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Lista Ligada
(Lista Encadeada)

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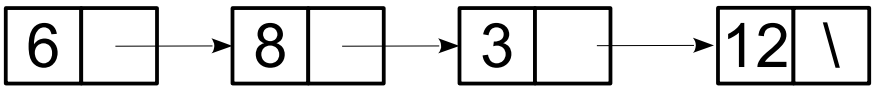
Lista Ligada

- Estrutura de dados linear ou dinâmica.

- A lista encadeada ou lista ligada é uma sequencia de elementos (nós), onde cada nó possui:
  - Um ou mais campos de informações
  - Um ponteiro para o próximo nó da lista



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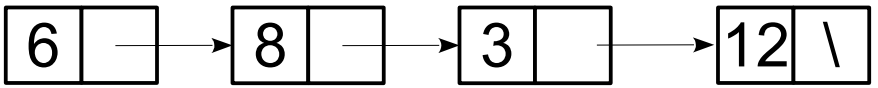
Lista Ligada

- Exemplo
  - Dinâmica



  - Linear

6	8	3	12

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Lista

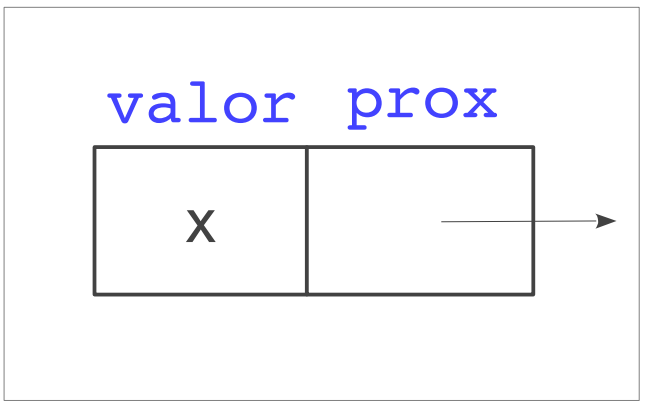
- Conjunto de operações
  - Inicializar lista vazia
  - Inserir um elemento após o i-ésimo elemento da lista
  - Alterar o i-ésimo elemento da lista
  - Ordenar a lista em ordem crescente ou decrescente
  - Remover o i-ésimo elemento da lista
  - Concatenar uma lista em outra lista.

Lista Encadeada

- lista.c

```
#include <stdio.h>
#include <stdlib.h>


typedef struct no {
   int valor;
   struct no* prox;
}No;
```



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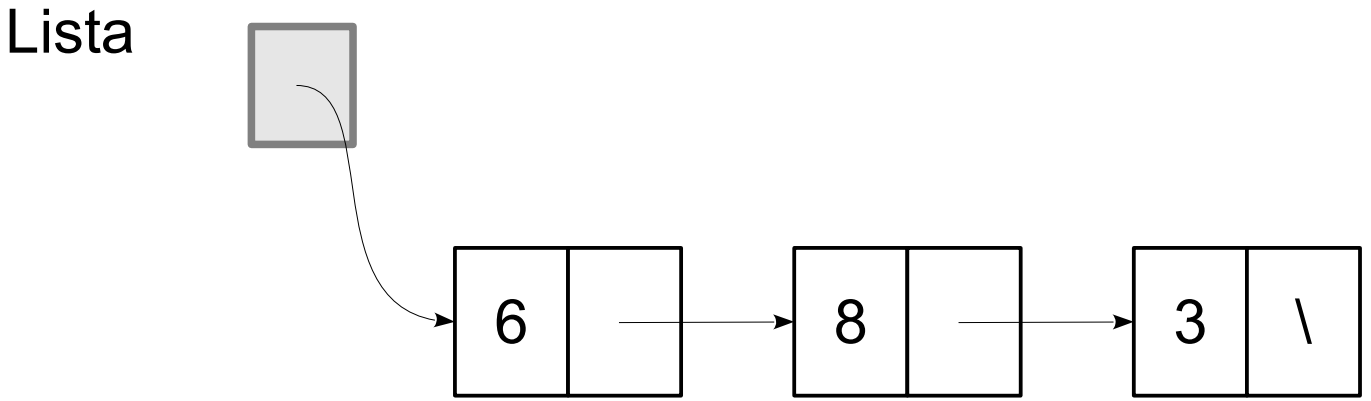
Lista Encadeada



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Lista Encadeada

- lista.c

```
void imprime_lista(No* lista) {
  while (lista != NULL) {
    printf("%d\n", lista->valor);
    lista = lista->prox;
  }
}
```

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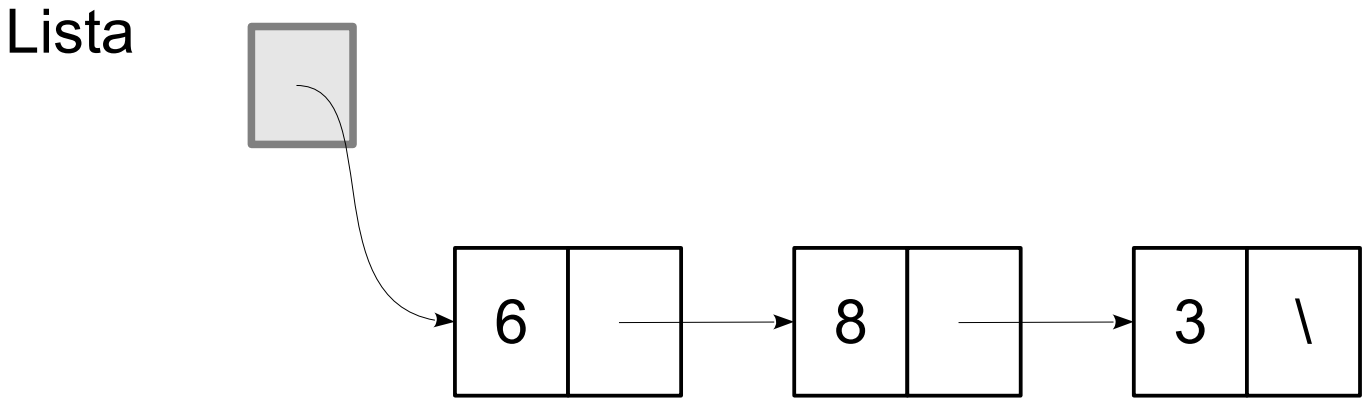
Lista Encadeada



