

Operator ++ for Pointers

# ++ for Pointers

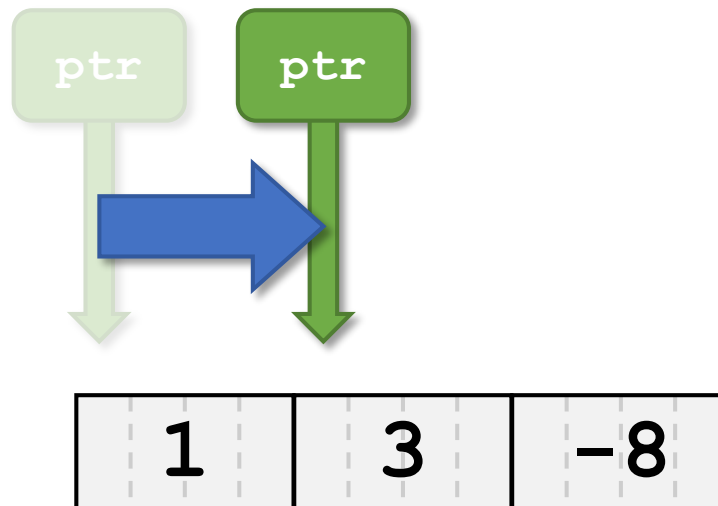
- Same idea...

# ++ for Pointers

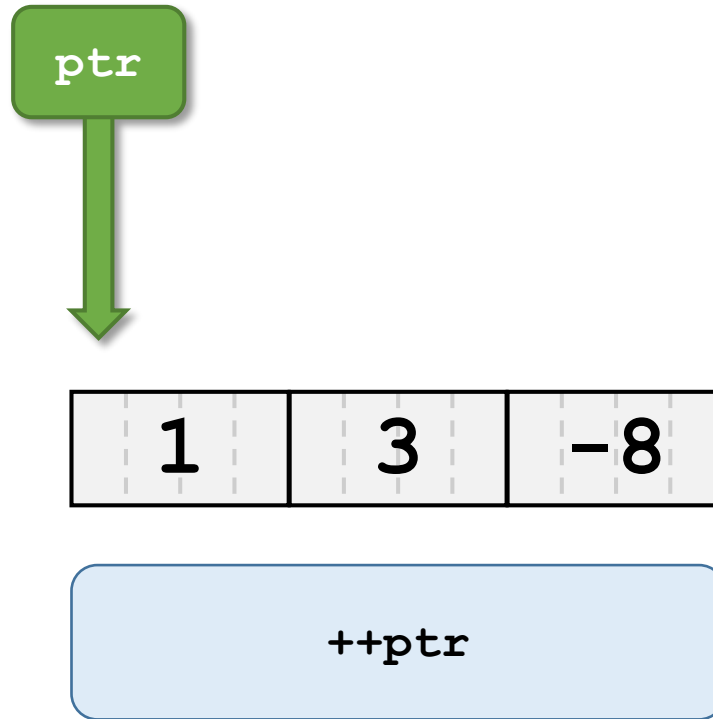
- Same idea...
- ...but: value of pointer is an **address**.

# ++ for Pointers

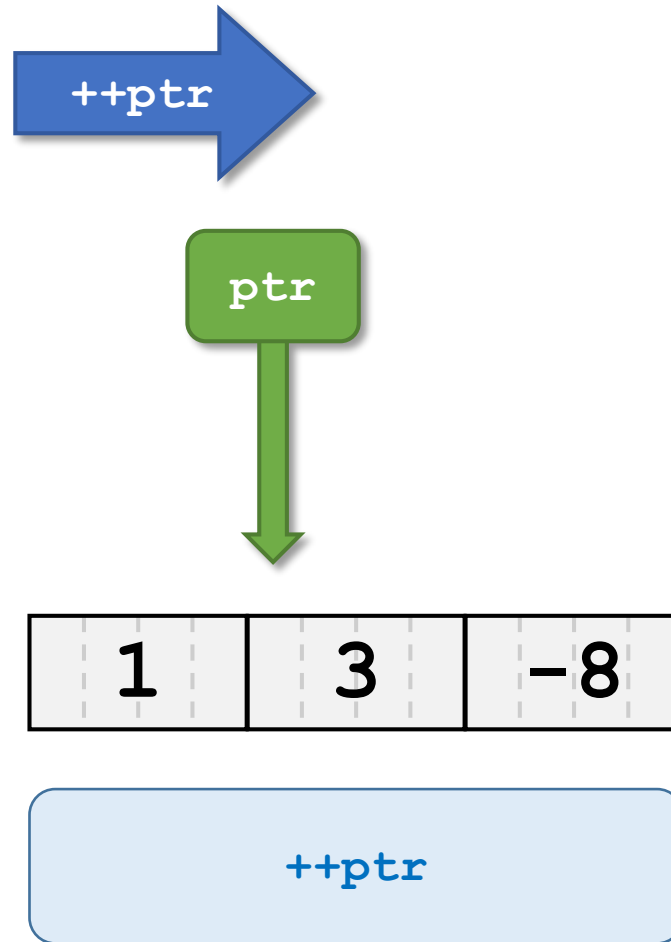
- Same idea...
- ...but: value of pointer is an **address**.
  - Shift pointer to **next object**.



