This is CS50.

cs50.brianyu.me

Week 3

- Searching (Linear, Binary)
- Sorting (Bubble, Selection)
- Big O
- Structs
- Recursion
- Merge Sort

What questions do you have?

Today

Search and Sort

Recursion and Structs

Lab

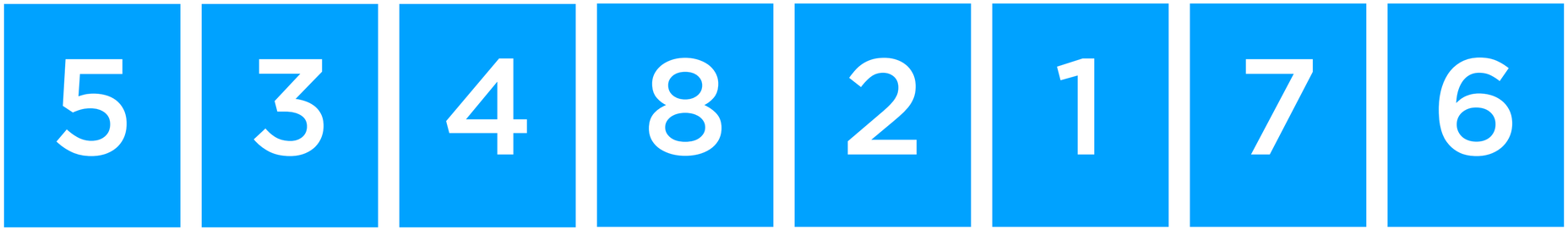
Part One

Search and Sort

Linear Search

Binary Search

Bubble Sort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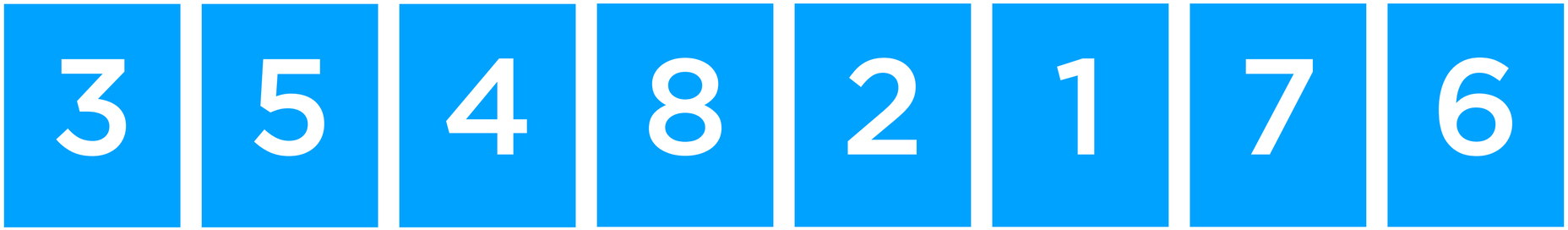
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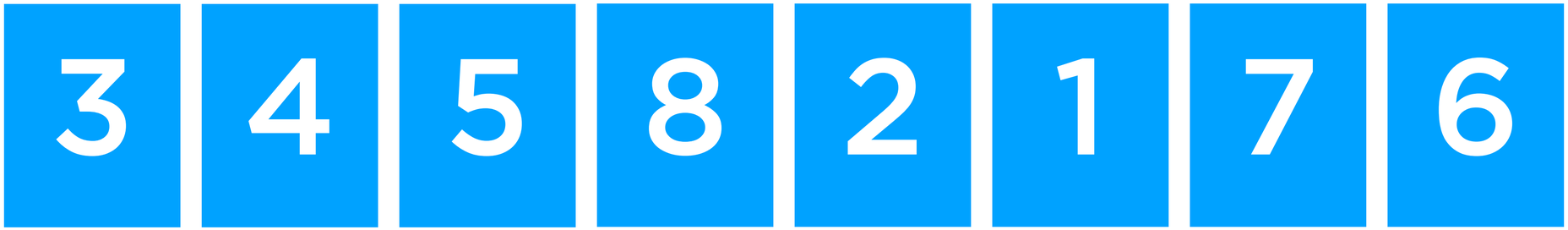
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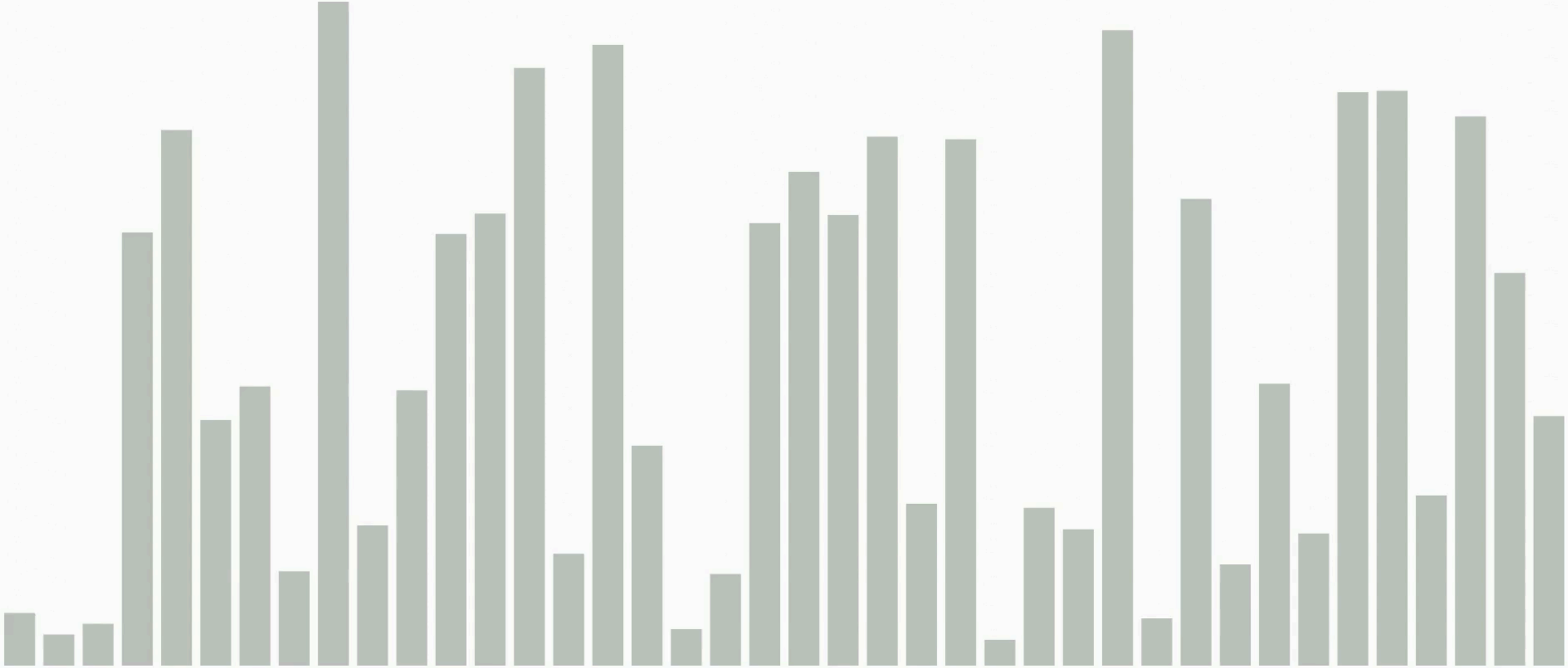
Bubble Sort



```
Repeat n-1 times
    For j from 0 to n - 2
        If j'th and j + 1'th elements out of order
            Swap them
```

cs50.brianyu.me/sorting.c

Exercise

Complete **sorting.c** such that it sorts integers using Bubble Sort.

cs50.brianyu.me/sorting.c

```
Repeat n-1 times
    For j from 0 to n - 2
        If j'th and j + 1'th elements out of order
            Swap them
```

Bubble Sort

```
Repeat n-1 times
    For j from 0 to n-2
        If j'th and j+1'th elements out of order
            Swap them
```

Bubble Sort

```
Repeat n-1 times
    For j from 0 to n-2
        If j'th and j+1'th elements out of order
            Swap them
```

```
for (int i = 0; i < n - 1; i++)
{









}
```

Bubble Sort

```
Repeat n-1 times
    For j from 0 to n-2
        If j'th and j+1'th elements out of order
            Swap them
```

```
for (int i = 0; i < n - 1; i++)
{
    for (int j = 0; j < n - 1; j++)
    {









    }
}
```

Bubble Sort

```
Repeat n-1 times
    For j from 0 to n-2
        If j'th and j+1'th elements out of order
            Swap them
```

```
for (int i = 0; i < n - 1; i++)
{
    for (int j = 0; j < n - 1; j++)
    {
        if (values[j] > values[j + 1])
        {



        }
    }
}
```