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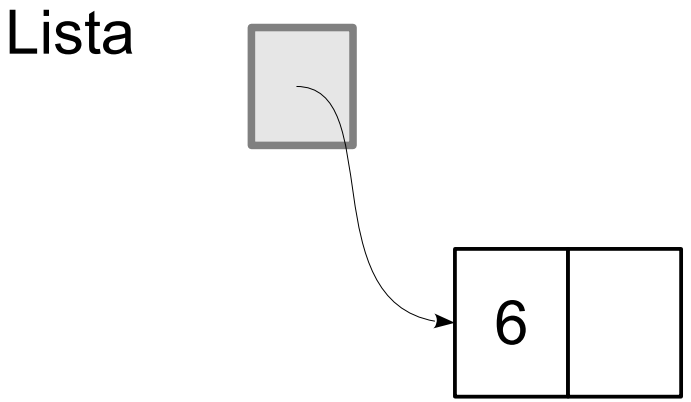
Lista Encadeada



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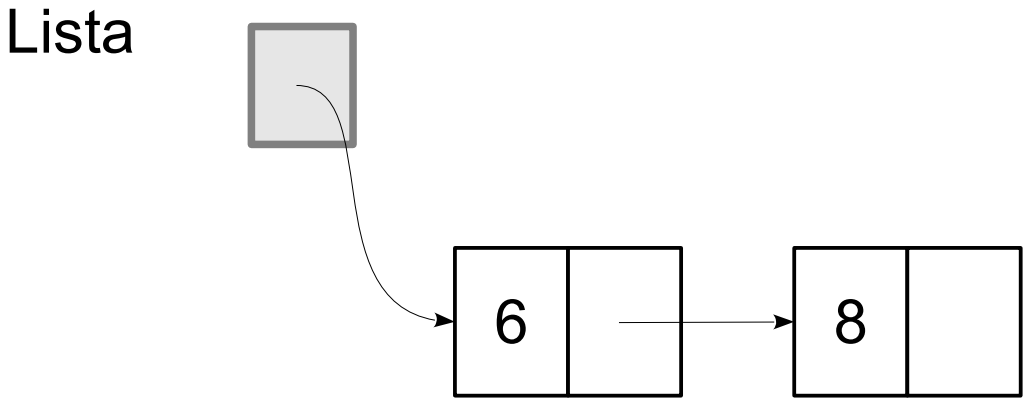
Lista Encadeada



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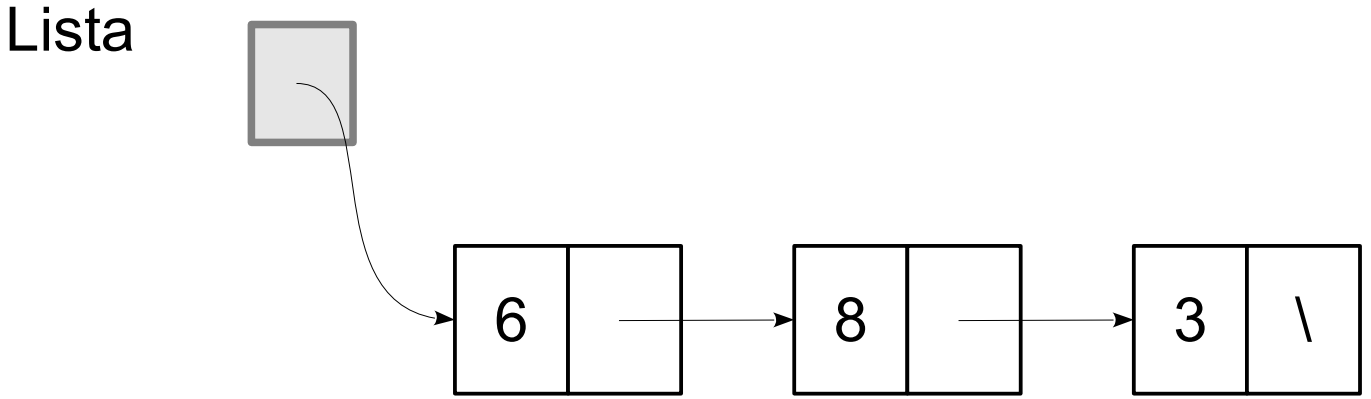
Lista Encadeada



Lista Encadeada

- Função

```
void insere_comeco(No** lista, int valor{
   No* no;
   no = (No*) malloc(sizeof(No));

   no->valor = valor;
   no->prox = *lista;

   *lista = no;

   imprime_lista(*lista);
}

//   ...
```

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Lista Encadeada

```
void main(){

   No* lista;

   lista = NULL;

   insere_comeco(&lista, 3);
   insere_comeco(&lista, 8);
   insere_comeco(&lista, 6);
   insere_comeco(&lista, 6);

   imprime_lista(lista);
}
```