`++ptr`



`++ptr`



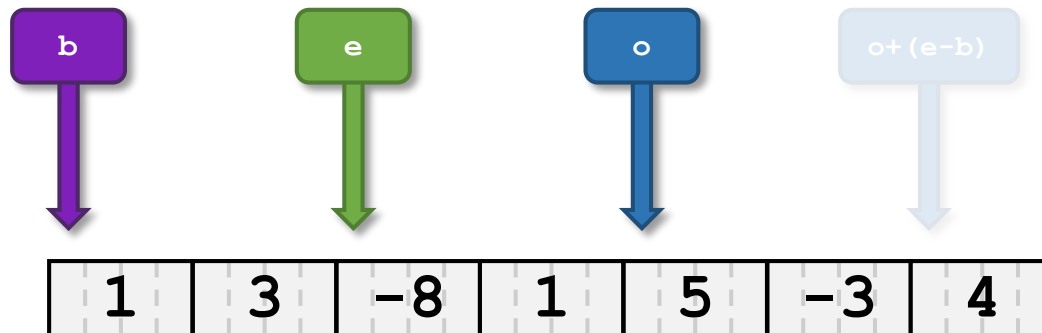
# Exercise – Applying Pointers

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- Apply this function...

```
// PRE: [b, e) and [o, o+(e-b)) are disjoint
//      valid ranges
void f (int* b, int* e, int* o) {
    while (b != e) {
        --e;
        *o = *e;
        ++o;
    }
}
```

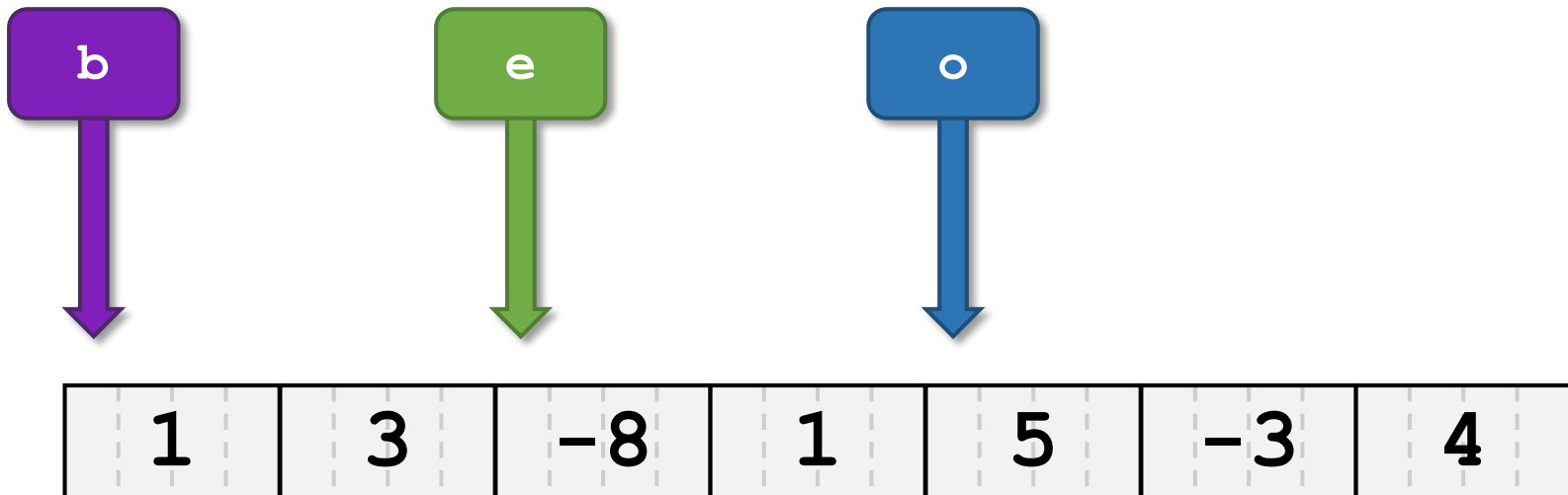
- ... to this example-array:





# Exercise – Applying Pointers

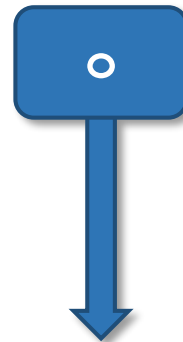
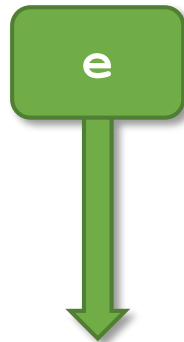
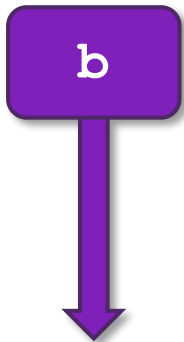
```
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    while (b != e) {  
        --e;  
        *o = *e;  
        ++o;  
    }  
}
```



# Exercise – Applying Pointers

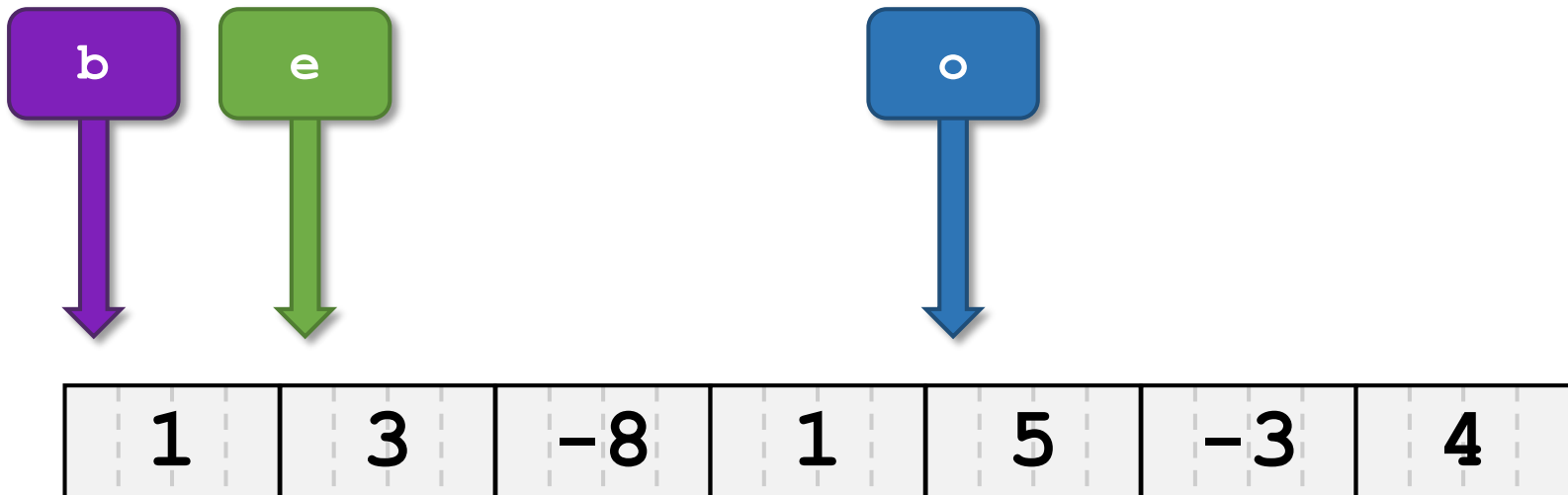
true

```
void f (int* b, int* e, int* o) {  
    while (b != e) {  
        --e;  
        *o = *e;  
        ++o;  
    }  
}
```



