Linked-List

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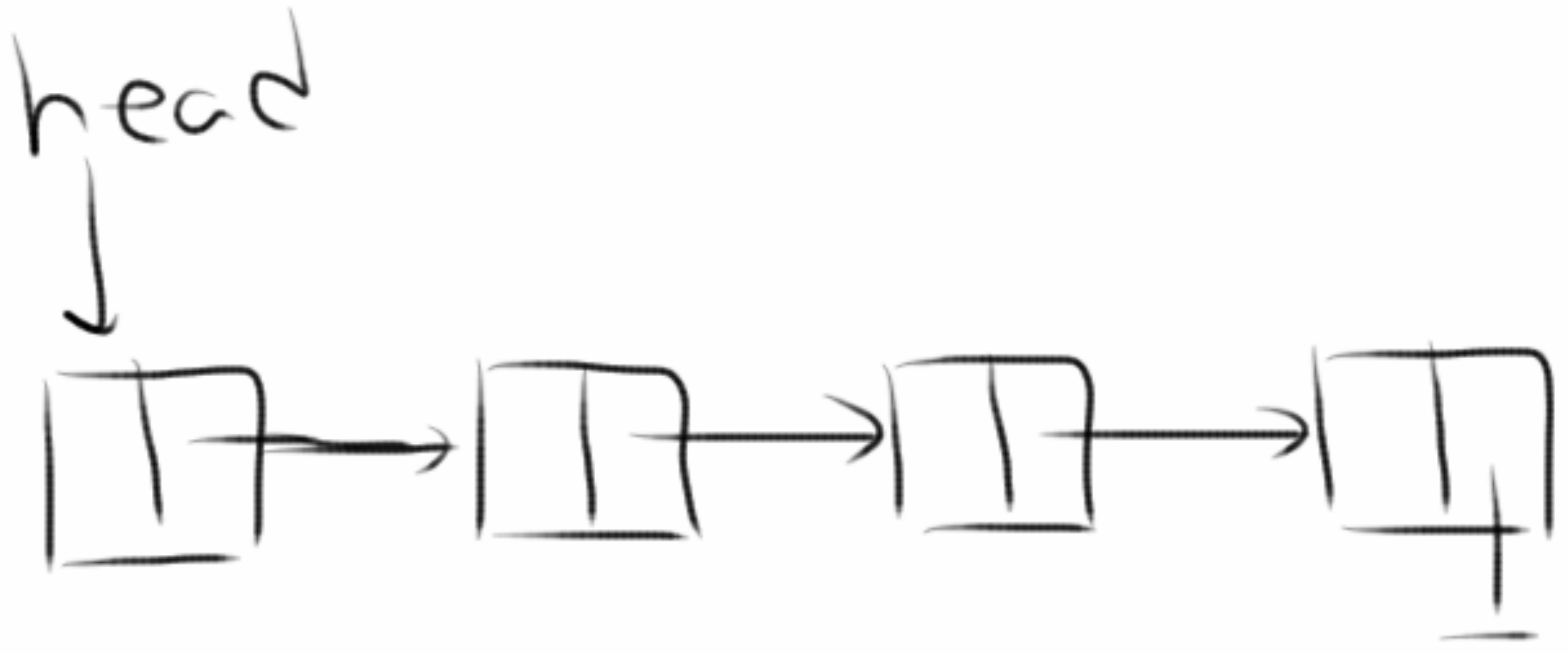
Basic Idea



- node -- 结点

data structure

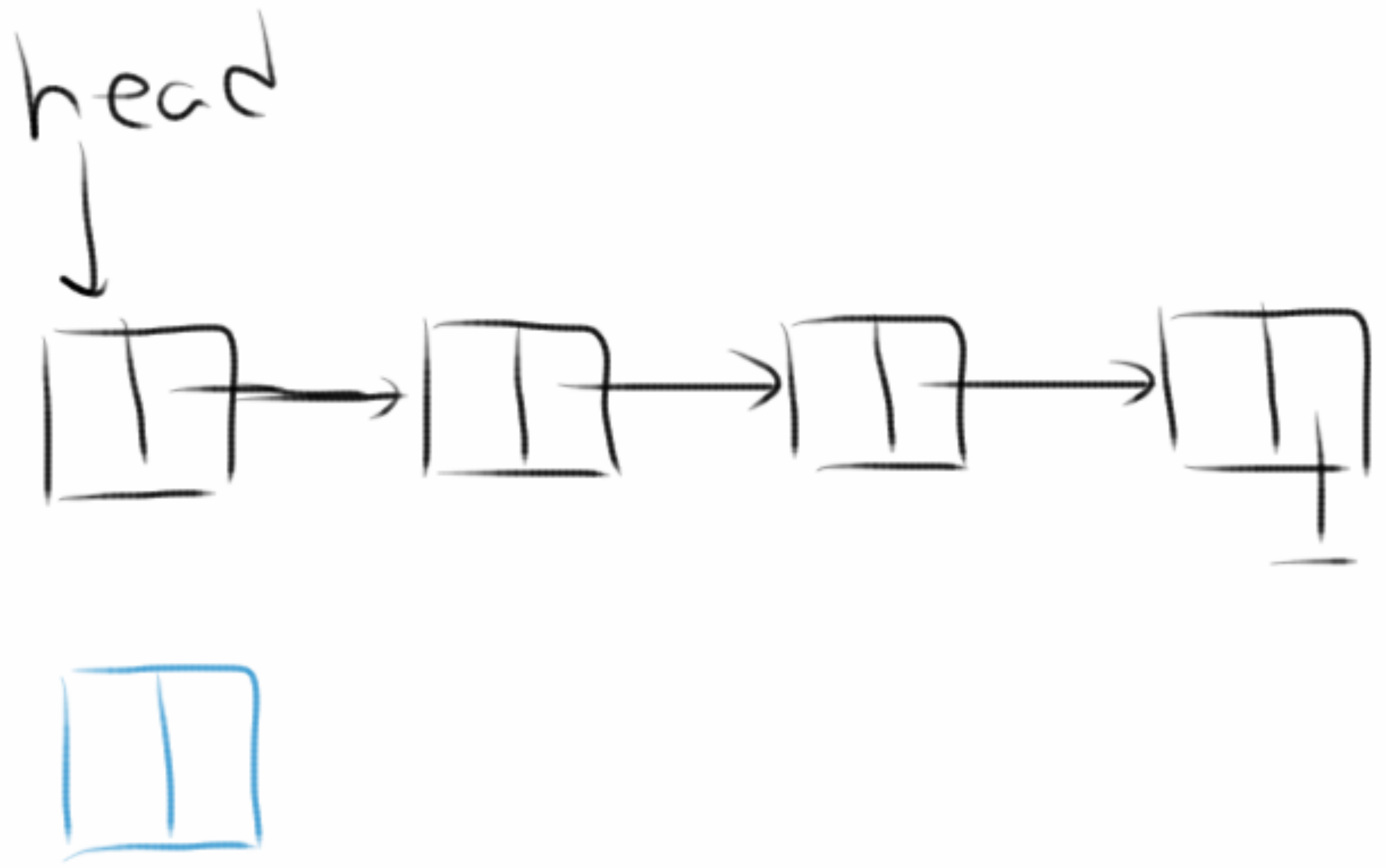
```
typedef struct _node {
    int value;
    struct _node* next;
} Node;
```