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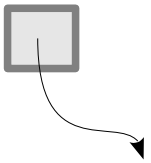
Inicializar a Lista

X = 3

Lista 

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Inicializar a Lista

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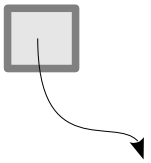
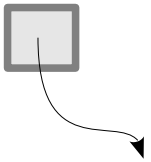
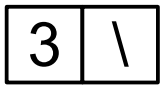
Lista 

Lista 



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Inicializar a Lista

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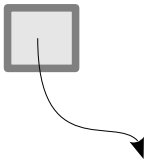
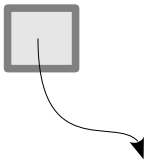
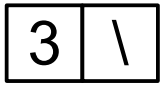
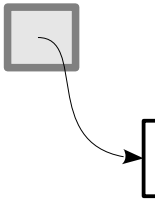
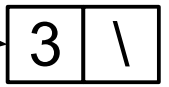
Lista 

Lista 



Lista 



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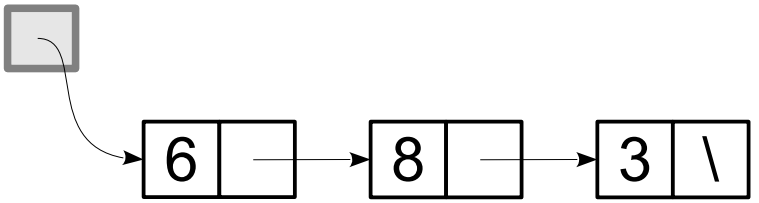
Inserir no início da lista

X = 10

Lista



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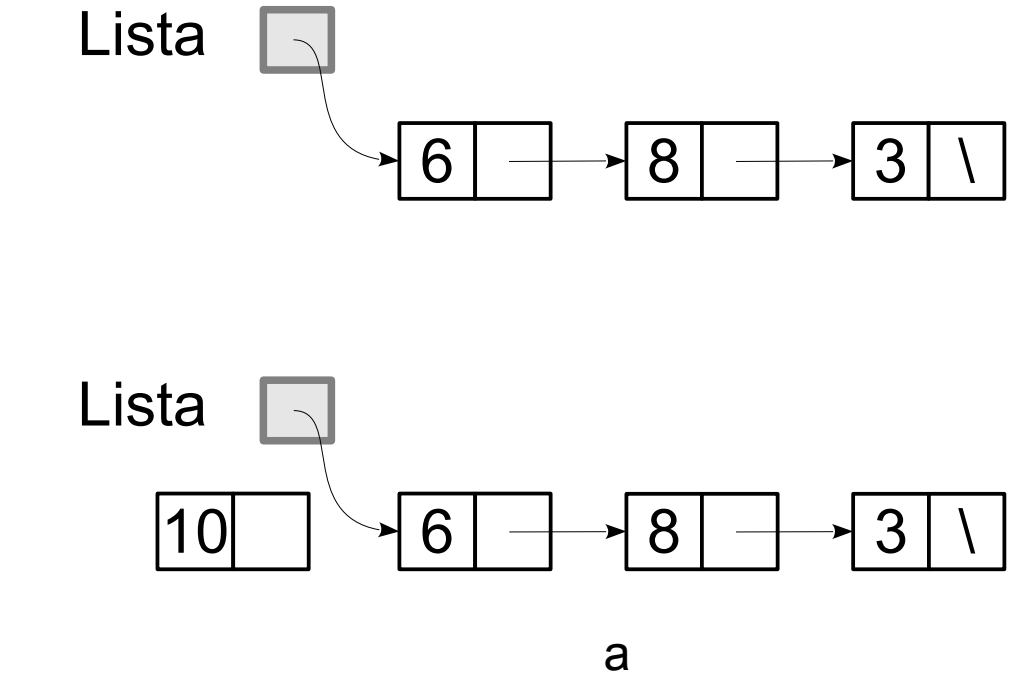
Inserir no início da lista

X = 10



a

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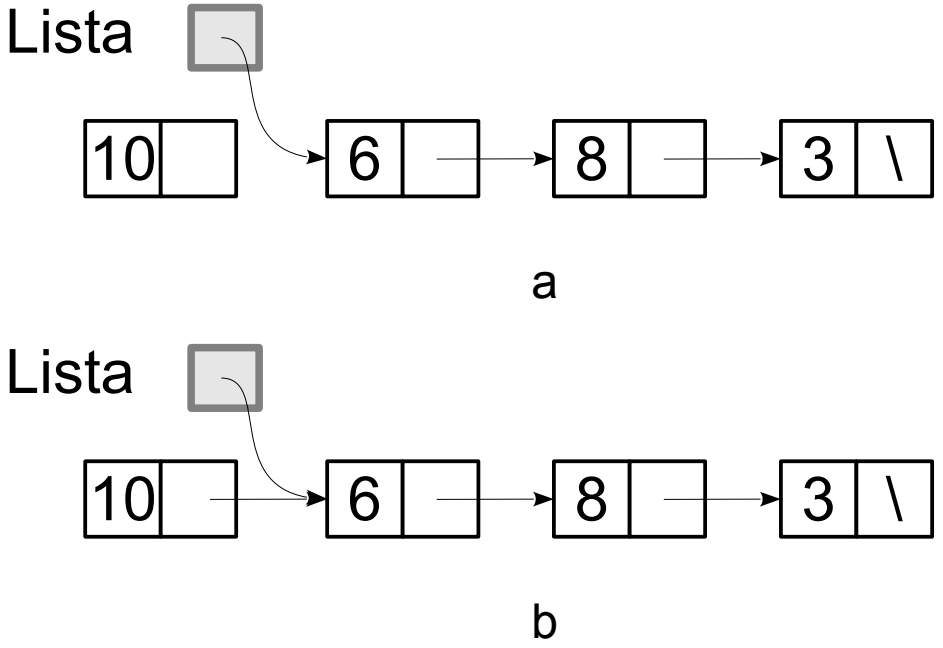
Inserir no início da lista



