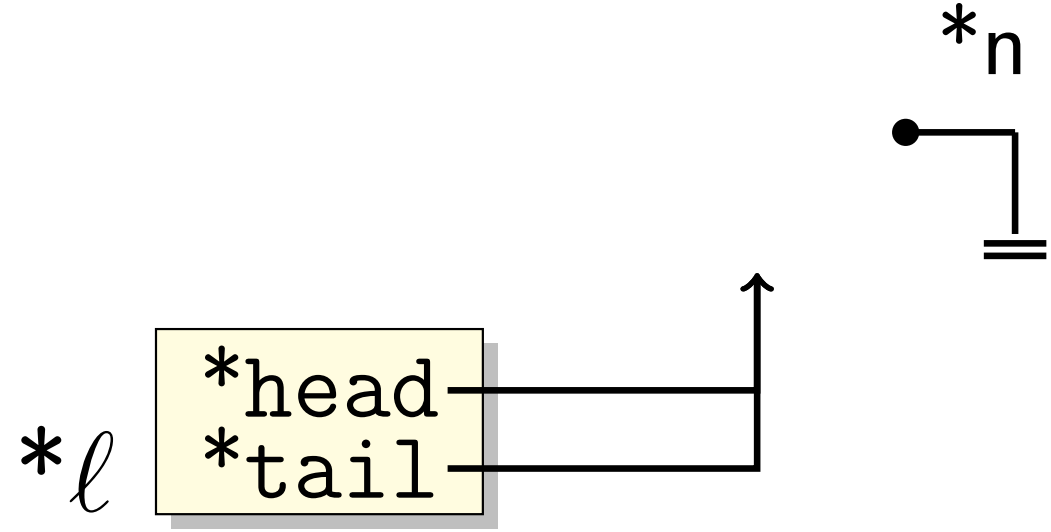
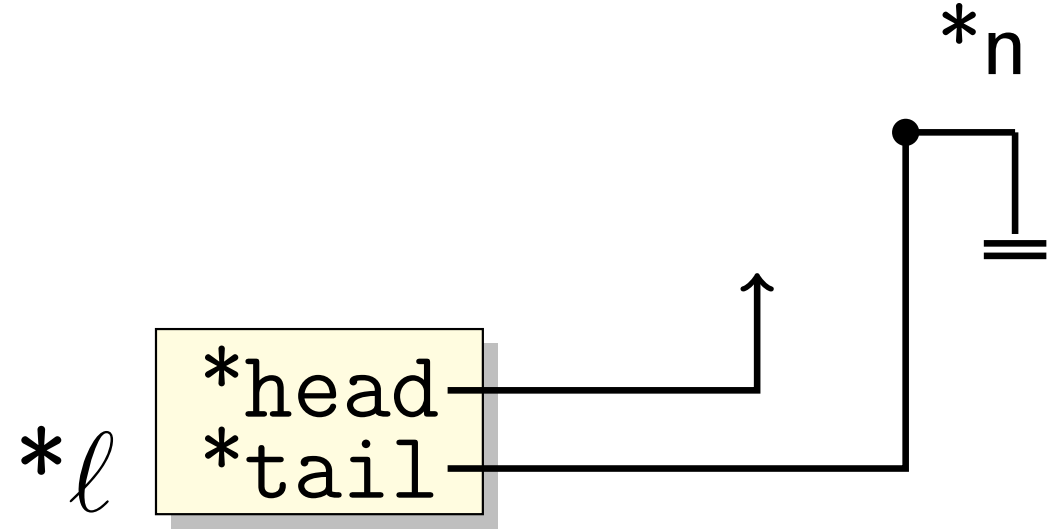
Remover (início)




```
1: void remove-front (List *ℓ, int elem)
2:     if (ℓ →head ≠ NULL)
3:         Node *n = ℓ →head→next;
4:         free (ℓ →head);
5:         if (n ≠ NULL)
6:             n→prev = NULL;
7:         else
8:             ℓ →tail = NULL;
9:         ℓ →head = n;
```

Remover: 3

Remover (início)

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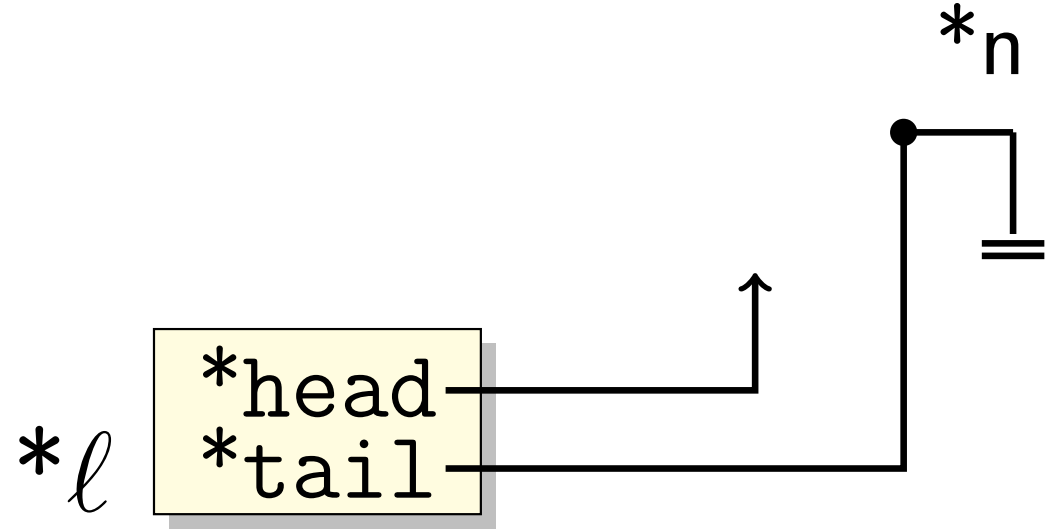


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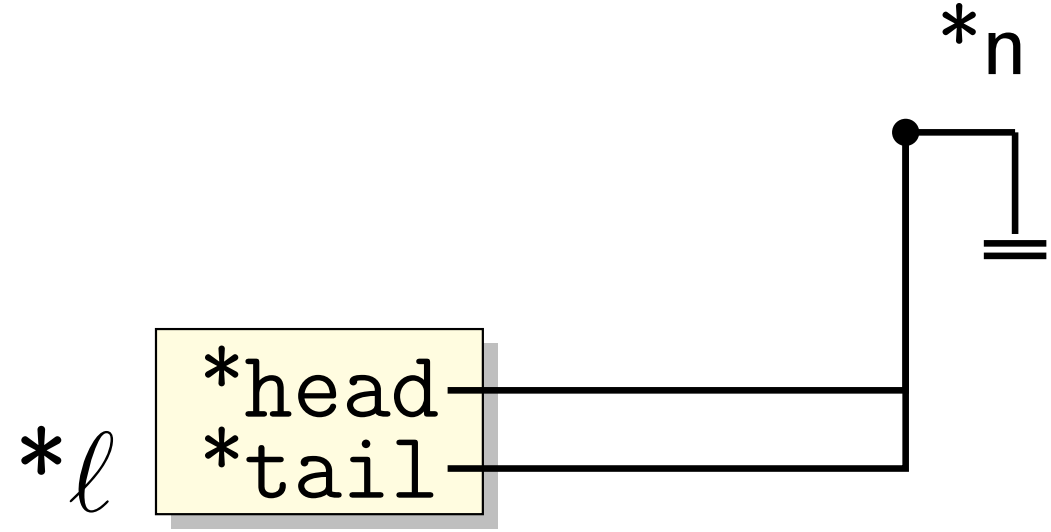


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