basic operation

- insert head
- iterate/search
- append tail
- remove
- clear all

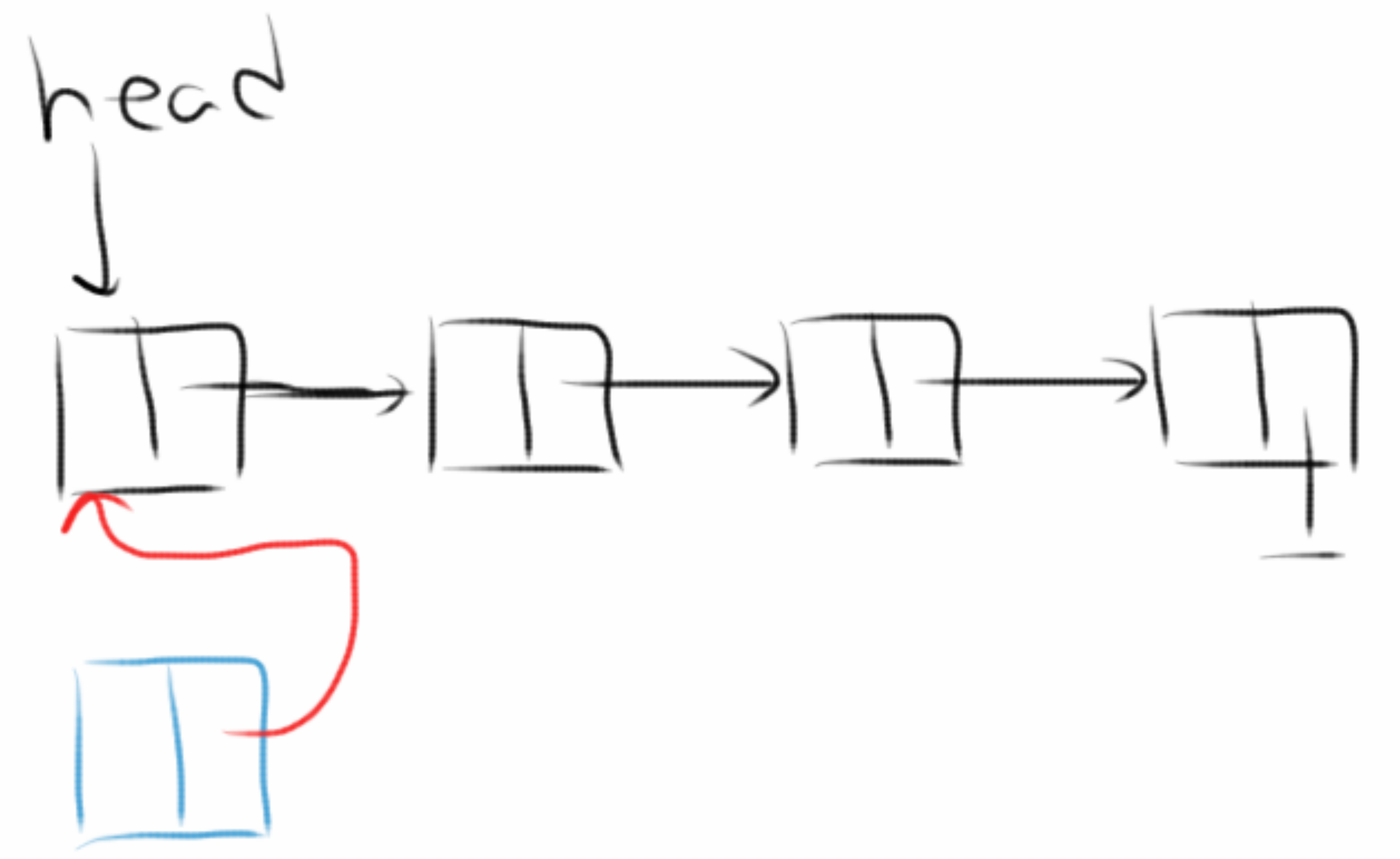
insert head 1

- Create a new node.



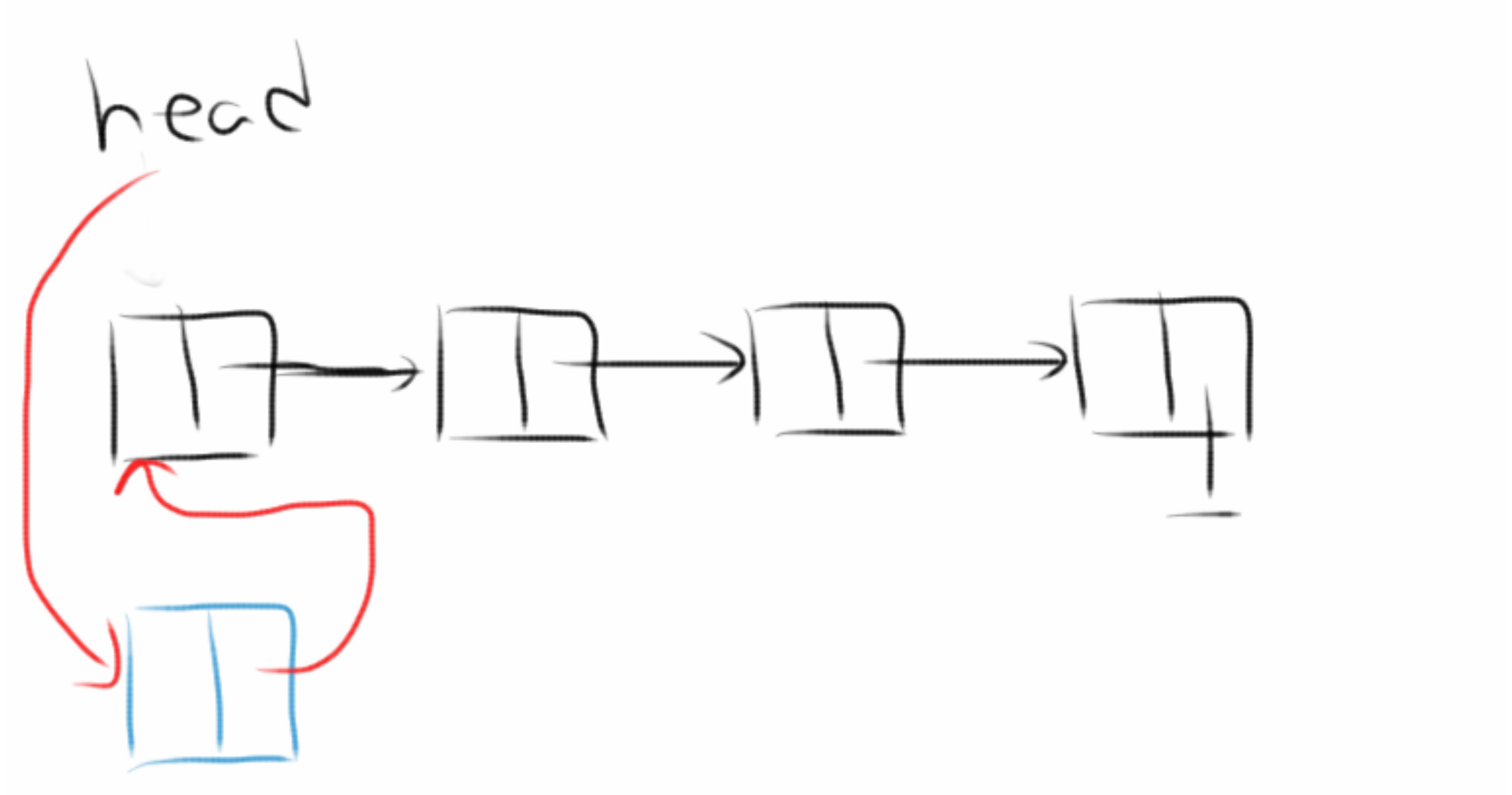
insert head 1I

- Make the new next point to the head.



insert head III

- Point the head to the new node.



insert head IV

```
Node* n =
(Node*)malloc(sizeof(Node));
n->value = i;
n->next = head;
head = n;
```

- Any boundary condition?

make it a func?