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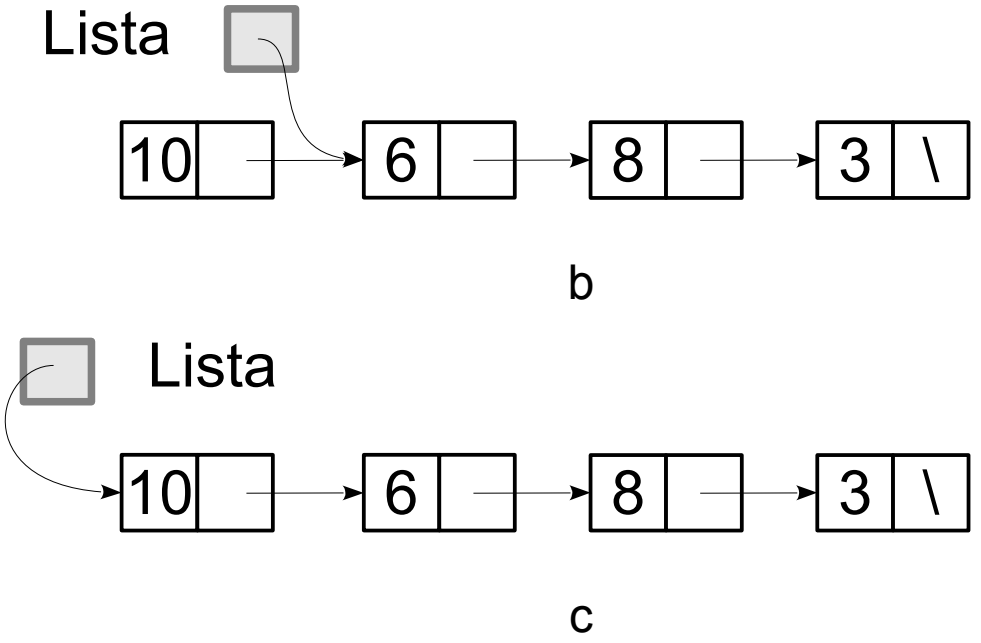
Inserir no início da lista



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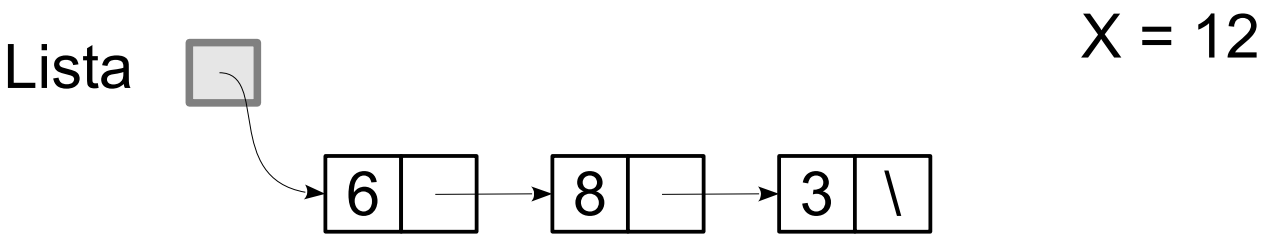
Inserir no final da lista



Inserir no final da lista

```
void insere_final(No** lista, int v) {

   No *n, *aux;
   n = (No*) malloc(sizeof(No));
   n->valor = v;
   n->prox = NULL;  // Ultimo elemento da lista

   if (*lista == NULL)
      *lista = n;
   else {
      aux = *lista;
      while (aux->prox != NULL)
         aux = aux->prox;
      aux->prox = n;
   }
}
```

Inserir no final da lista

```
void main() {

   ...
   insere_final(&lista, 12);
   imprime_lista(lista);

}
```