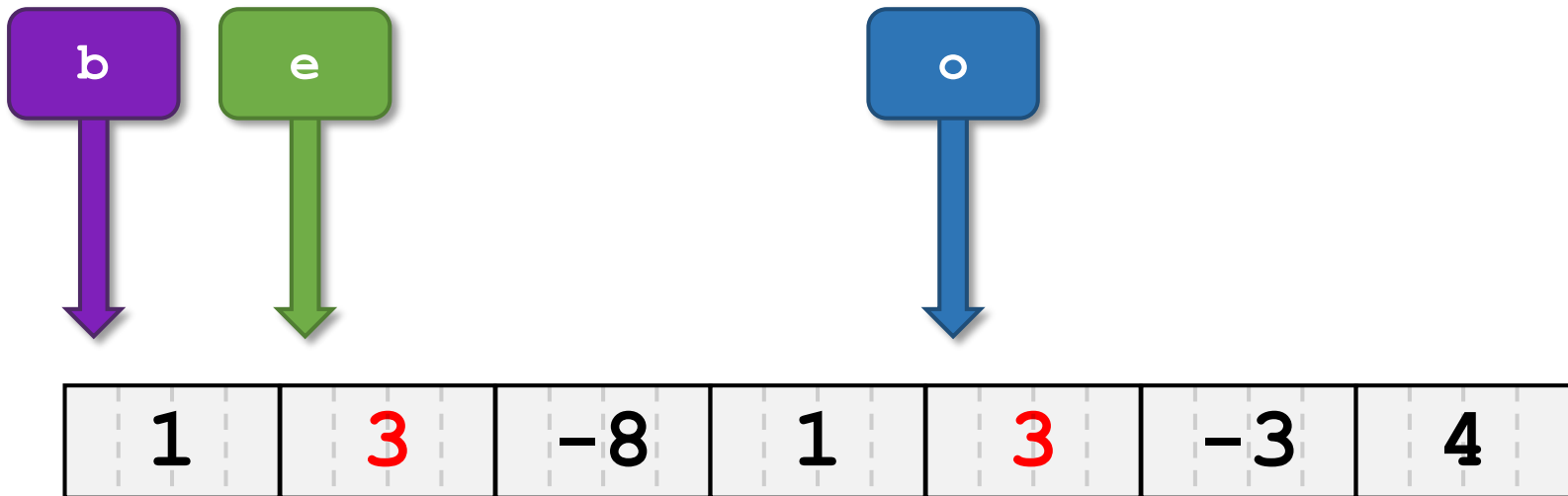
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    }  
}
```



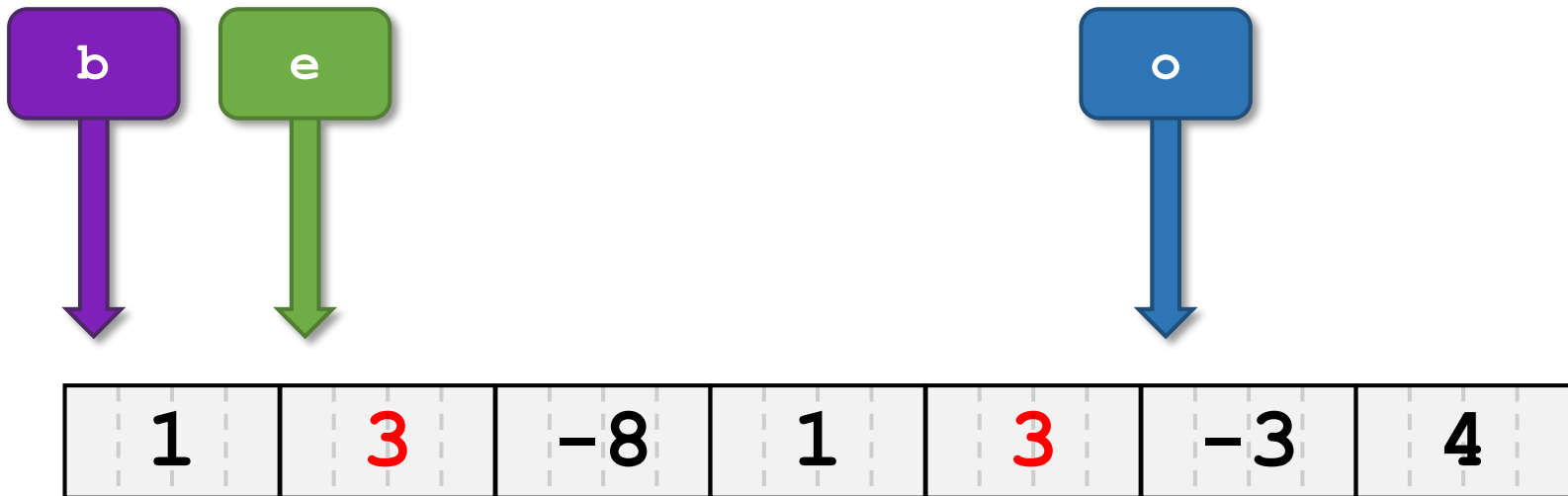
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# Exercise – Applying Pointers