- void add_head(Node* head, int i);
- void add_head(Node** pHead, int i);
- Node* add_head(Node* head, int i);
- ??

struct List

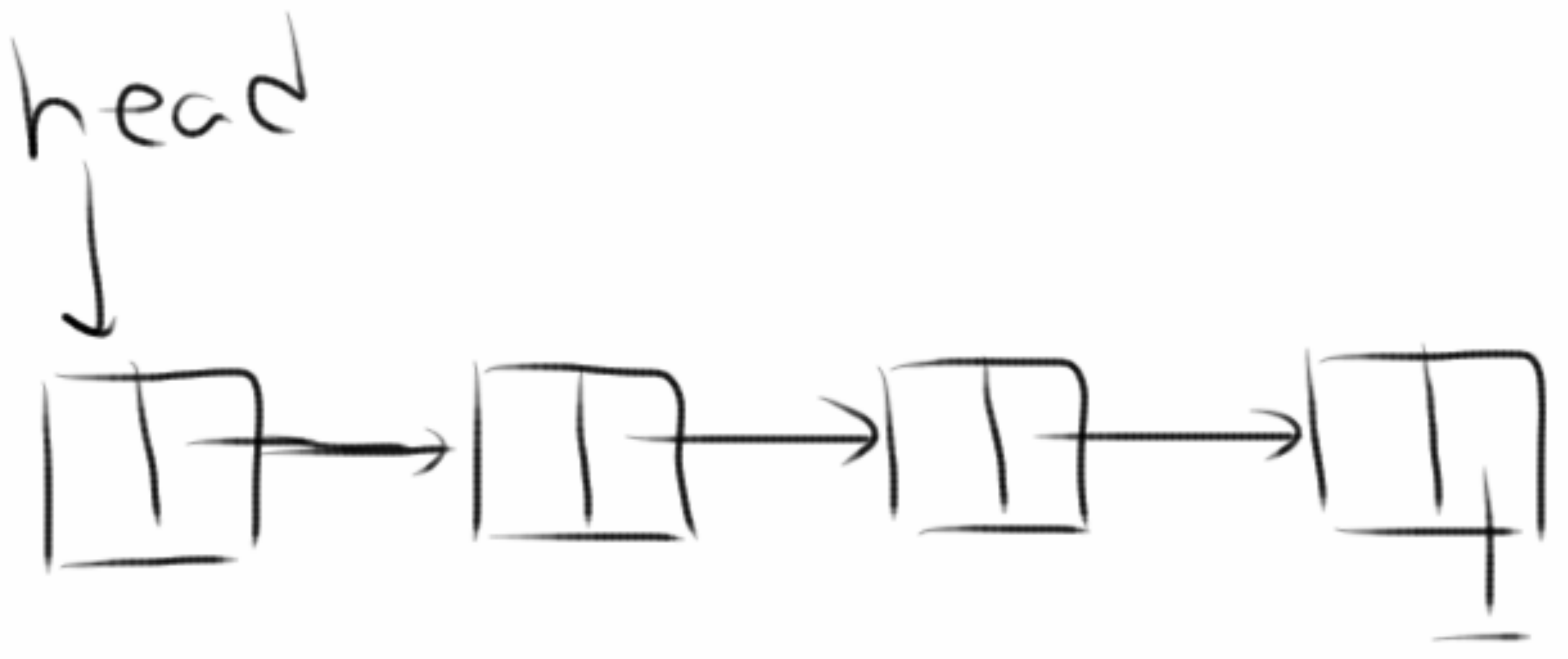
```
typedef struct {
    Node* head;
} List;


void add_head(List* list, int i);
```

iterate

- follow the next pointers

```
for ( p = head; p; p=p->next ) {
}
```



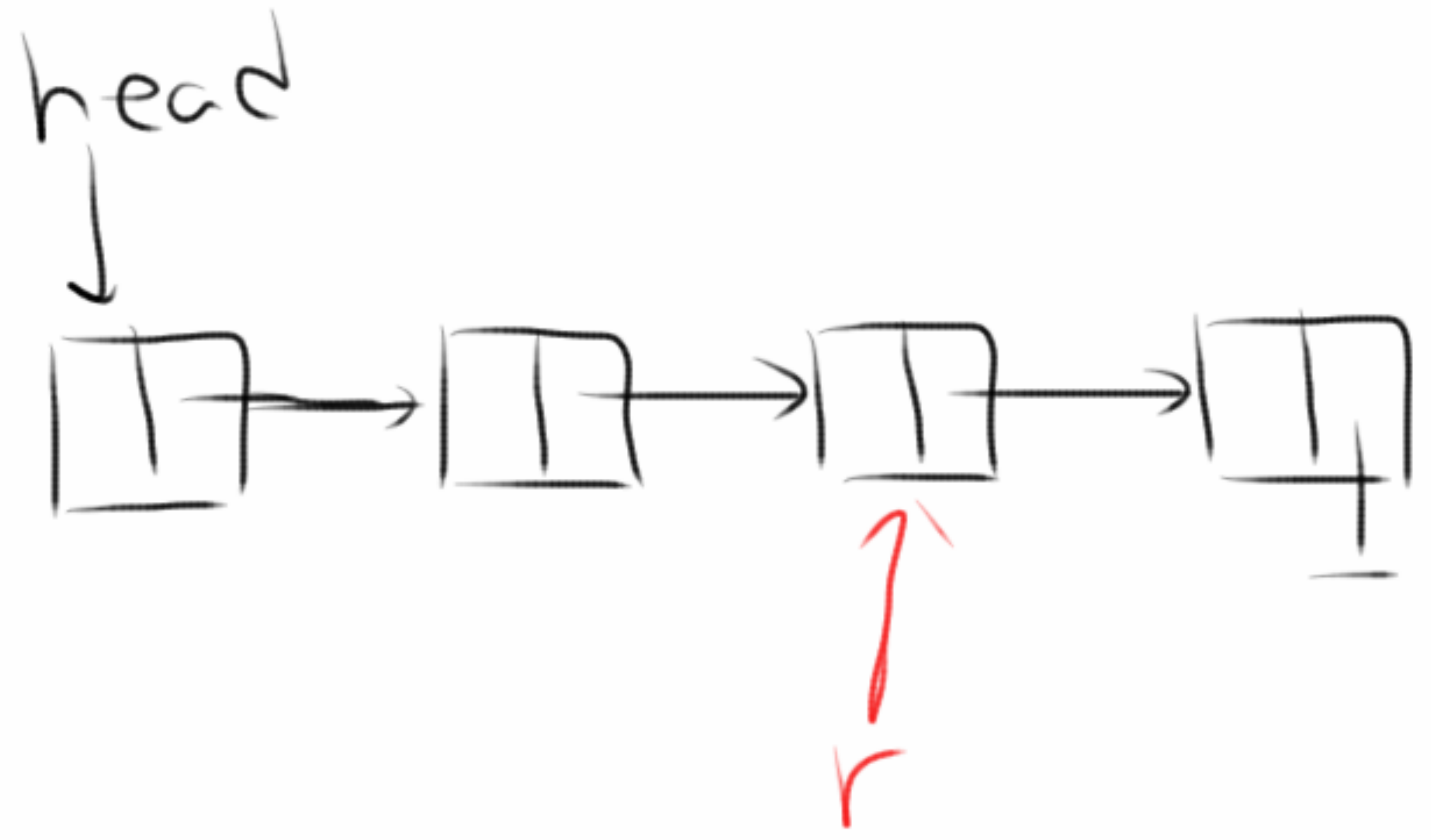
search

- find the value and return the pointer

```
ret = 0;
for ( p = head; p; p=p->next ) {
 if ( p->value == i ) {
  ret = p;break;
 }
}
```