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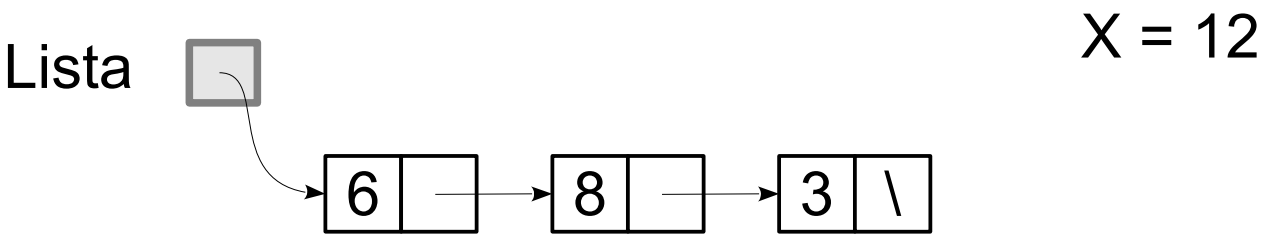
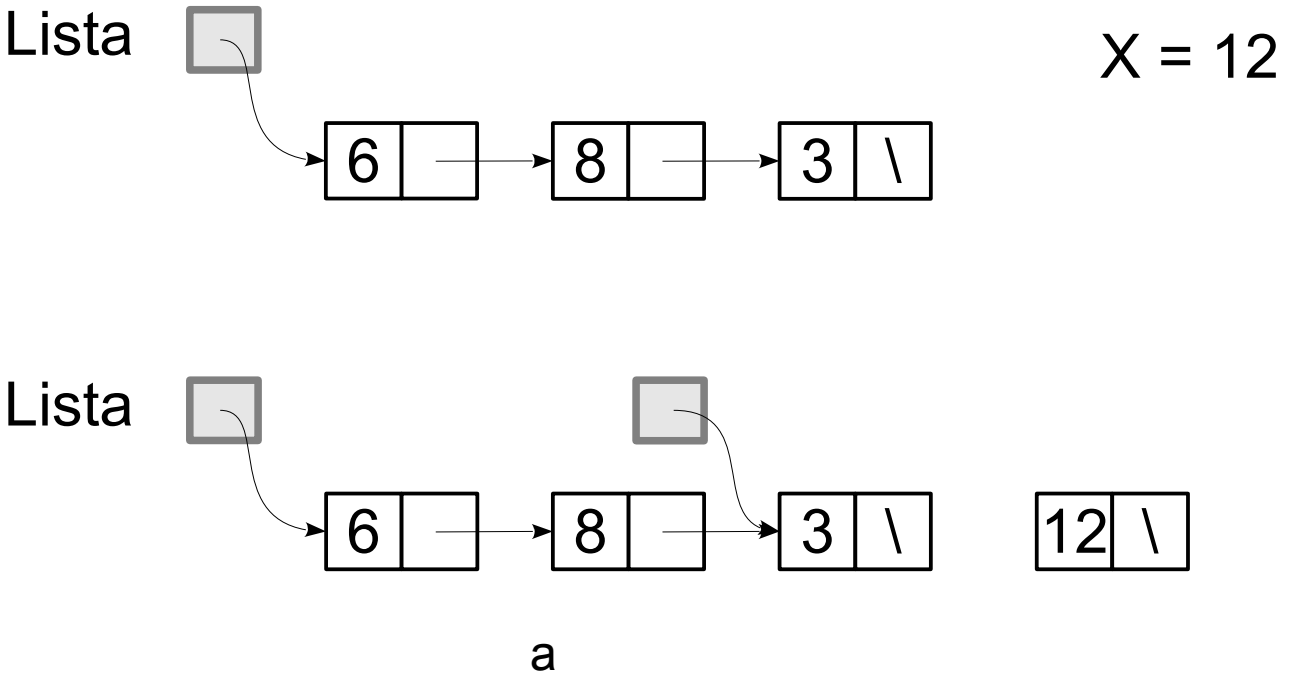
Inserir no final da lista



Inserir no final da lista



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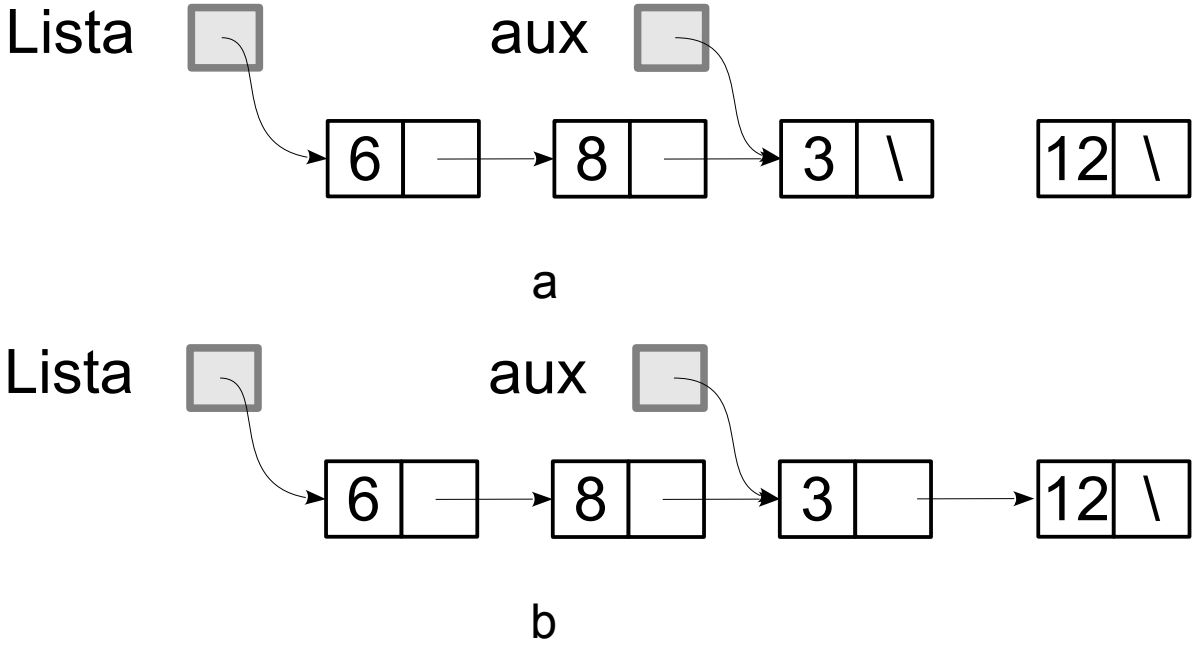
Inserir no final da lista



