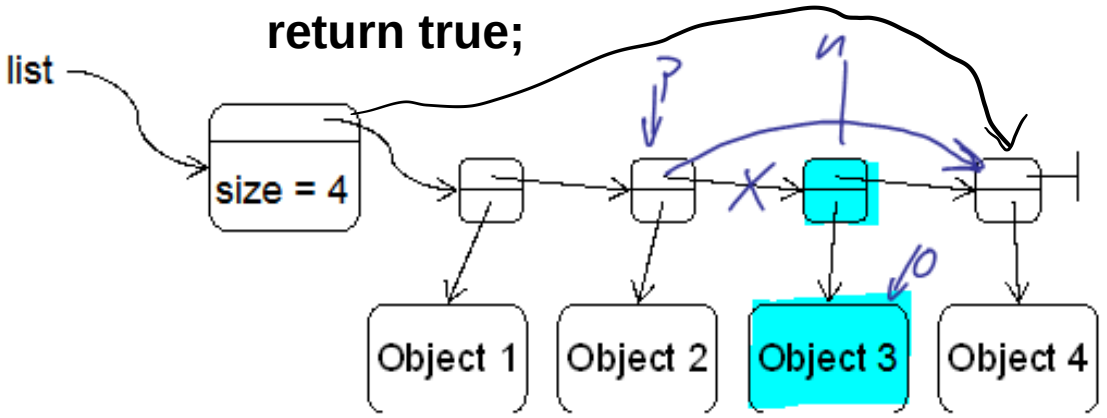
Listen
Algorithmen und Datenstrukturen 2

- Grüne Farbe: Bitte im Script nachtragen

Lösung: public boolean remove(Object o) (Schleppzeiger) : Komplexität: O(n)

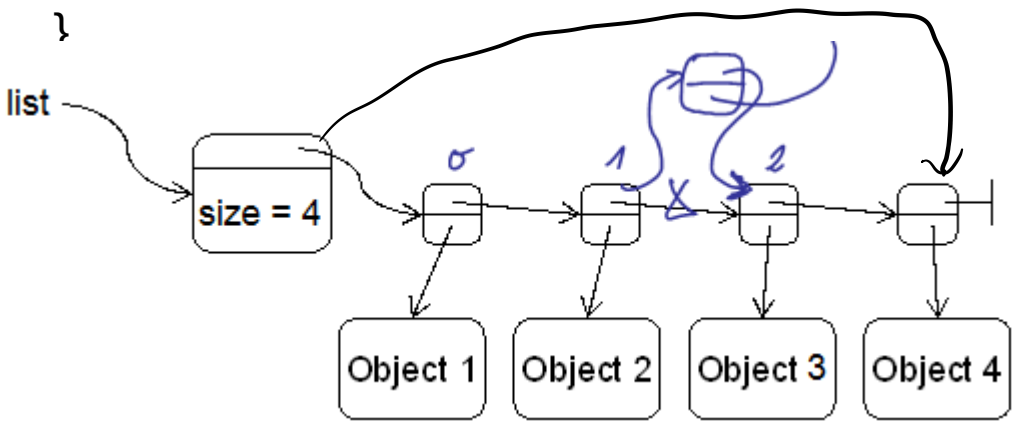
```
Node<E> current = first, before = null;
while (current != null &&
!Objects.equals(o, current.elem)) {
  before = current;
  current = current.next;
} // End of list – not found
if (current == null) {
  return false;
} // Tail pointer check
if (current == last) {
  last = before;
}
// Remove first element
if (before == null) {
  first = current.next;
// Remove element in between
} else {
  before.next = current.next;
}
current.next = null; size--;
return true;
```



Lösung: public void add(int index, E item) : Komplexität: O(n)

```
if (index < 0 || index > size) {
throw new
IndexOutOfBoundsException()}
if (index == 0) {
   // First position (O(1))
   addHead(item);
} else if (index == size) {
   // Last position (O(1))
   addTail(item);
} else {
  // In Between O(n))
  addElementAt(index, item);
}
```

```
private void addElementAt (int index, E
item) {
Node<E> current = first;
for (int i = 1; i < index; i++) {
  current = current.next;
}
Node<E> toAdd = new Node<E>(item);
toAdd.next = current.next;
current.next = toAdd;++size;
}
```