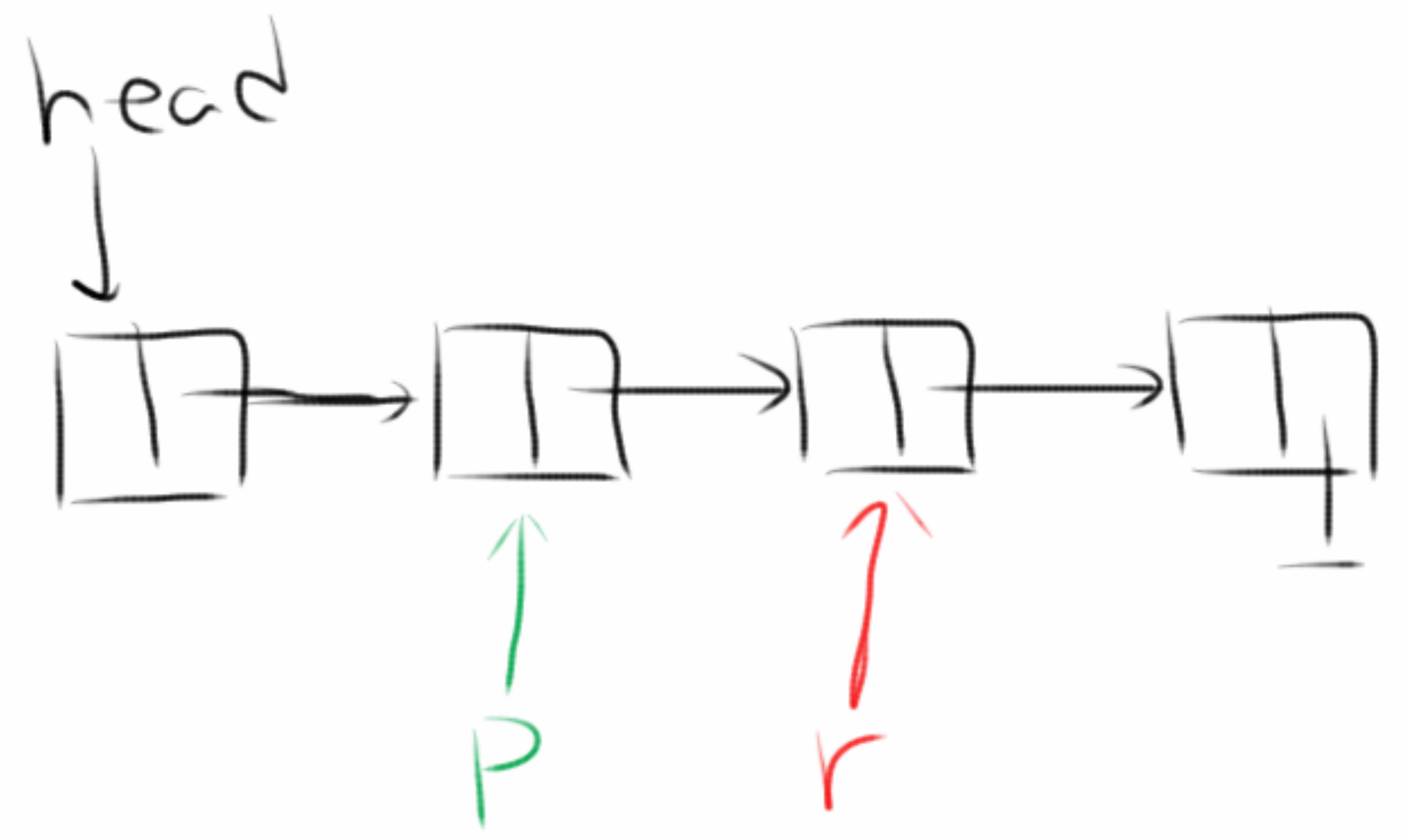
remove by a pointer I

- remove(Node* r);



remove by a pointer II

- find it's previous node p

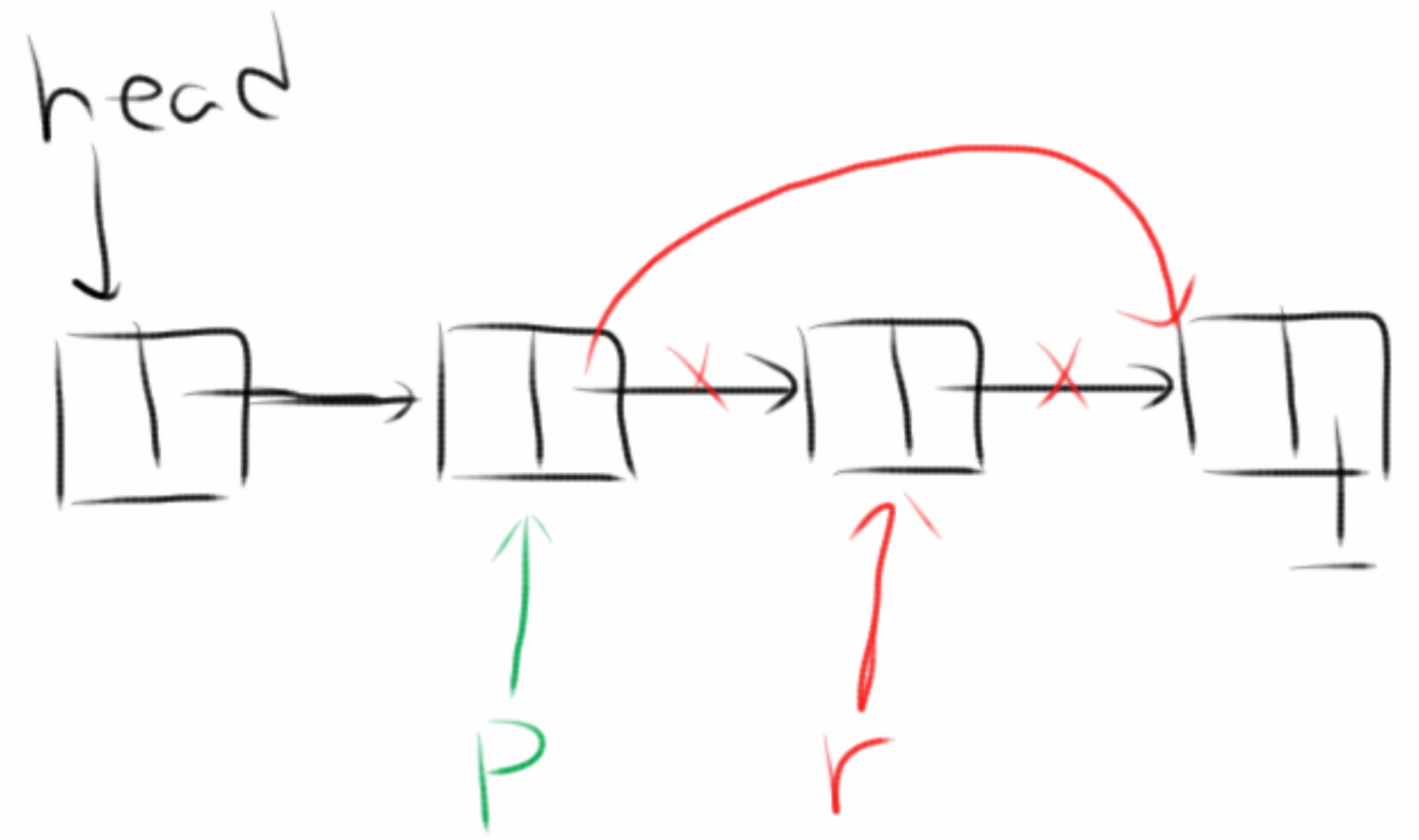


remove by a pointer III

```
for ( p = head; p; p=p->next ) {
  if ( p->next == r ) {
  }
}
```