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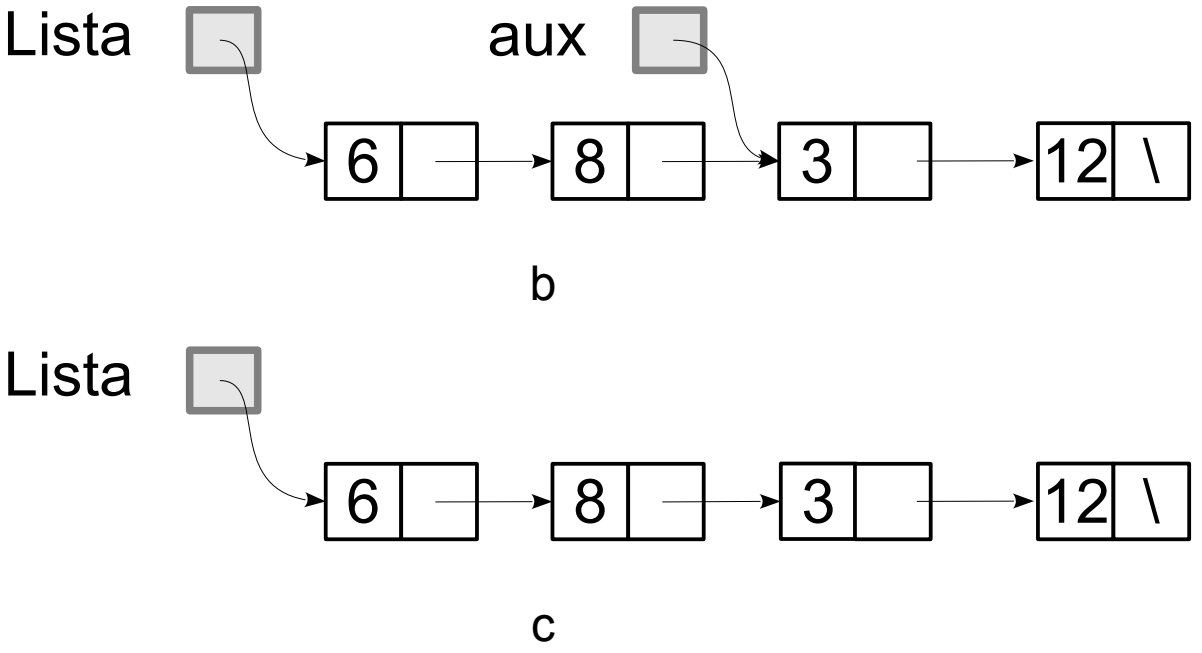
Inserir no final da lista



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Remover no início da lista

```
int remove_inicio(No** lista) {
   No* n;
   int v;

   if (*lista == NULL)
      return -1;

   n = *lista;
   *lista = n->prox;

   v = n->valor;
   free(n);
   return v;
}
```

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Remover no início da lista

```
void main() {

   ...
   while (remove_inicio(&lista) != -1)
     imprime_lista(l);
}
```

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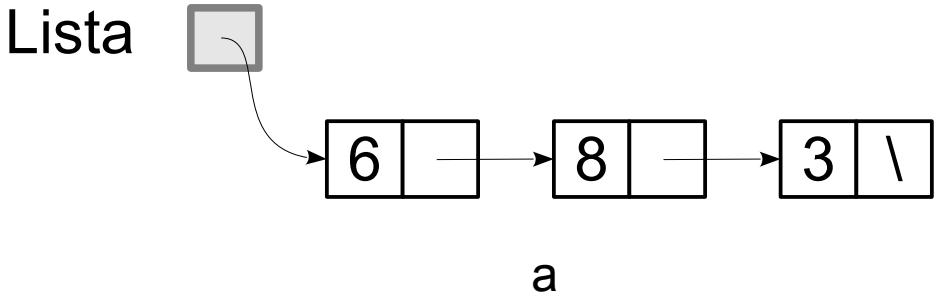
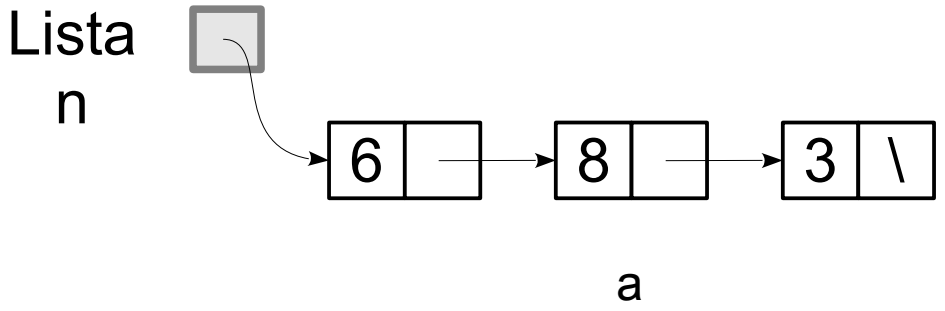
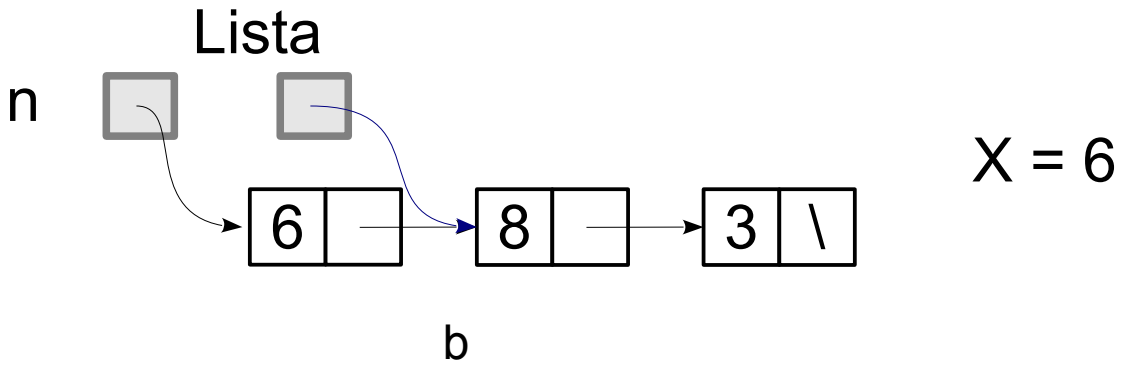
Remover no início da lista