Bubble Sort

```
Repeat n-1 times
    For j from 0 to n-2
        If j'th and j+1'th elements out of order
            Swap them
```

```
for (int i = 0; i < n - 1; i++)
{
    for (int j = 0; j < n - 1; j++)
    {
        if (values[j] > values[j + 1])
        {
            int temp = values[j];



        }
    }
}
```

Bubble Sort

```
Repeat n-1 times
    For j from 0 to n-2
        If j'th and j+1'th elements out of order
            Swap them
```

```
for (int i = 0; i < n - 1; i++)
{
    for (int j = 0; j < n - 1; j++)
    {
        if (values[j] > values[j + 1])
        {
            int temp = values[j];
            values[j] = values[j + 1];

        }
    }
}
```

Bubble Sort

```
Repeat n-1 times
    For j from 0 to n-2
        If j'th and j+1'th elements out of order
            Swap them
```

```
for (int i = 0; i < n - 1; i++)
{
    for (int j = 0; j < n - 1; j++)
    {
        if (values[j] > values[j + 1])
        {
            int temp = values[j];
            values[j] = values[j + 1];
            values[j + 1] = temp;
        }
    }
}
```

Bubble Sort

```
for (int i = 0; i < n - 1; i++)
{
    for (int j = 0; j < n - 1; j++)
    {
        if (values[j] > values[j + 1])
        {
            int temp = values[j];
            values[j] = values[j + 1];
            values[j + 1] = temp;
        }
    }
}
```

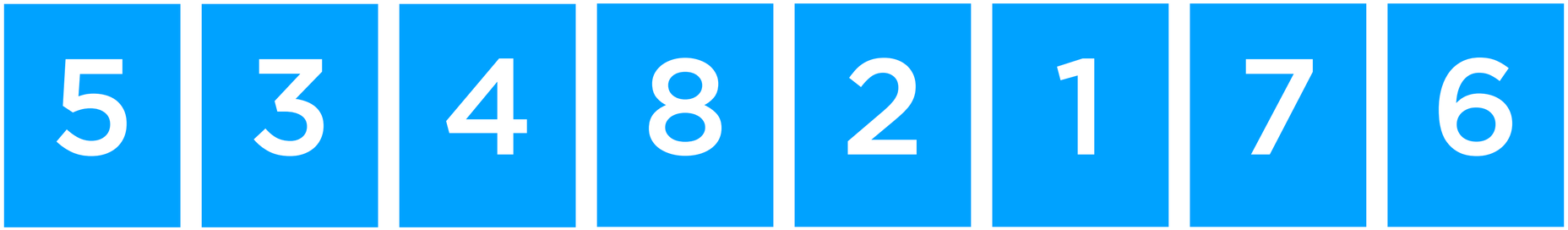
Bubble Sort

```
for (int i = 0; i < n - 1; i++)
{
    for (int j = 0; j < n - 1 - i; j++)
    {
        if (values[j] > values[j + 1])
        {
            int temp = values[j];
            values[j] = values[j + 1];
            values[j + 1] = temp;
        }
    }
}
```

Bubble Sort

```
for (int i = 0; i < n - 1; i++)
{
    bool swaps = false;
    for (int j = 0; j < n - 1 - i; j++)
    {
        if (values[j] > values[j + 1])
        {
            int temp = values[j];
            values[j] = values[j + 1];
            values[j + 1] = temp;
            swaps = true;
        }
    }
    if (swaps == false)
        break;
}
```