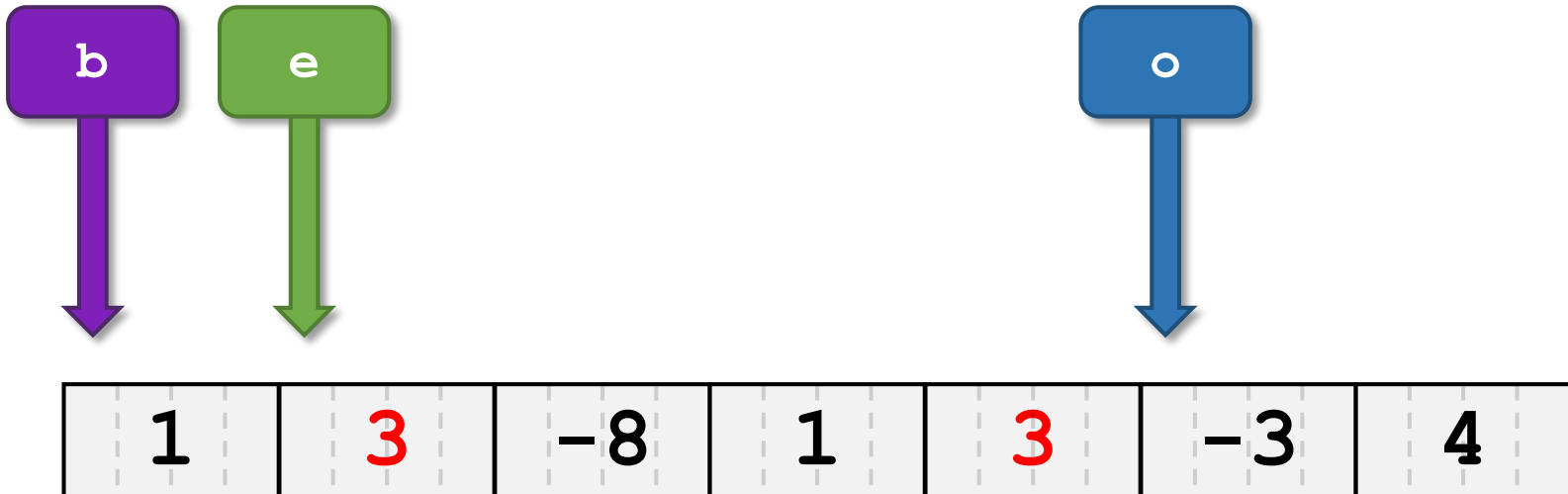
```
void f (int* b, int* e, int* o) {  
    while (b != e) {  
        --e;  
        *o = *e;  
        ++o;  
    }  
}
```



# Exercise – Applying Pointers

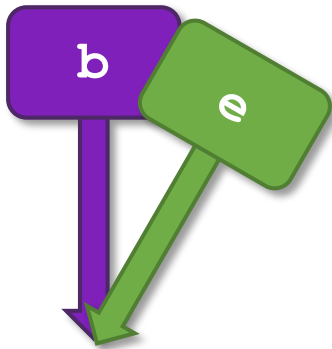
true