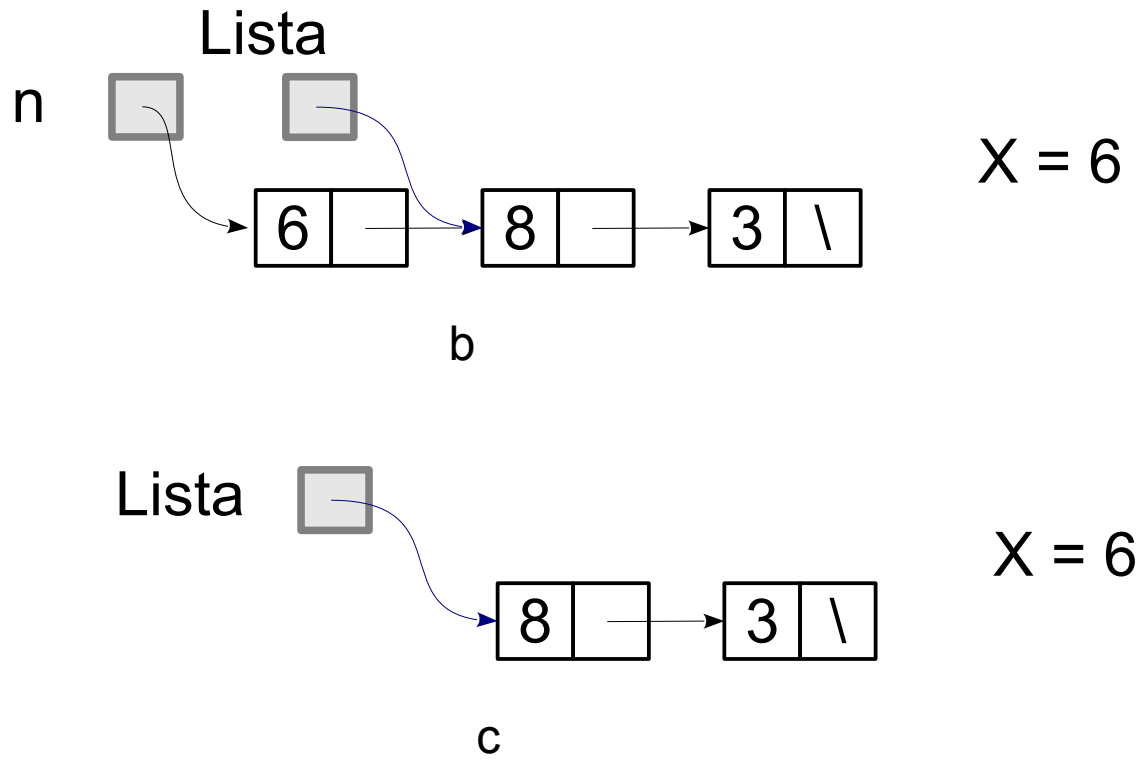


Remover no início da lista





Remover no início da lista



Remover no final da lista

```
int remove_final(No** lista) {
   No *n, *aux;
   int v;

   if (*lista == NULL)
      return -1;
   if ((*lista)->prox == NULL) {
      n = *lista;
      *lista = NULL;
   }
   //...
}
```

Remover no final da lista

```
int remove_final(No** lista) {
   // ...

   else {
      aux = *lista; /* Para no penúltimo nó */
      while (aux->prox->prox != NULL)
         aux = aux->prox;
      n = aux->prox;
      aux->prox = NULL;
   }
   v = n->valor;
   free(n);
   return v;
}
```

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Remover no final da lista

```
void main() {

   ...
   while (remove_final(&lista) != -1)
     imprime_lista(l);
}
```