Selection Sort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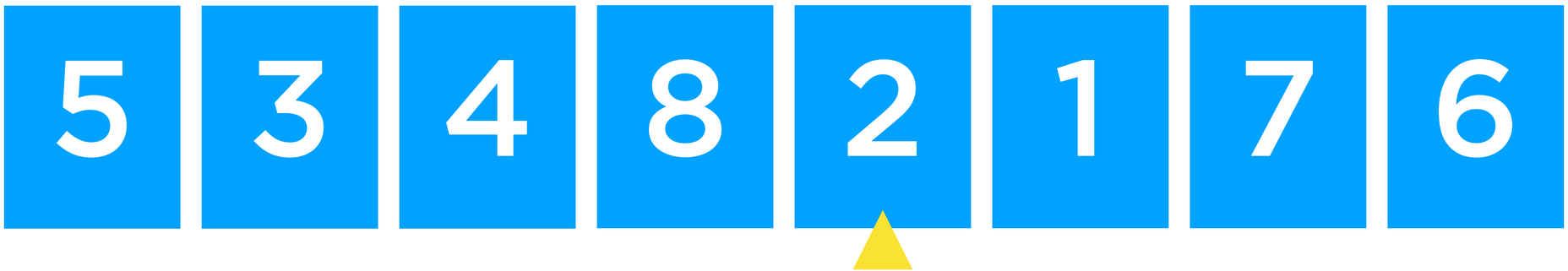
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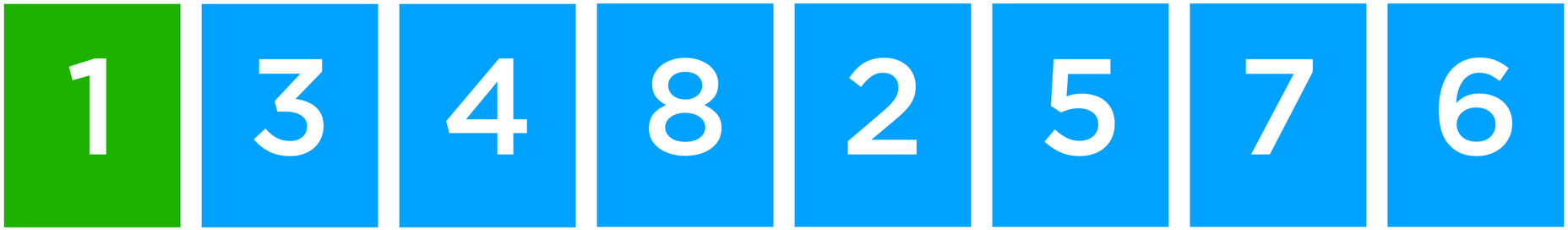
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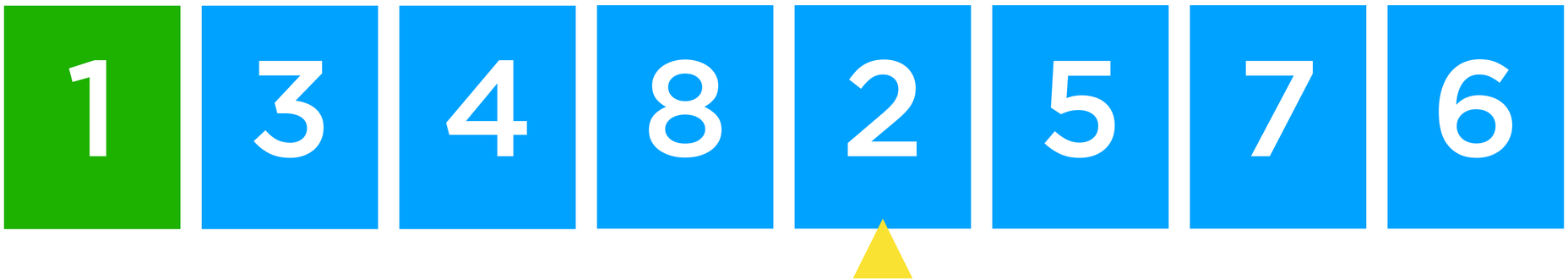
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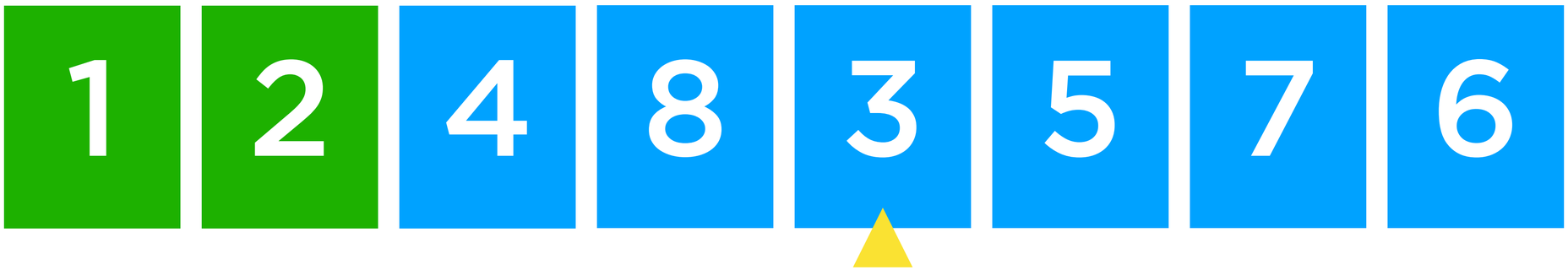
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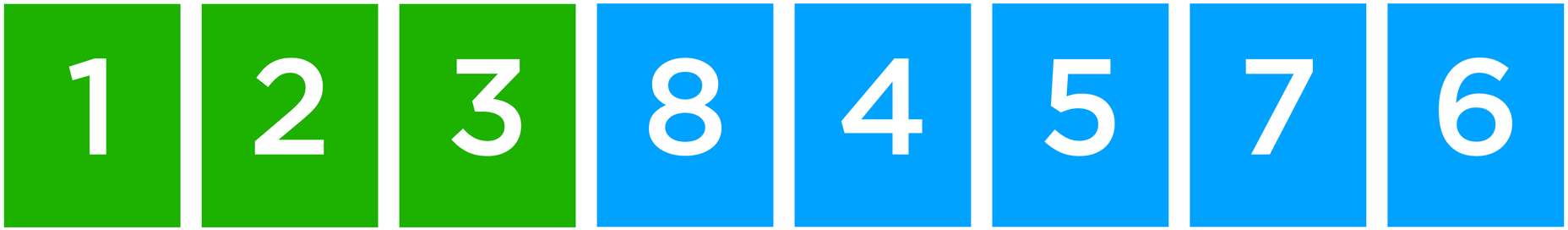
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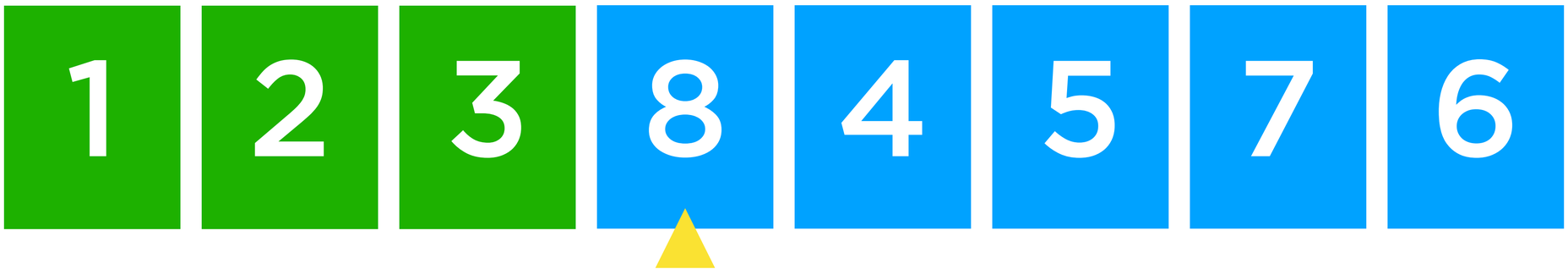
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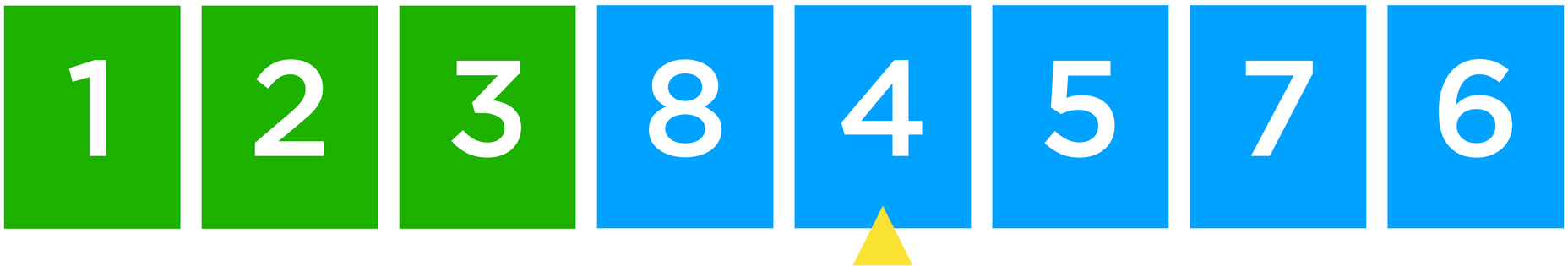
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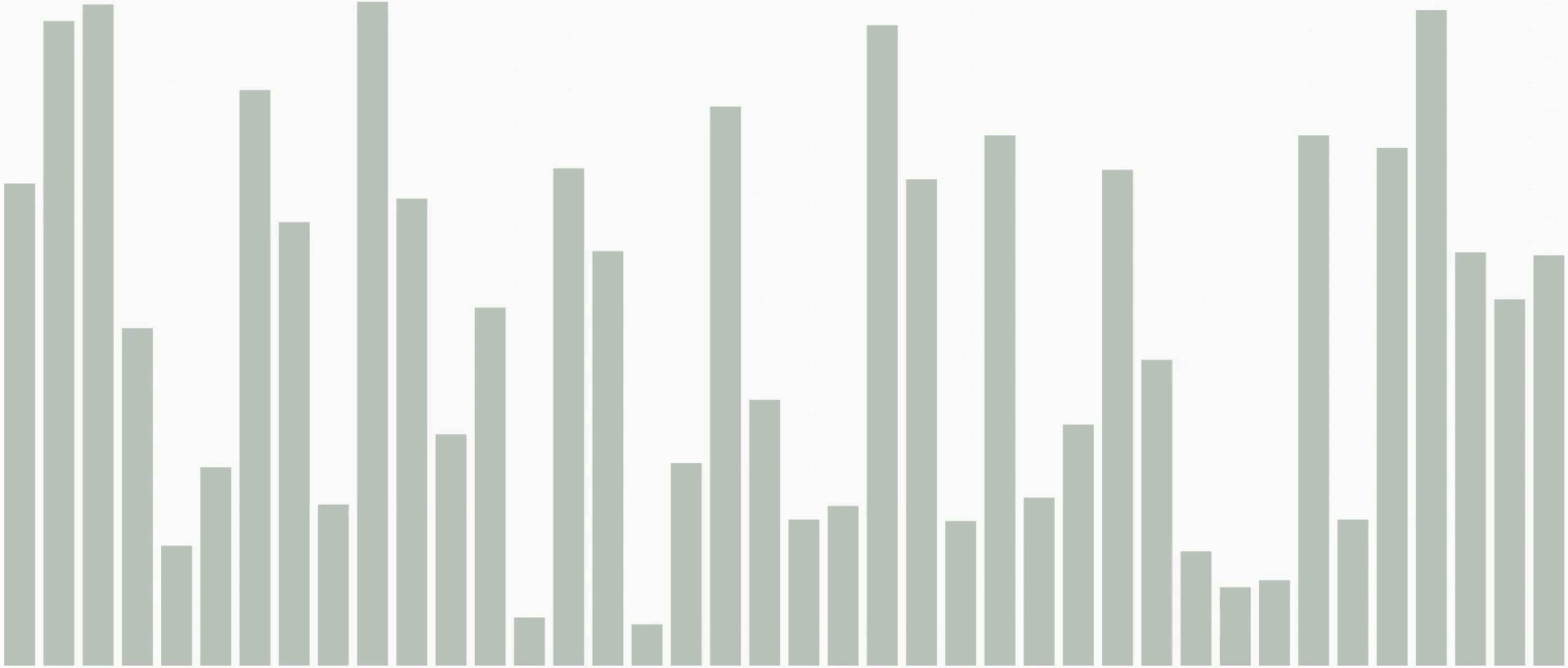
Selection Sort



```
For i from 0 to n-1
    Find smallest item between i'th item and last item
    Swap smallest item with i'th item
```

Exercise

Complete `sorting.c` such that it sorts integers using Selection Sort.

`cs50.brianyu.me/sorting.c`

```
For i from 0 to n-1
    Find smallest item between i'th item and last item
    Swap smallest item with i'th item
```

Part Two

Recursion and Structs

```
void countdown(int n)
{
    if (n == 0)
        return;
    printf("%i\n", n);
    countdown(n - 1);
}
```

```
void countdown(int n)
{
    if (n == 0)
        return;
    printf("%i\n", n);
    countdown(n - 1);
}
```

```
void countdown(int n)
{
    if (n == 0)
        return;
    printf("%i\n", n);
    countdown(n - 1);
}
```

base case

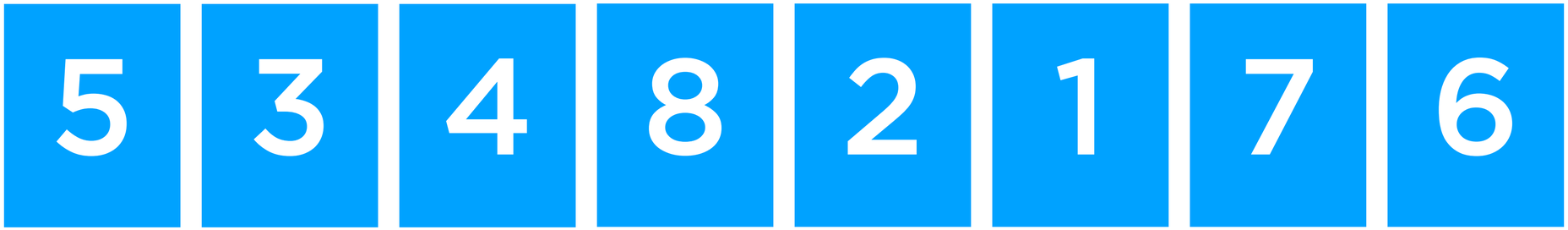
```
void countdown(int n)
{
    if (n == 0)
        return;
    printf("%i\n", n);
    countdown(n - 1);
}
```

```
void countdown(int n)
{
    if (n == 0)
        return;
    printf("%i\n", n);
    countdown(n - 1);
}
```

recursive call

```
void countdown(int n)
{
    if (n == 0)
        return;
    printf("%i\n", n);
    countdown(n - 1);
}
```