```
void f (int* i, int* e, int* o) {  
    while (b != e) {  
        --e;  
        *o = *e;  
        ++o;  
    }  
}
```



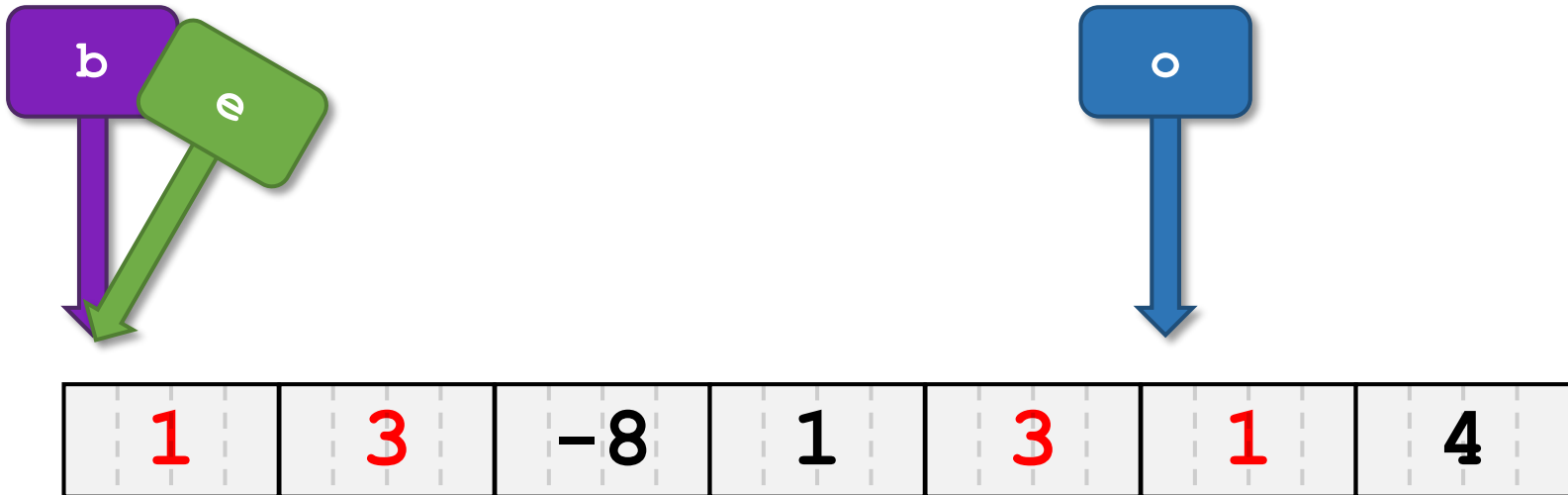
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        *o = *e;  
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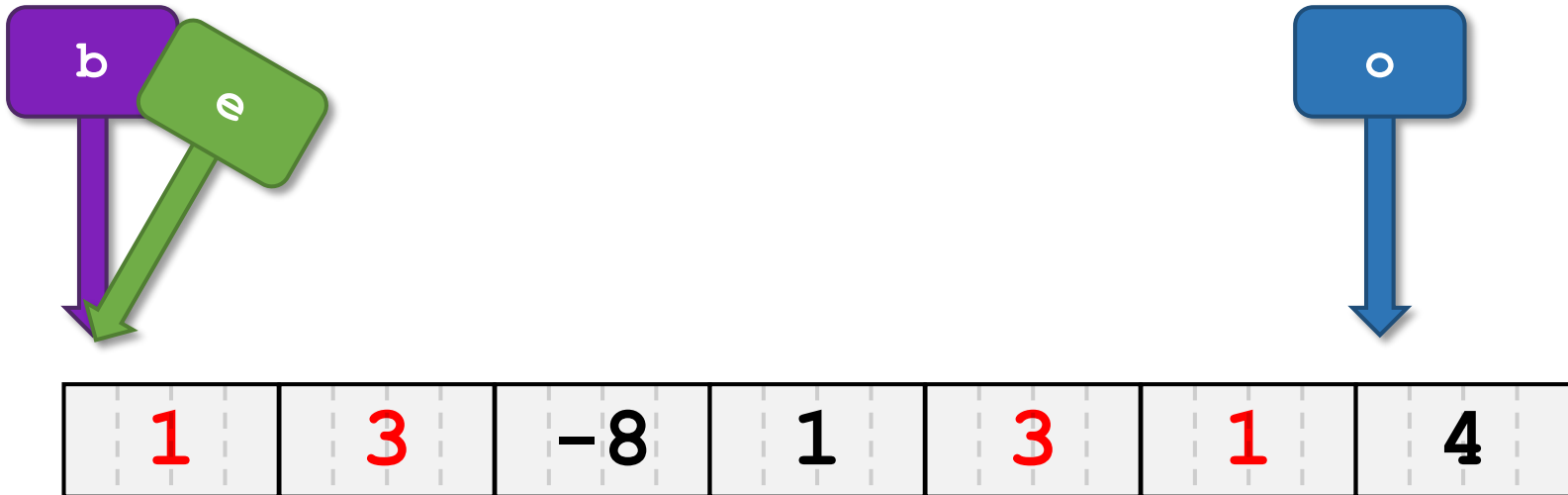
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    while (b != e) {  
        --e;  
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    }  
}
```