Lösung: Erlauben von null-Werten in der Collection

Anpassen der equals-Funktion, da sonst NullpointerException sowie auch Entfernen der Null-checks bei den Methoden.

```
private boolean elementValueEquals(Object o, Node<E> current) {
  if (o == null) {
    return current.elem == null;
  }
  return o.equals.(current.elem);
}
```

Oder einfach:

```
Objects.equals(o, current.elem)  // (macht das selbe wie oben)
```

Feedback: Optionale Detail-Diskussion: For-Loop vs. While-Loop

For-Loop:

- Anzahl Durchläufe bekannt

```
private void addElementAt(int index, E item) {
    Node<E> current = first;
    for (int i = 1; i < index; i++) {
        current = current.next;
    }
    Node<E> toAdd = new Node<E>(item);
    toAdd.next = current.next;
    current.next = toAdd;
    ++size;
}
```

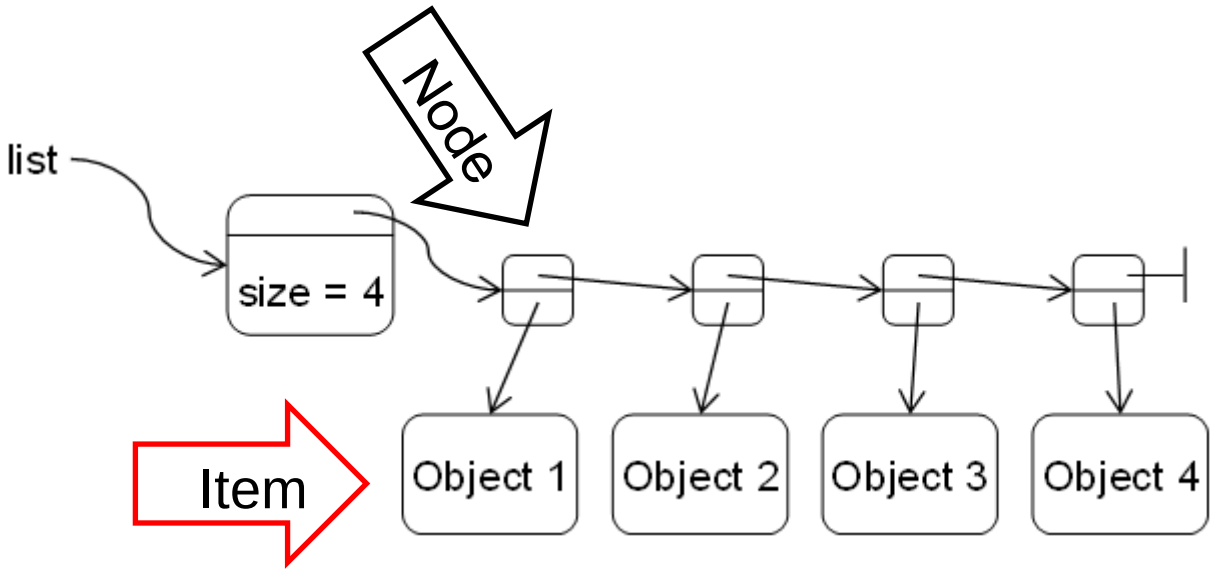
While-Loop

- Anzahl Durchläufe nicht bekannt

```
public boolean contains(Object o) {
    Node<E> current = first;
    while (current != null &&
            !elementValueEquals(o, current)) {
        current = current.next;
    }
    return current != null;
}
```

Feedback: Achtung, equals auf dem richtigen Objekt

- ~~**Falsch**: return first.equals(number);~~
- **Richtig**: return first.**elem**.equals(*number*);