Mergesort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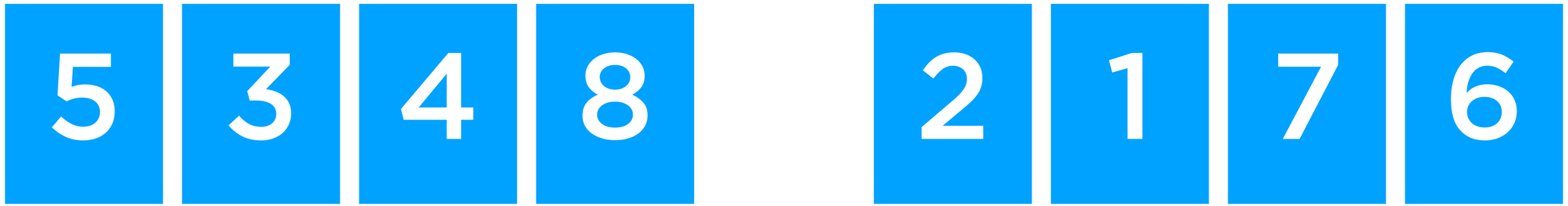
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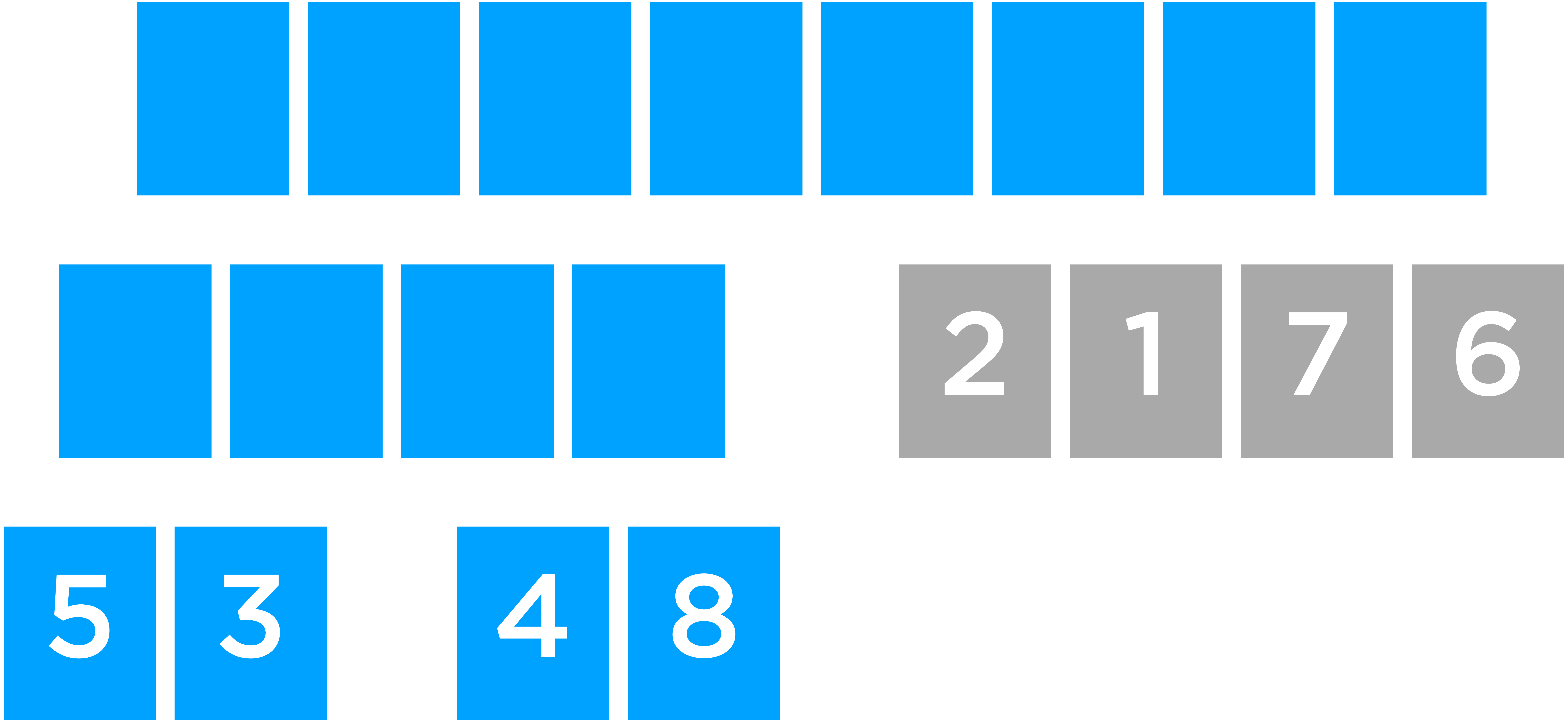
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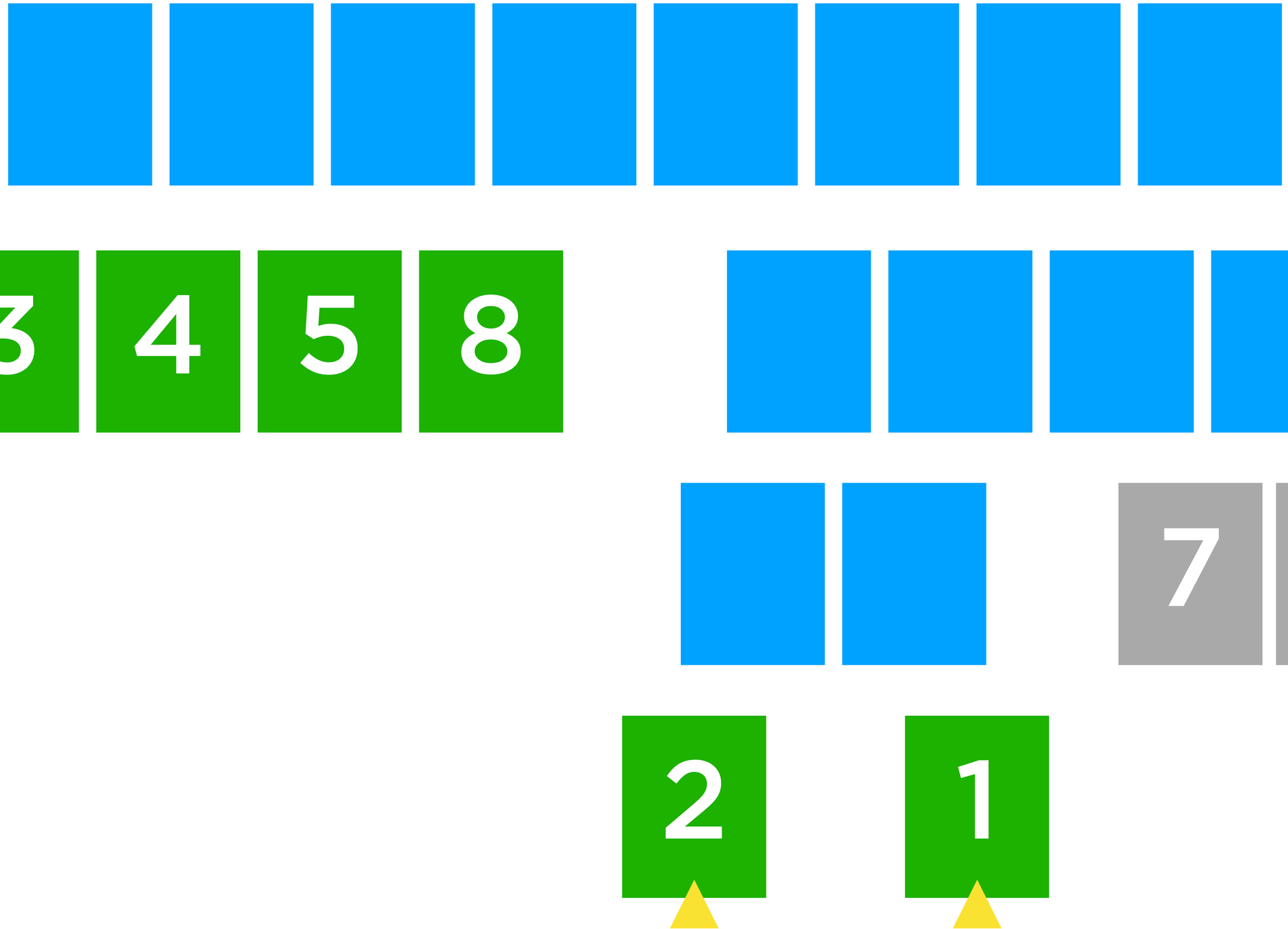