# Exercise – Applying Pointers

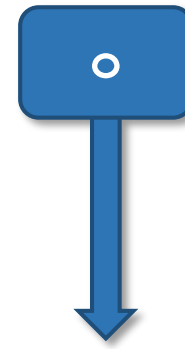
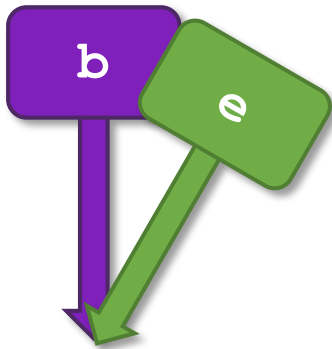
```
void f (int* b, int* e, int* o) {  
    while (b != e) {  
        --e;  
        *o = *e;  
        ++o;  
    }  
}
```



# Exercise – Applying Pointers

false

```
void f (int* b, int* e, int* o) {  
    while (b != e) {  
        --e;  
        *o = *e;  
        ++o;  
    }  
}
```



# Exercise – Applying Pointers

- Now determine a POST-condition for the function.

```
// PRE: [b, e) and [o, o+(e-b)) are disjoint
//      valid ranges
void f (int* b, int* e, int* o) {
    while (b != e) {
        --e;
        *o = *e;
        ++o;
    }
}
```

# Exercise – Applying Pointers

- Something like this:

```
// PRE: [b, e) and [o, o+(e-b)) are disjoint
//      valid ranges
// POST: The range [b, e) is copied in reverse
//      order into the range [o, o+(e-b))
void f (int* b, int* e, int* o) {
    while (b != e) {
        --e;
        *o = *e;
        ++o;
    }
}
```

# Exercise – Valid Inputs

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- Which of these inputs are valid?

```
int a[5] = {1, 2, 3, 4, 5};  
a) f(a, a+5, a+5);  
b) f(a, a+2, a+3);  
c) f(a, a+3, a+2);
```

```
// PRE: [b, e) and [o, o+(e-b)) are disjoint  
//      valid ranges  
void f (int* b, int* e, int* o) {  
    while (b != e) {  
        --e;  
        *o = *e;  
        ++o;  
    }  
}
```

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```

$[o, o+(e-b))$   
is out of  
bounds

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        --e;  
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        ++o;  
    }  
}
```

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- Which of these inputs are valid?

```
int a[5] = {1, 2, 3, 4, 5};  
a) f(a, a+5, a+5); X  
b) f(a, a+2, a+3); ✓  
c) f(a, a+3, a+2);
```

$[o, o+(e-b))$   
is out of  
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```
// PRE: [b, e) and [o, o+(e-b)) are disjoint  
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void f (int* b, int* e, int* o) {  
    while (b != e) {  
        --e;  
        *o = *e;  
        ++o;  
    }  
}
```



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int a[5] = {1, 2, 3, 4, 5};  
a) f(a, a+5, a+5); X  
b) f(a, a+2, a+3); ✓  
c) f(a, a+3, a+2); X
```

$[o, o+(e-b))$   
is out of  
bounds

Ranges not  
disjoint

```
// PRE: [b, e) and [o, o+(e-b)) are disjoint  
//      valid ranges  
void f (int* b, int* e, int* o) {  
    while (b != e) {  
        --e;  
        *o = *e;  
        ++o;  
    }  
}
```

# Exercise – const Correctness

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- Make the function const-correct.

```
// PRE: [b, e) and [o, o+(e-b)) are disjoint
//      valid ranges
void f (int* b, int* e, int* o) {
    while (b != e) {
        --e;
        *o = *e;
        ++o;
    }
}
```

# Exercise – const Correctness

- Make the function `const`-correct.

**const**: no write-access to **target**  
**const**: no shifts of **pointer**

```
// PRE: [b, e) and [o, o+(e-b)) are disjoint
//      valid ranges
void f (const int* const b, const int* e, int* o) {
    while (b != e) {
        --e;
        *o = *e;
        ++o;
    }
}
```

By the way...

# By the way...

- ...that's the same function:

```
// PRE: [b, e) and [o, o+(e-b)) are disjoint
//      valid ranges
void f (int* b, int* e, int* o) {
    while (b != e) *(o++) = *(--e);
}
```