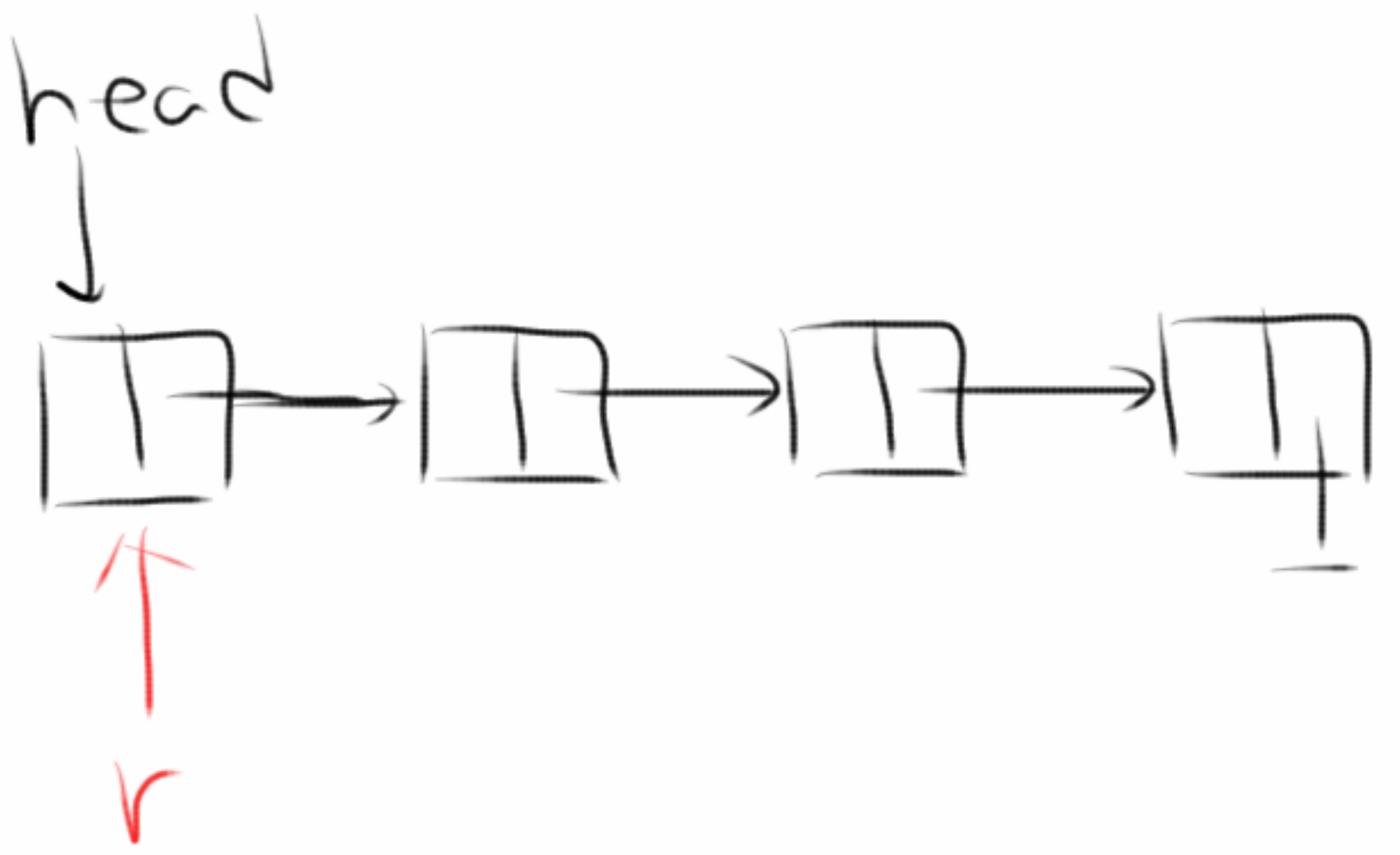
remove by a pointer IV

- p->next = r->next;



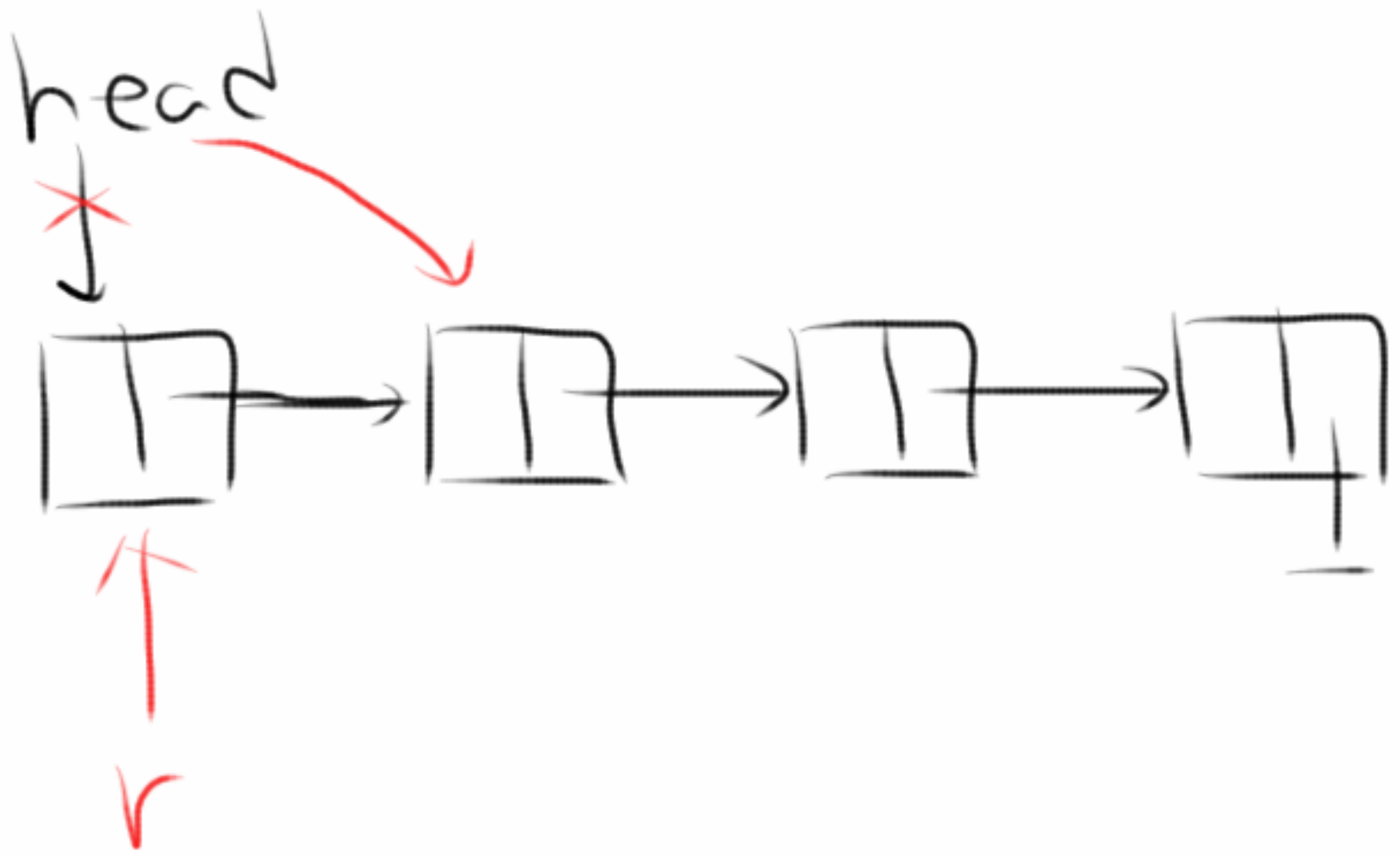
remove by a pointer V

- What if r is the head?