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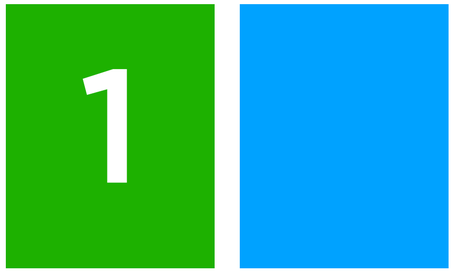
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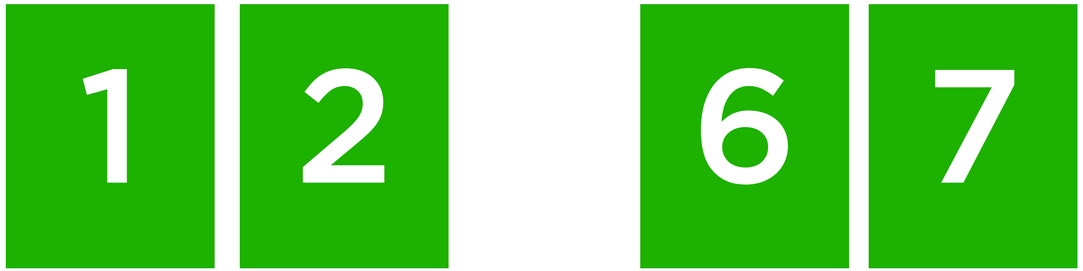
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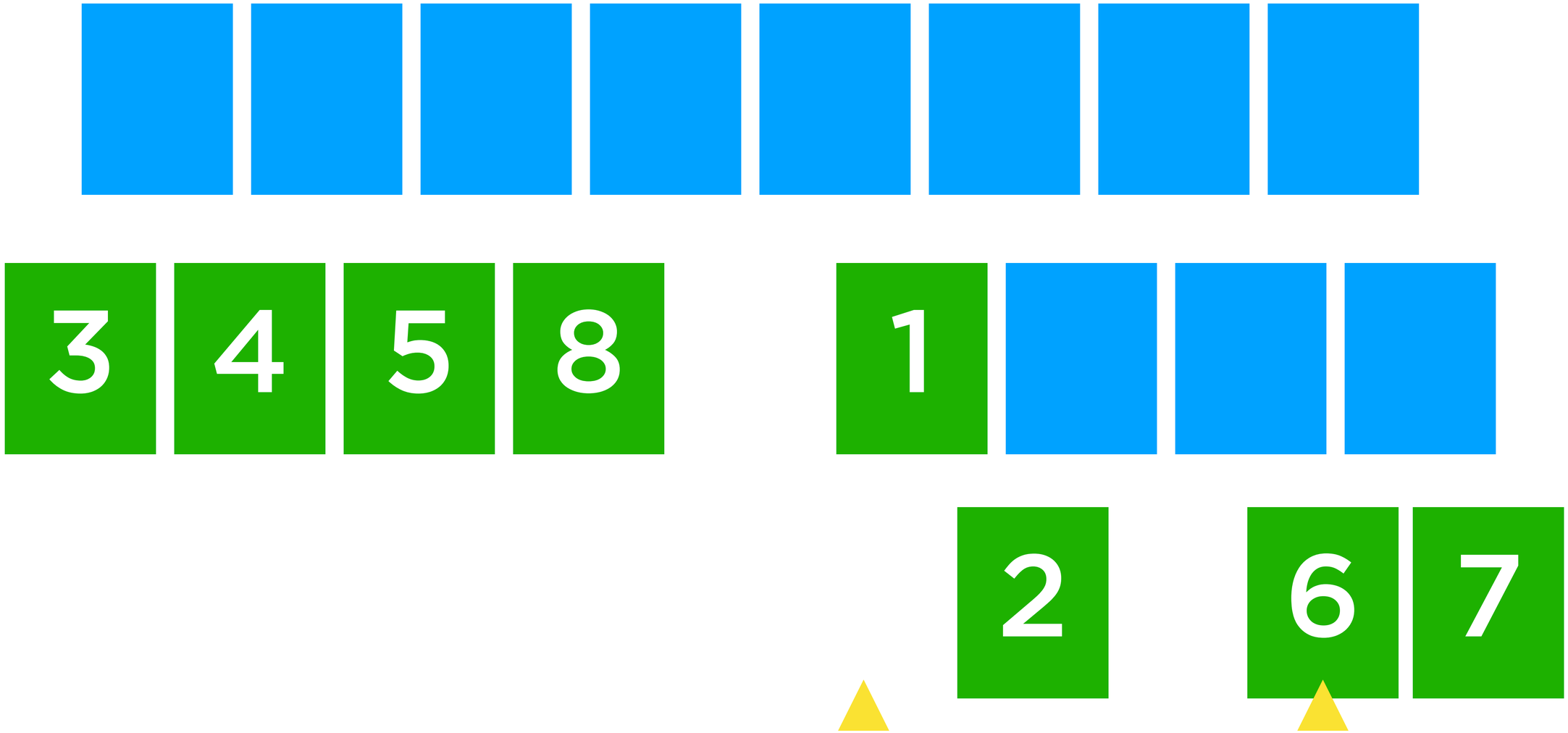
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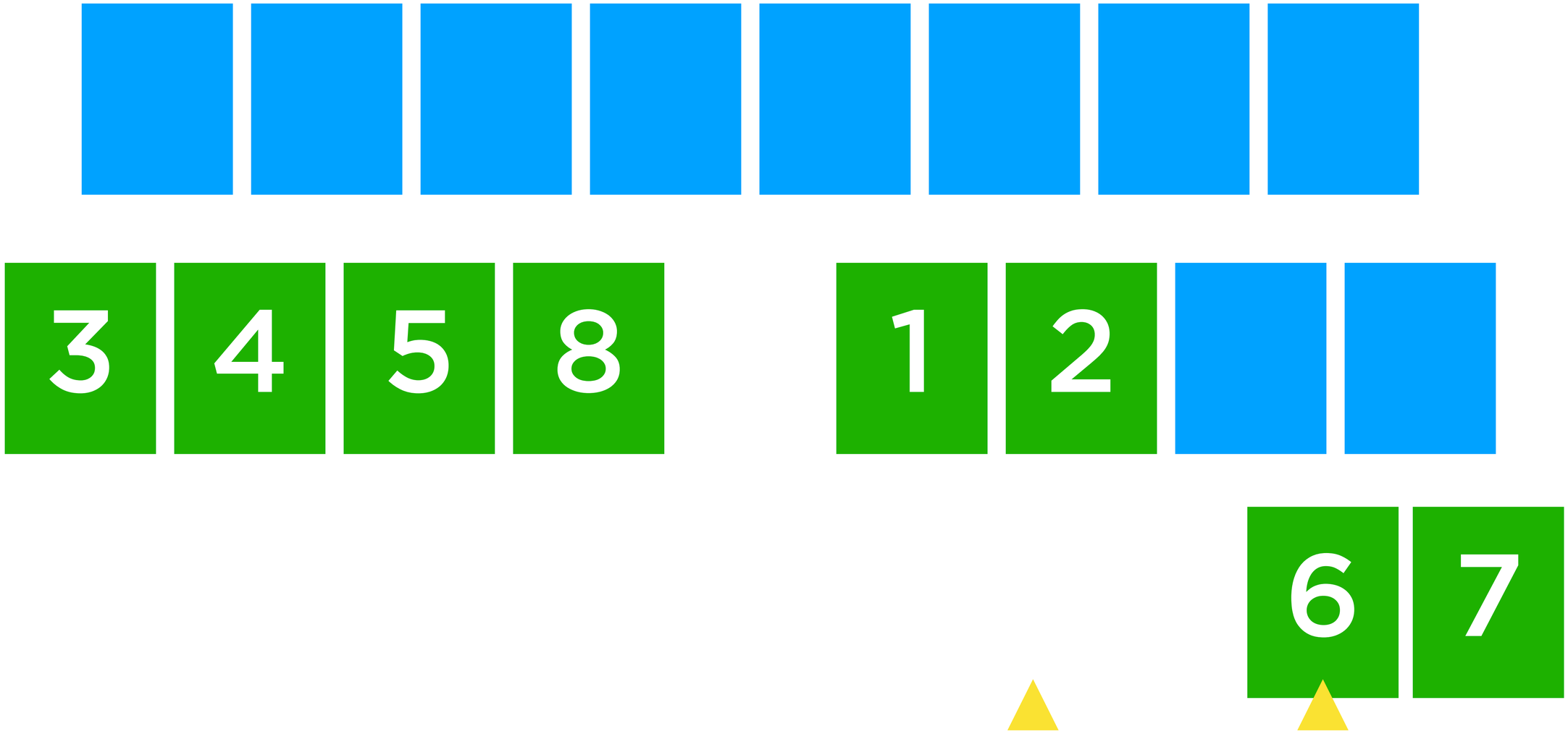