Feedback: Achtung, Flüchtigkeitsfehler

- **Node<E> current = first;**
- **while (first != null && !first.elem.equals(number)) {…}**

Feedback: Integer entfernen

- **List.remove(1);**

```
@Override
public E remove(int index) {
```

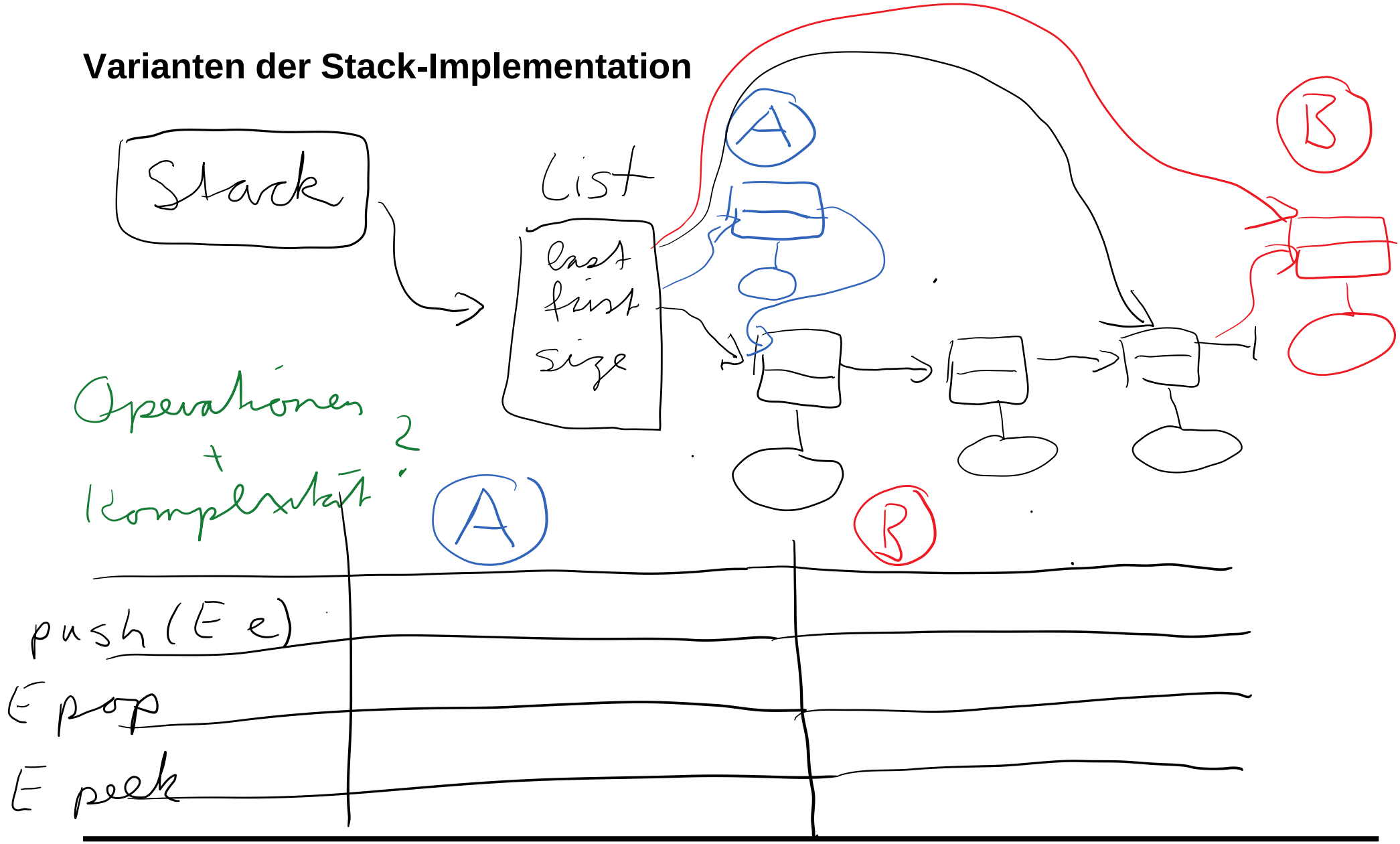
- **List.remove(Integer.valueOf(1));**

```
@Override
public boolean remove(Object o) {
```