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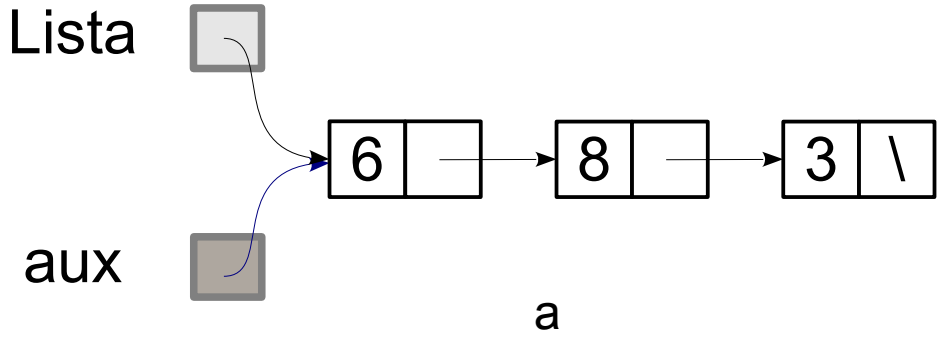
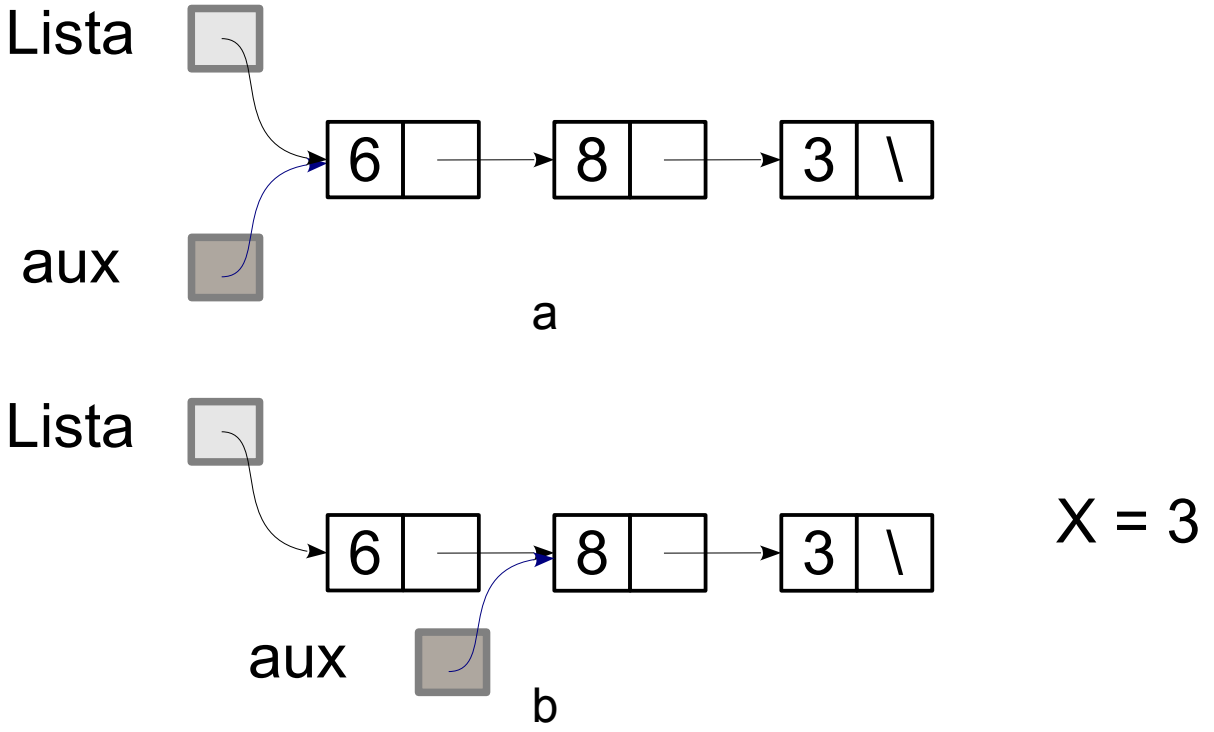
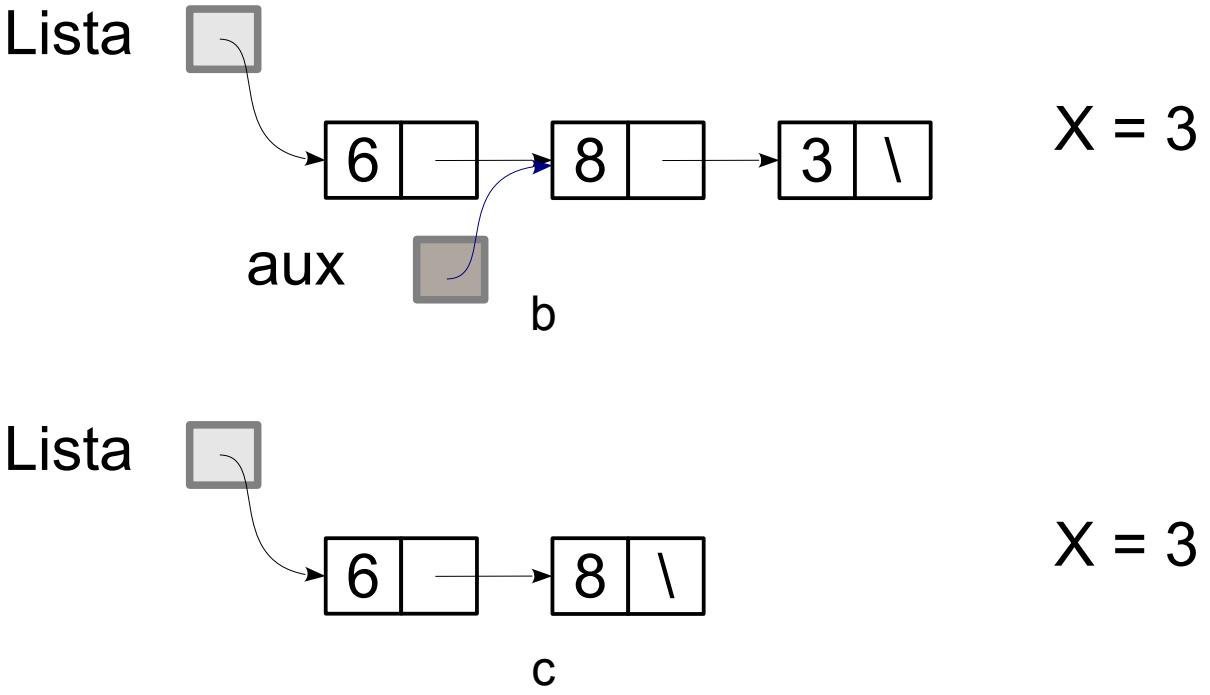
Remover no final da lista



Remover no final da lista



Remover no final da lista



Remover no final da lista