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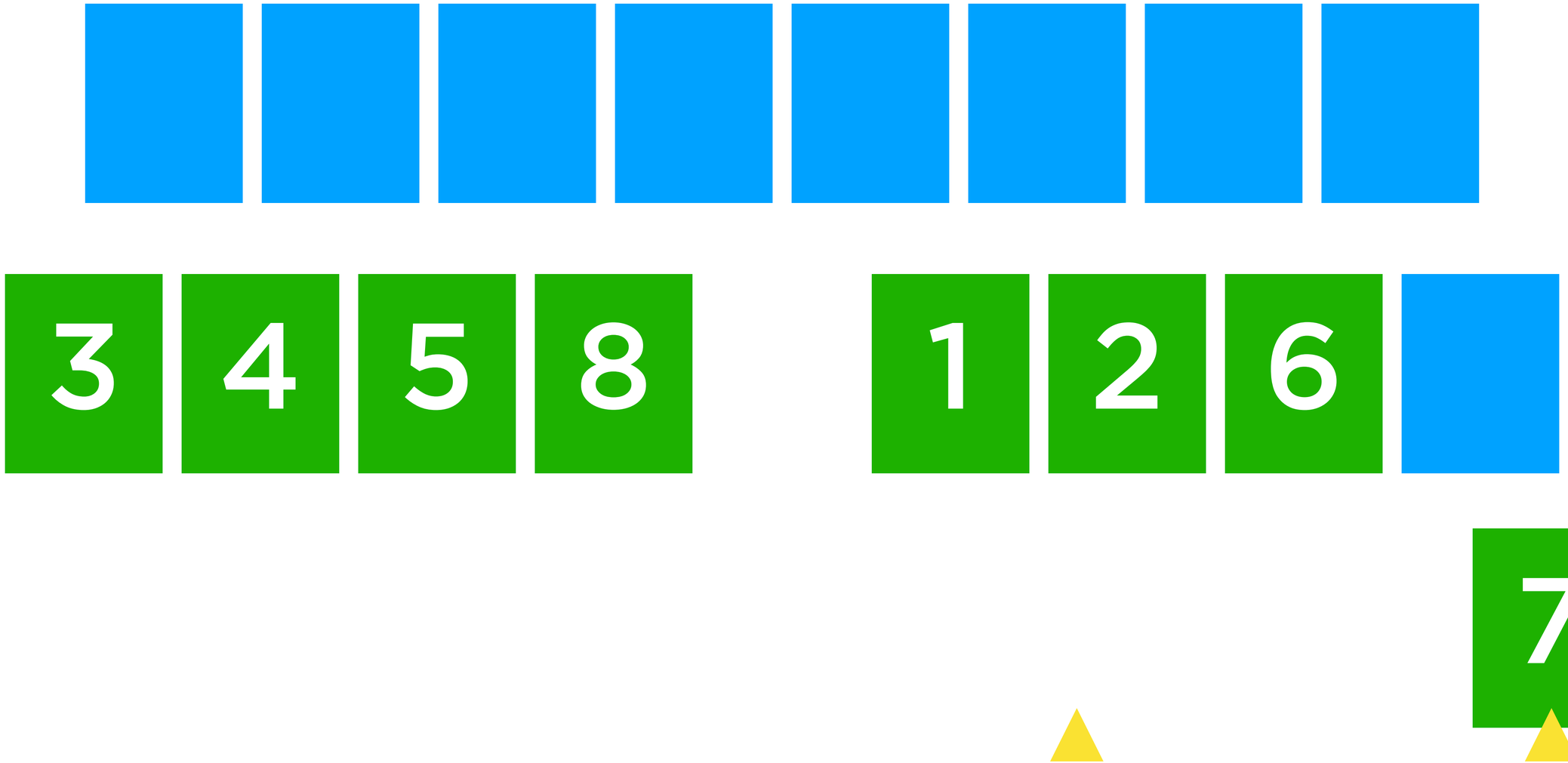
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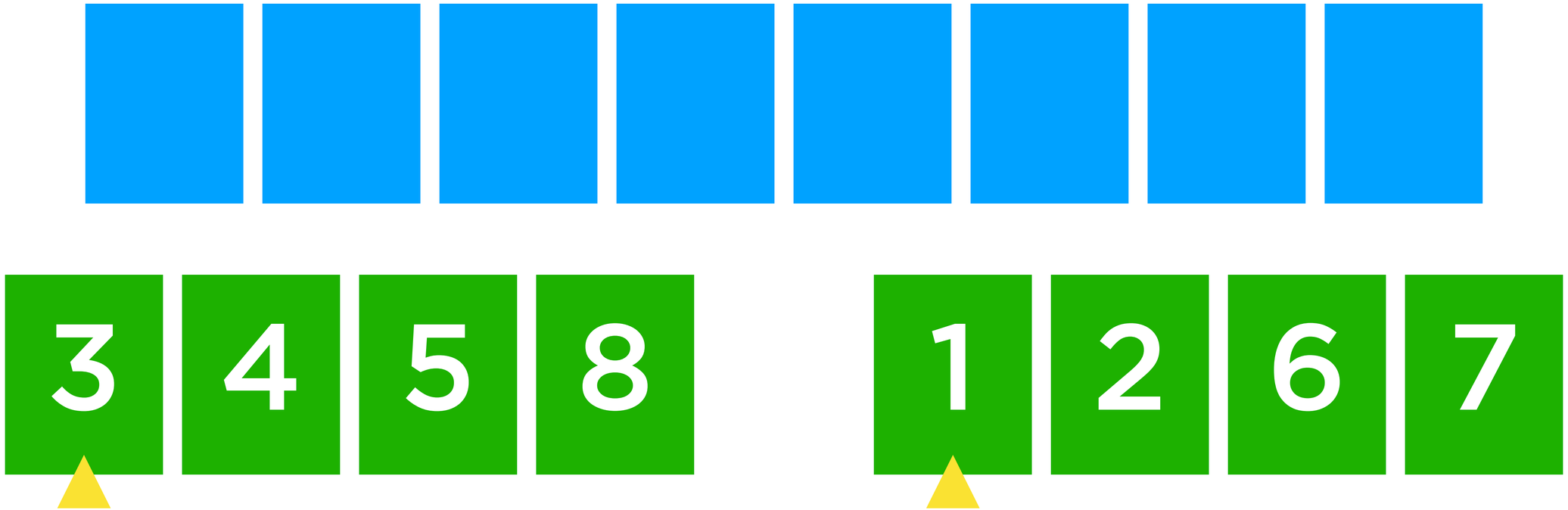
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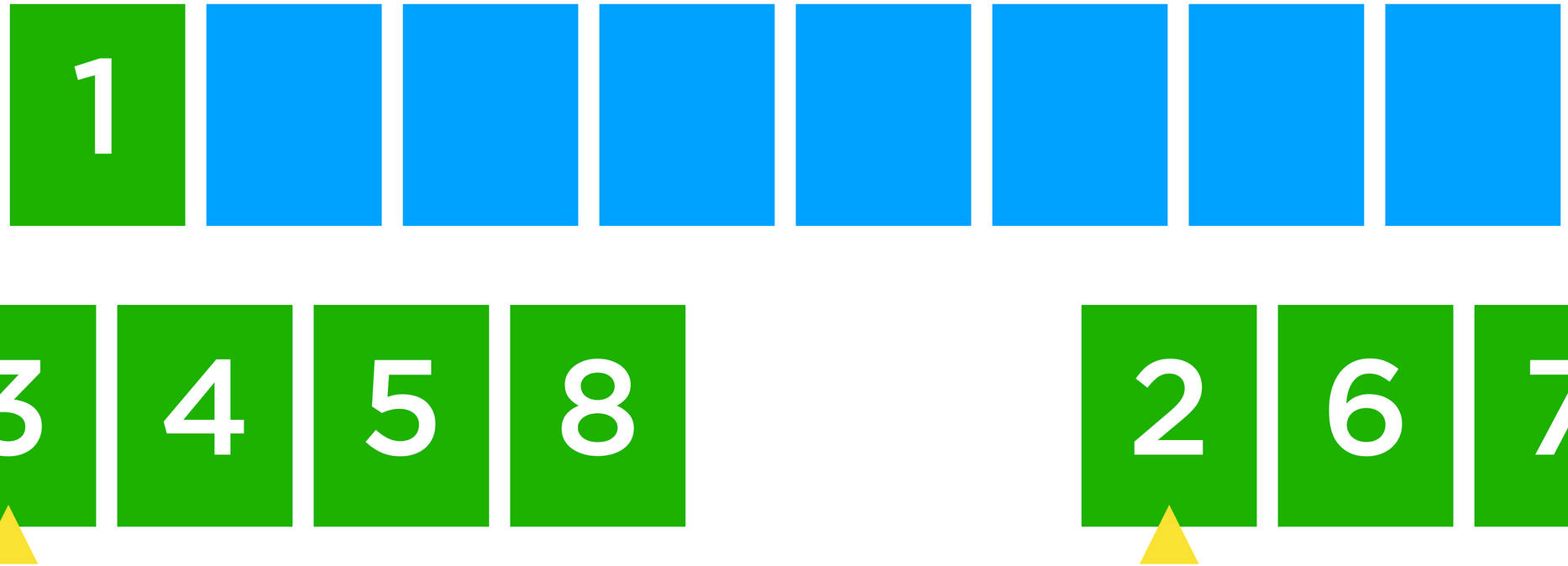