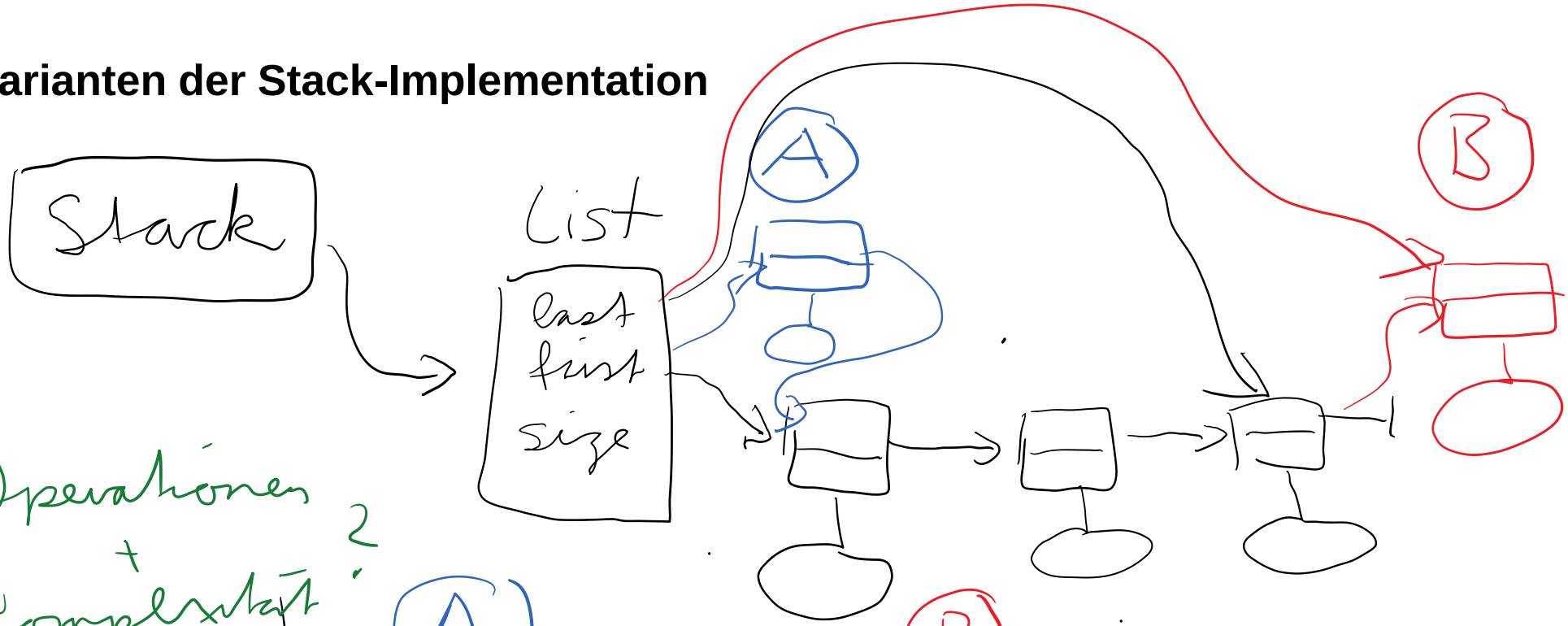
First- und Lastzeiger anpassen (wichtig, nicht vergessen!)

- **Bei allen add-Methoden**
- **Bei allen remove-Methoden**

Varianten der Stack-Implementation



Varianten der Stack-Implementation



Operationen + Komplexität ?

	A		B	
push(E e)	add(0, e)	O(1)	add(e)	O(1)
E pop	remove(0)	O(1)	remove(size()-1)	O(n) !
E peek	get(0)	O(1)	get(size()-1)	O(1)
		O(1)		O(n)