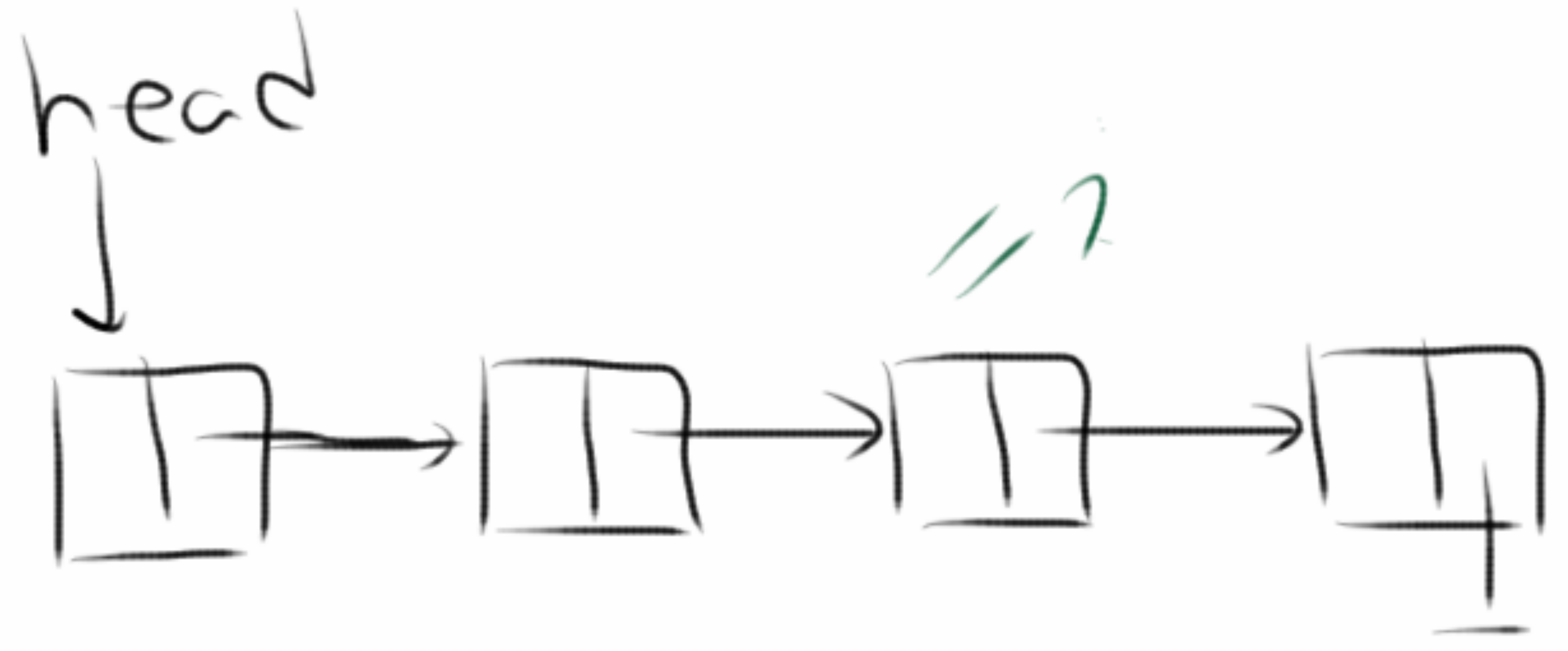
remove by a pointer VI

- new head = r->next



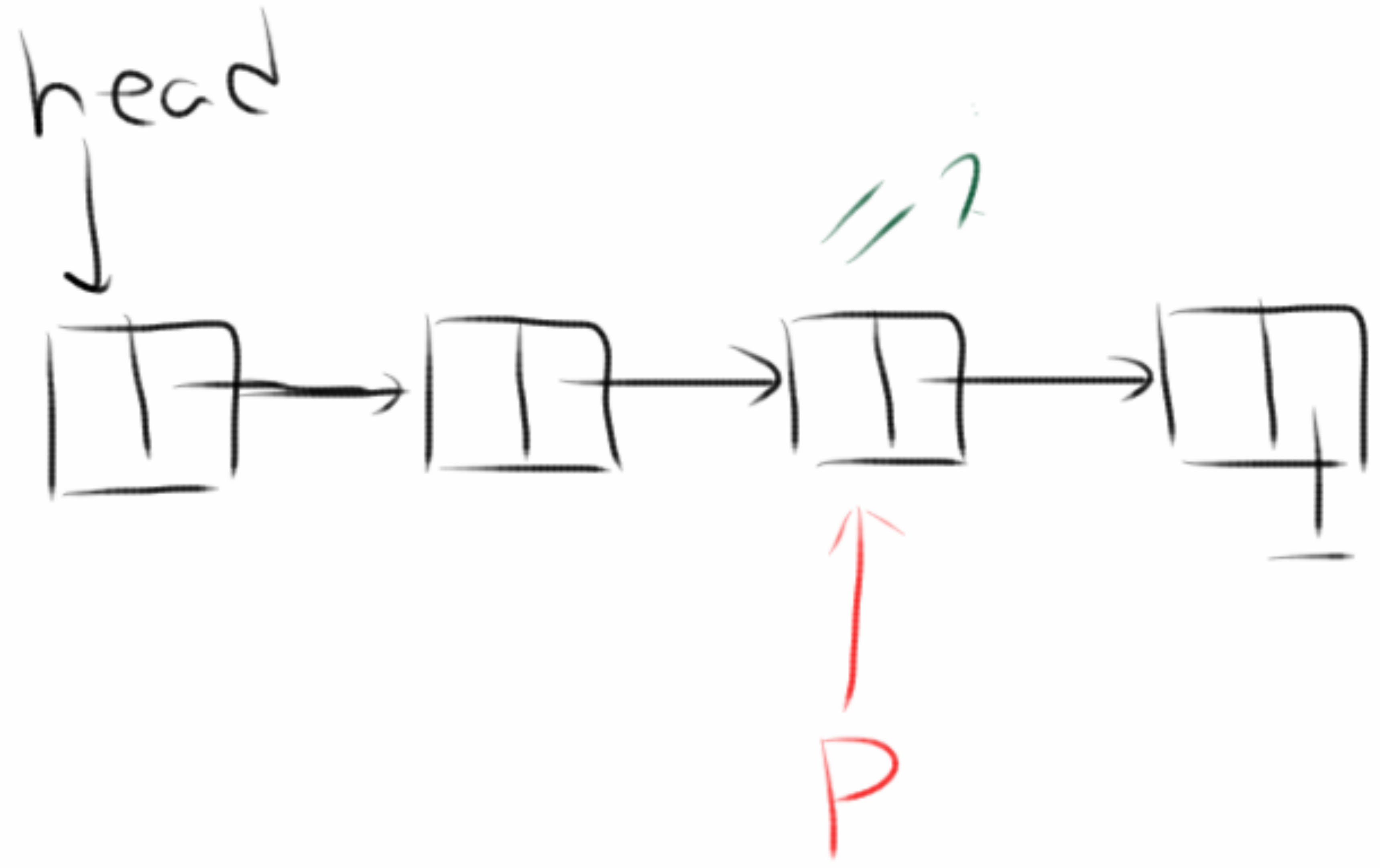
remove by a value I

- remove(int i);