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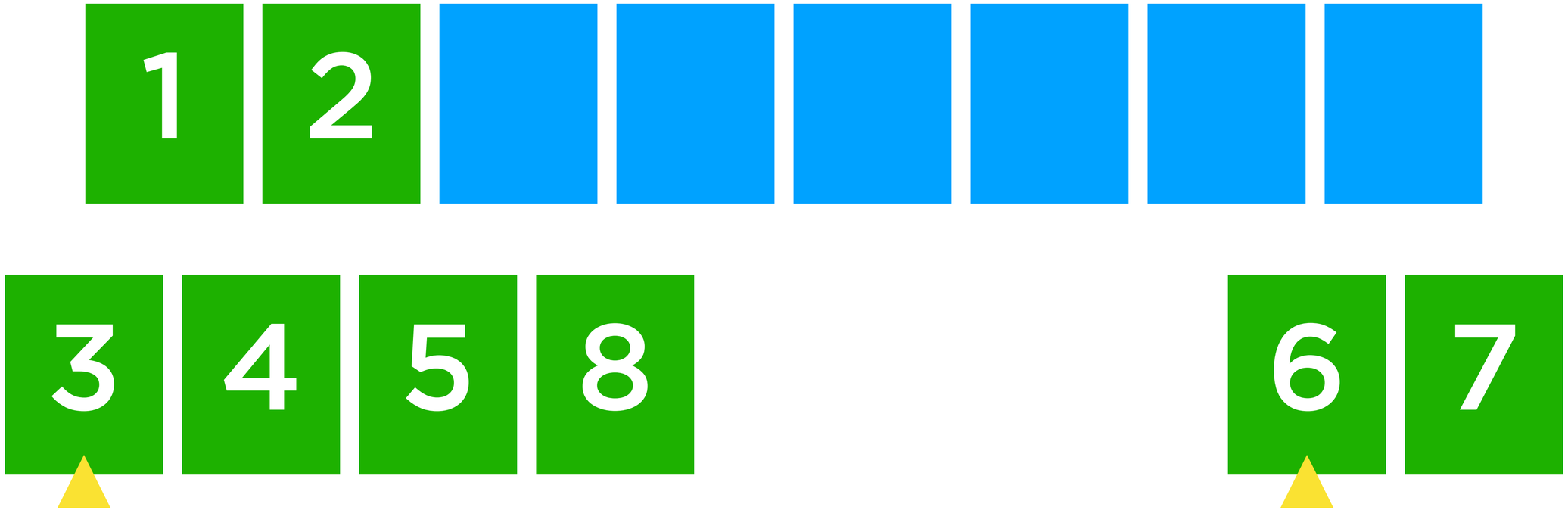
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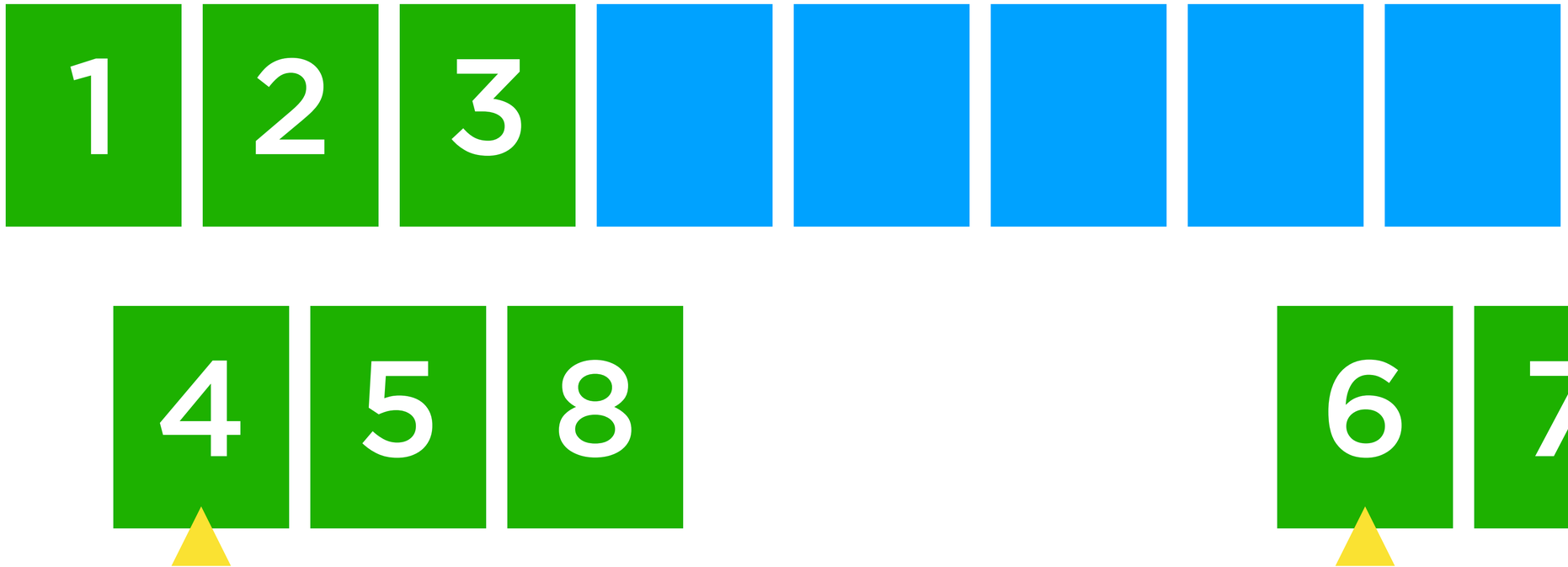
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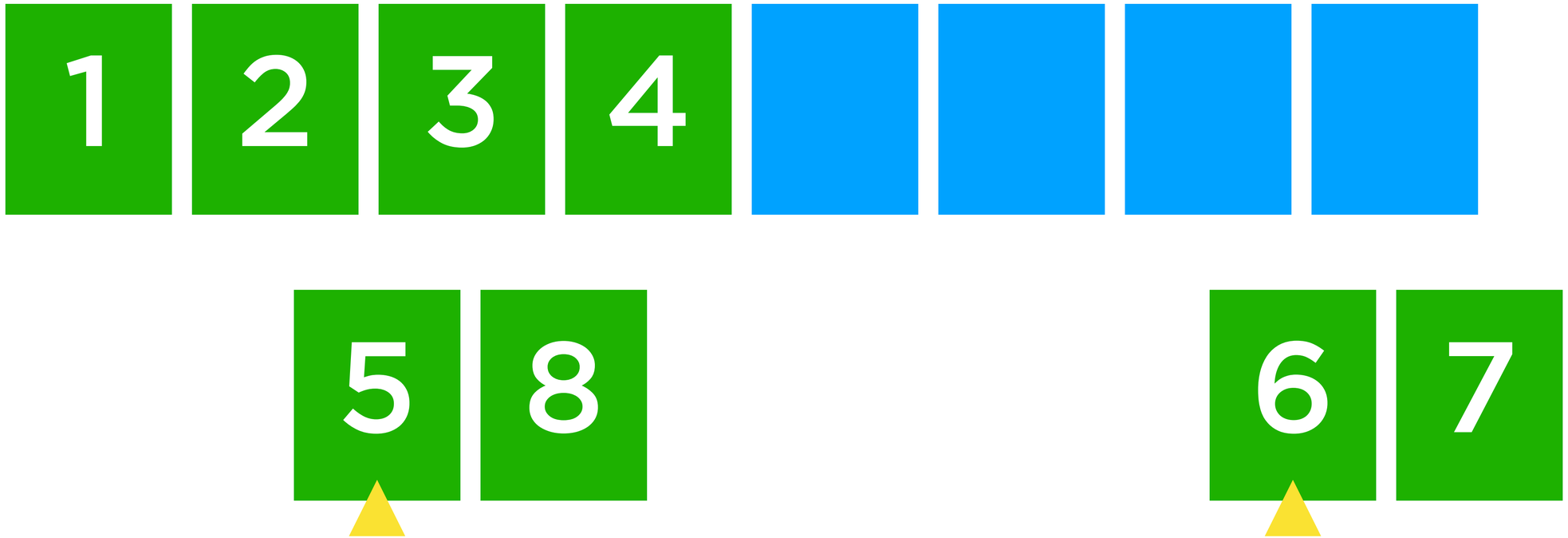