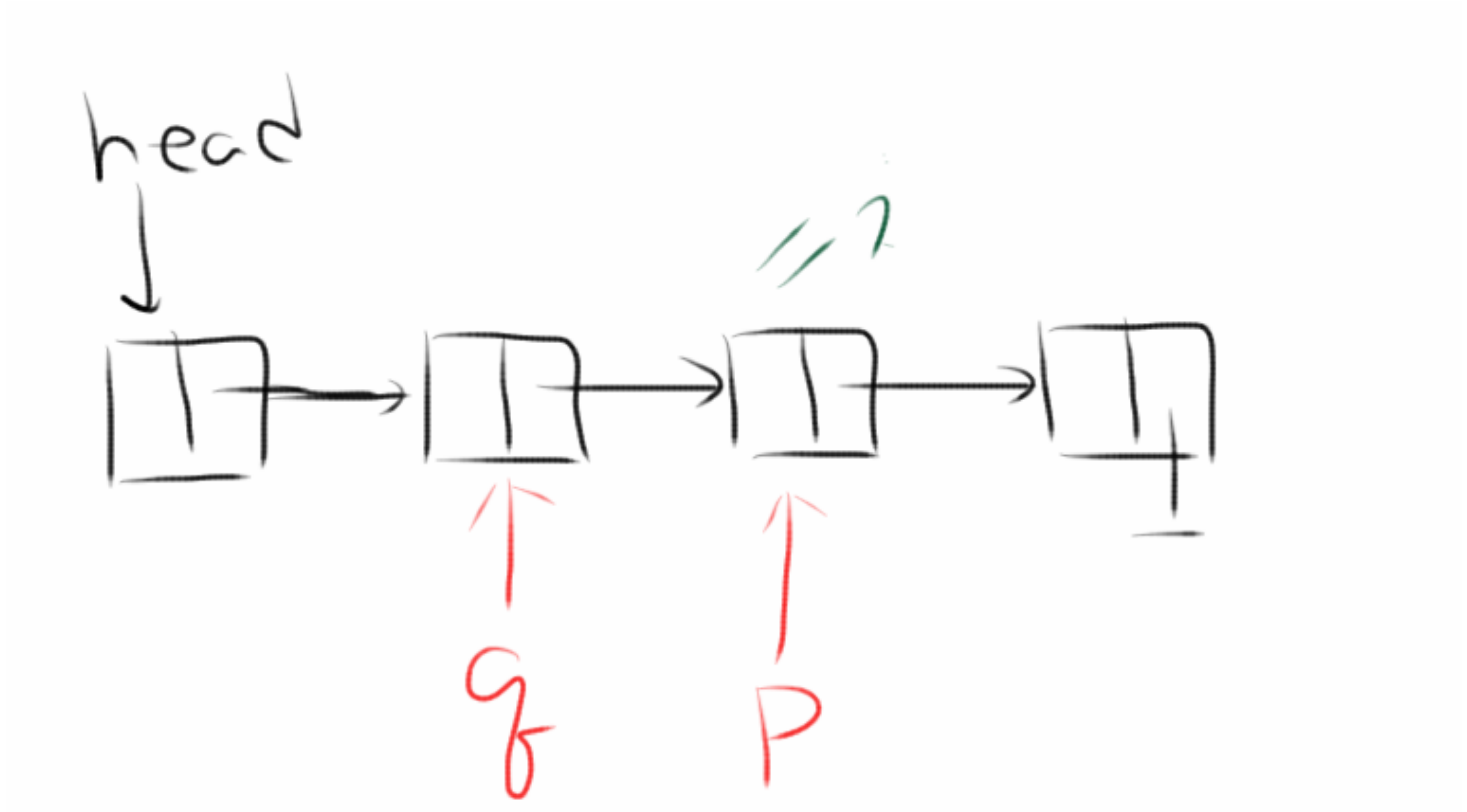
remove by a value II

- find p->value == i



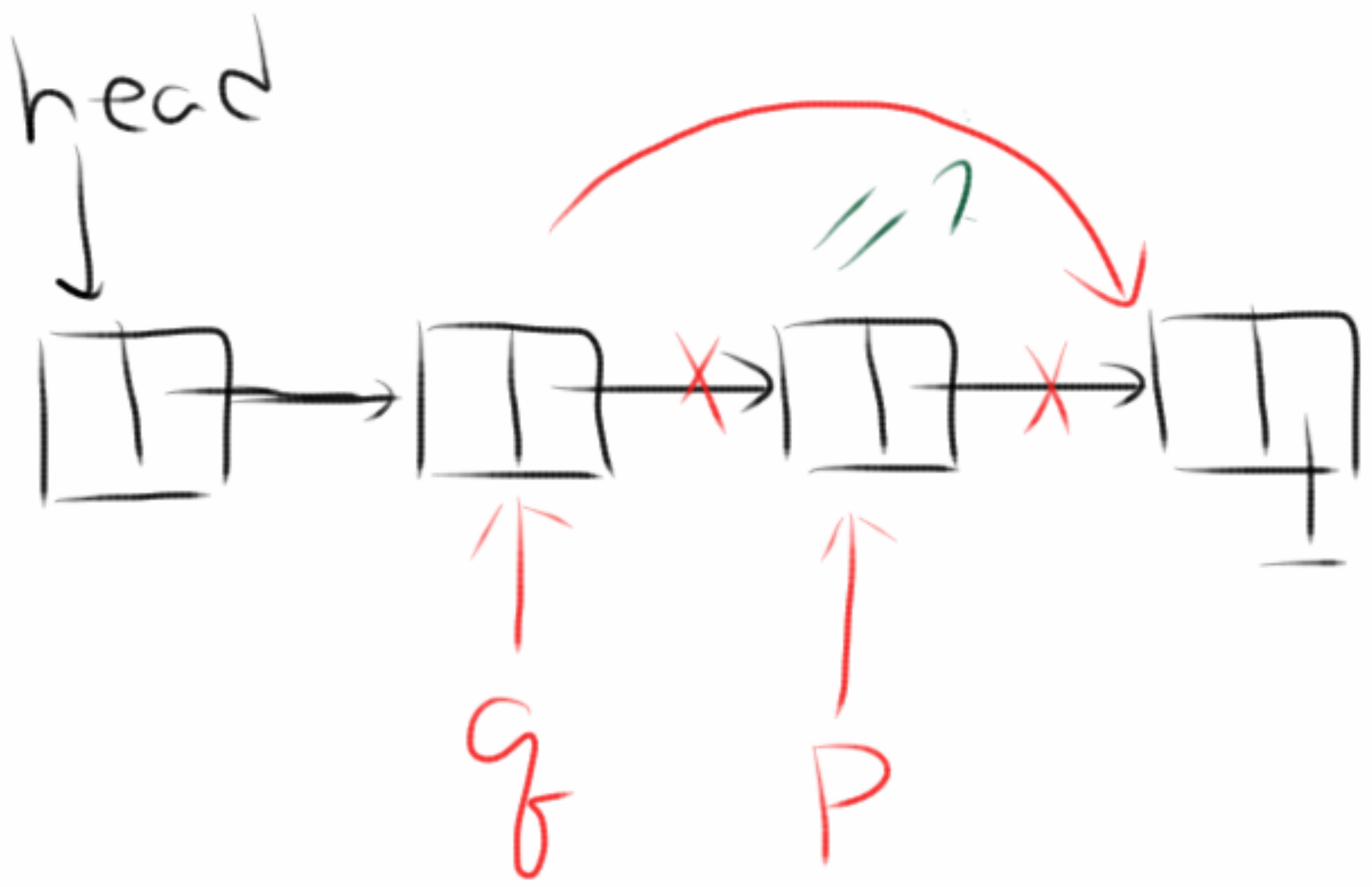
remove by a value III

- q for the previous node



remove by a value IV

- q->next = p->next;

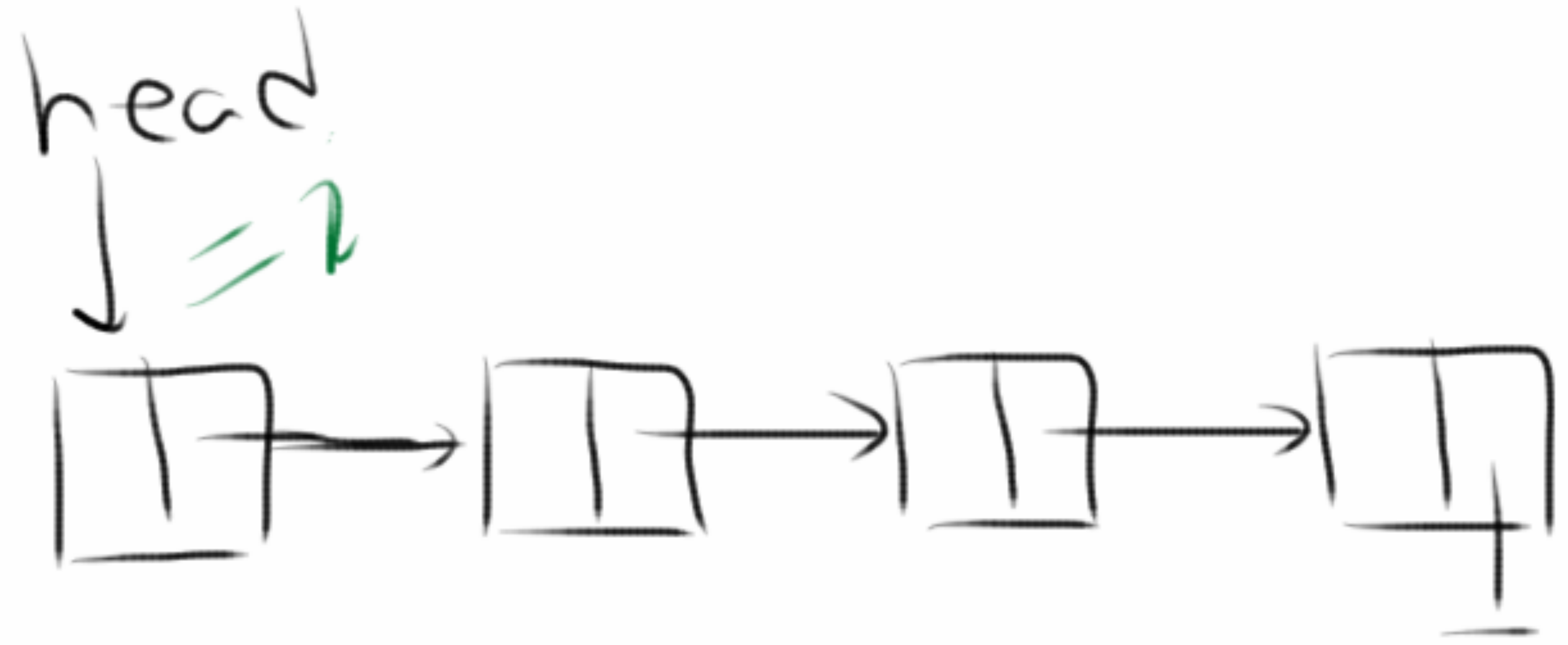


remove by a value V

```
for ( q=0,p = head; p; q=p,p=p-
>next ) {
  if ( p->value == i ) {
    q->next = p->next;
  }
}
```

remove by a value VI

- what if head->value == i?

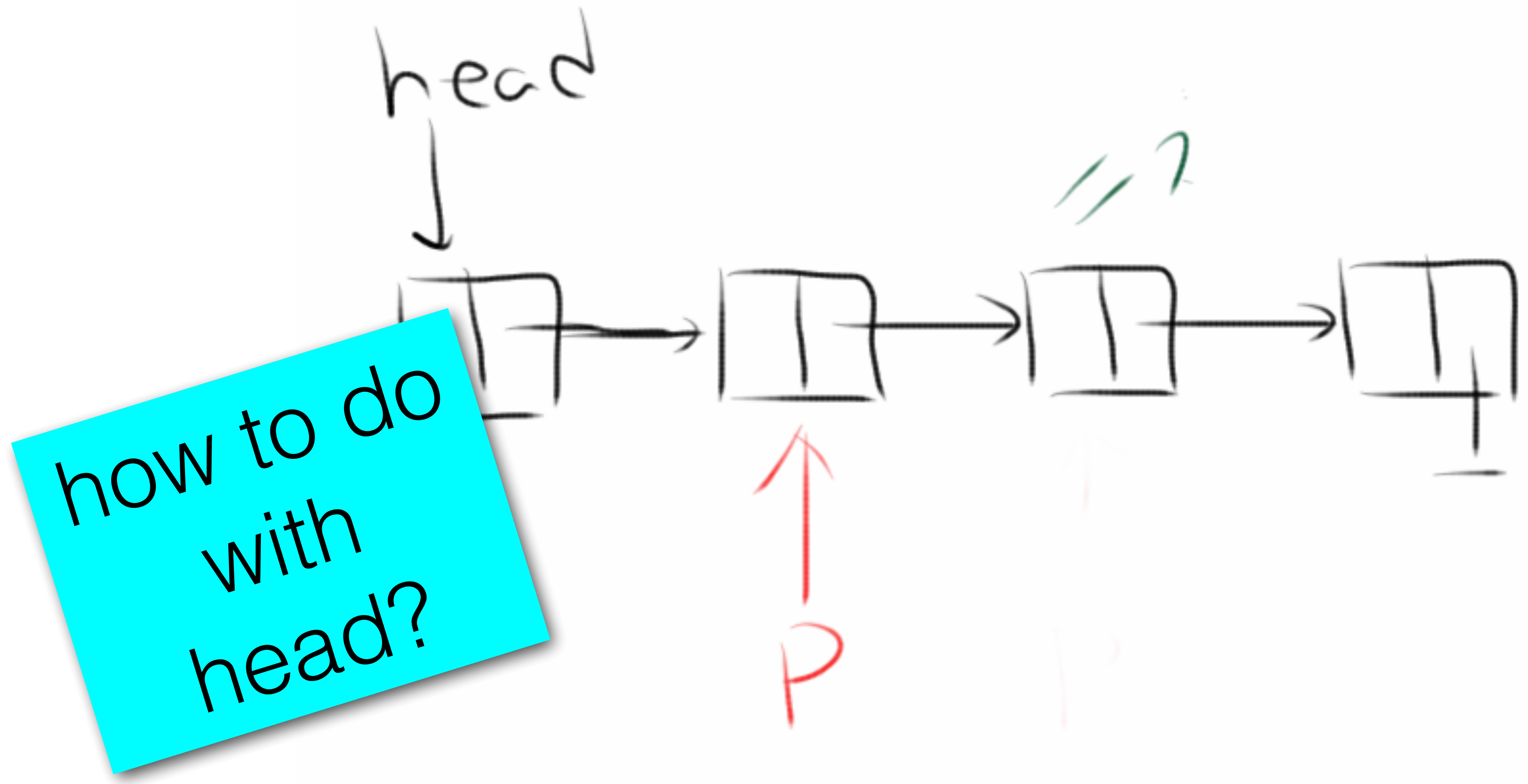


How do we find the boundary?

```
for ( q=0,p = head; p; q=p,p=p-
>next ) {
  if ( p->value == i ) {
   q->next = p->next;
  }
}
```

- Any pointer at the left of -> must be checked

remove by a value VII



- how about test next->value?
- if (p->next && p->next->value == i)

all funcs with tail

- add_head
- append_tail
- iterate/search
- remove
- clear

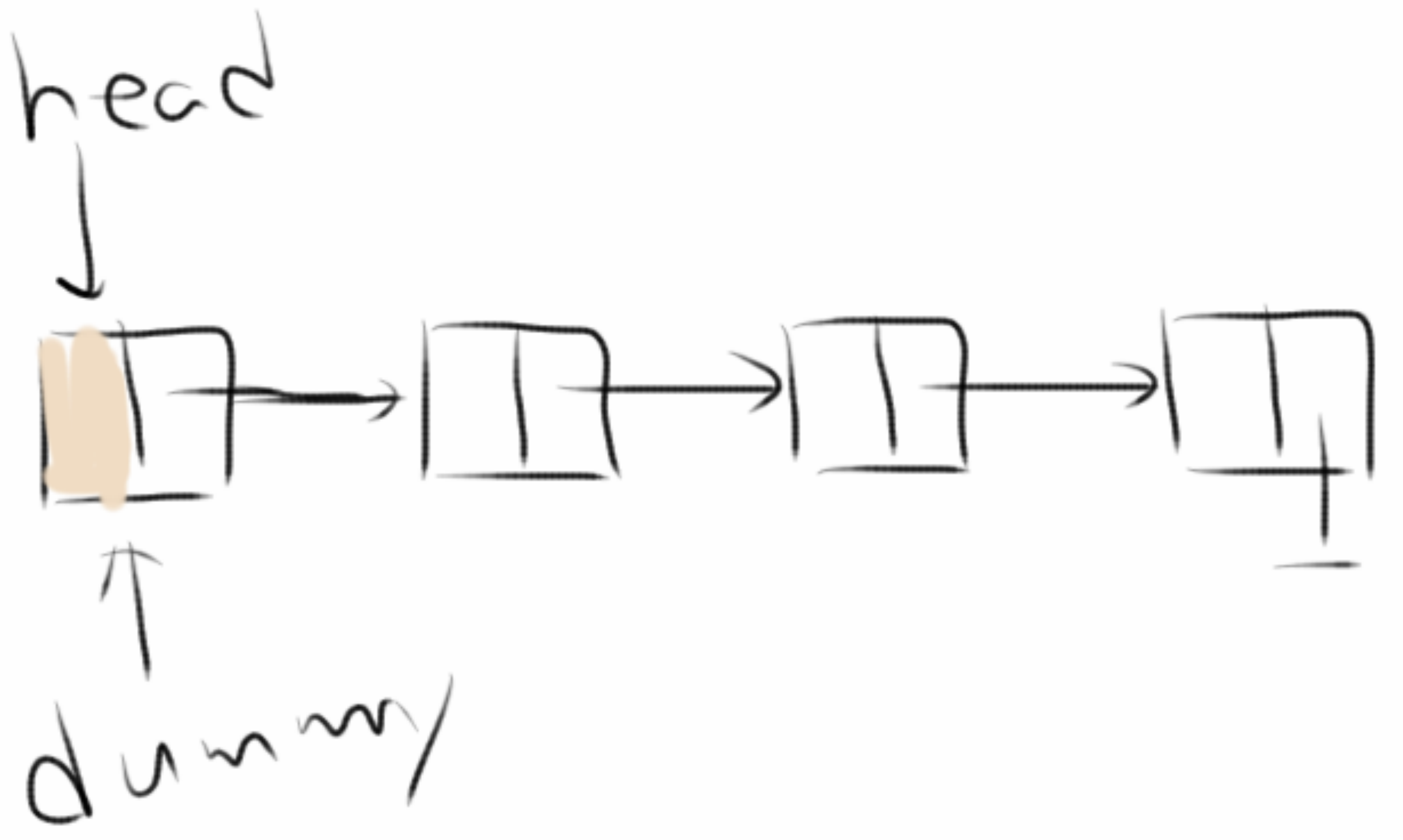
any benefit?

struct List II

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


 void add_head(List* list, int i);
```

sentinel node



- a dummy head to make code smooth

all funcs with sentinel

- add_head
- append_tail
- traversal/search
- remove

any benefit?

clear the whole list I

```
void clear(Node *head)
{
  if ( head->next )
    clear(head->next);
  free(head);
}
```

clear the whole list II

```
for ( p = head; p; p=q ) {
    q = p->next;
    free(p);
}
```

append tail

- find the tail
- tail->next = n;
- n->next = 0;

- what if empty list?

More Lists

- Head: Single/Double
- Link: Single/Double
- Sentinel: Yes/No

- create/destroy
- insert/append
- iterate
- serach
- remove
    - one value/multiple values
    - one node