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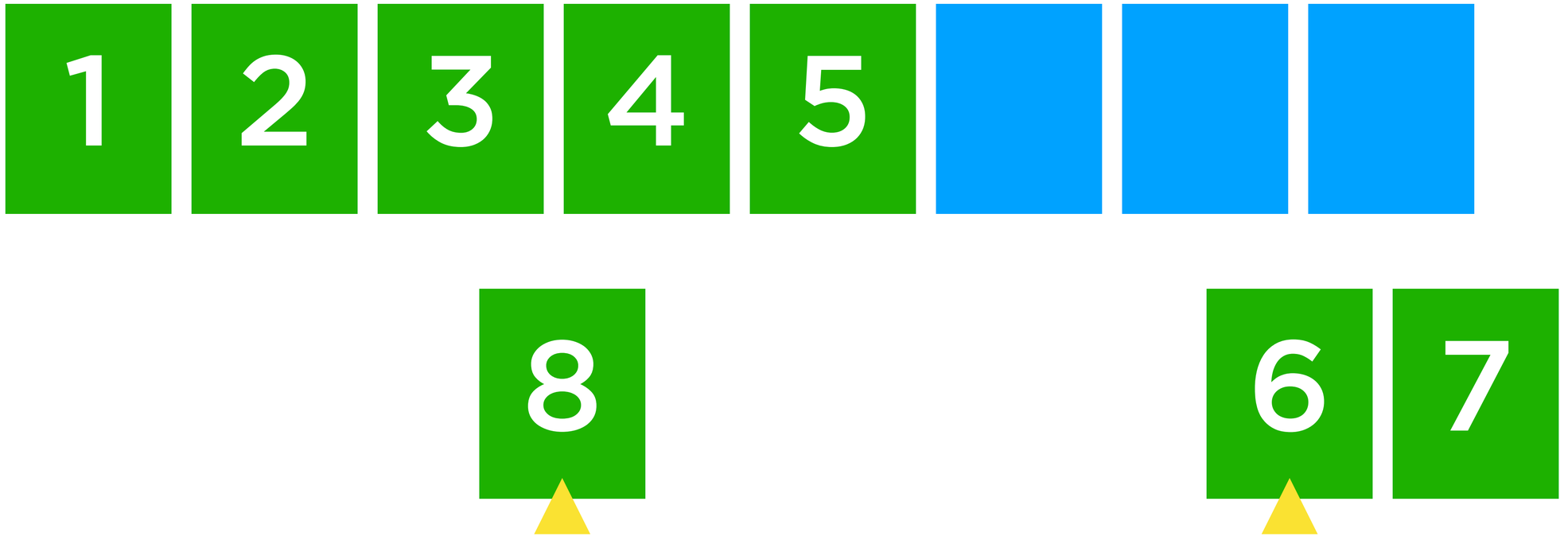
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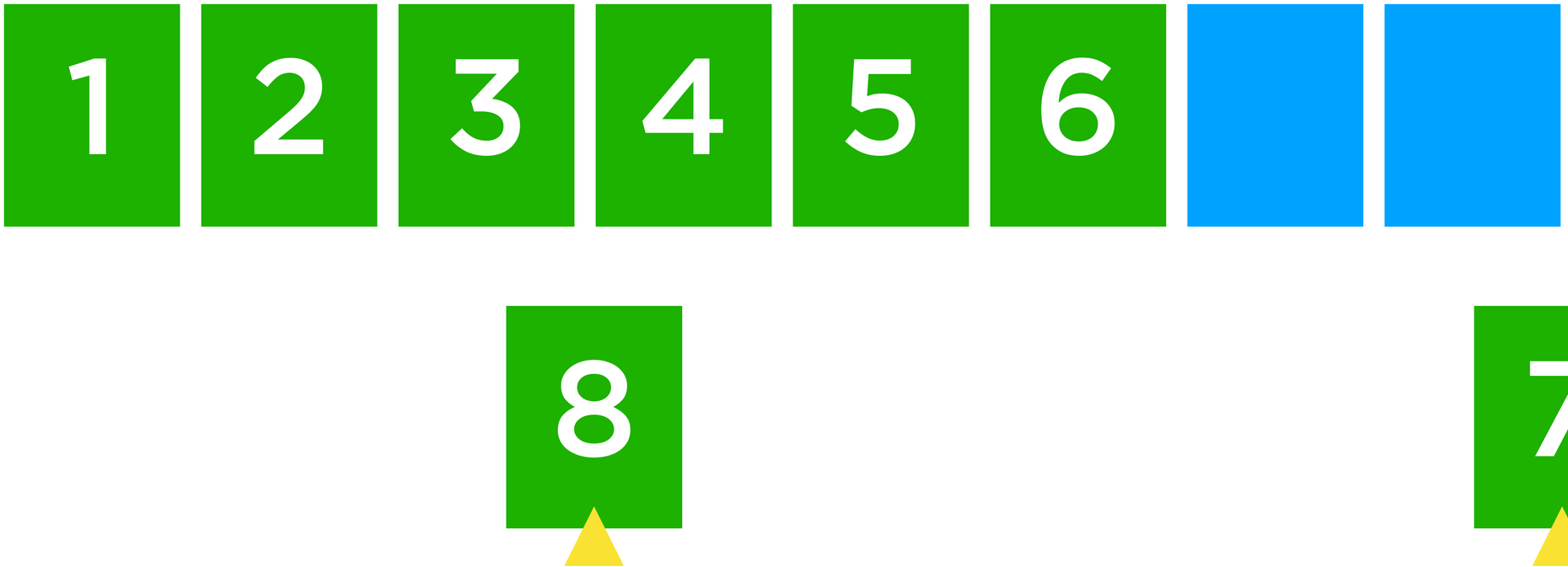
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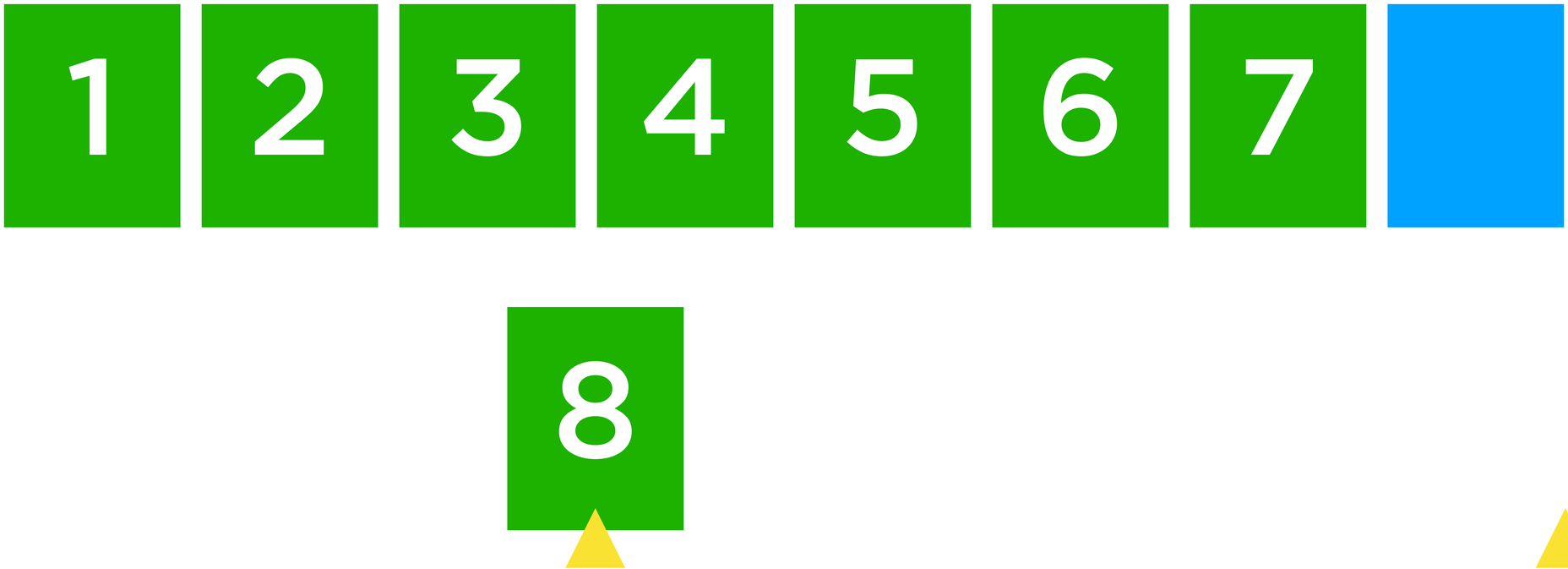
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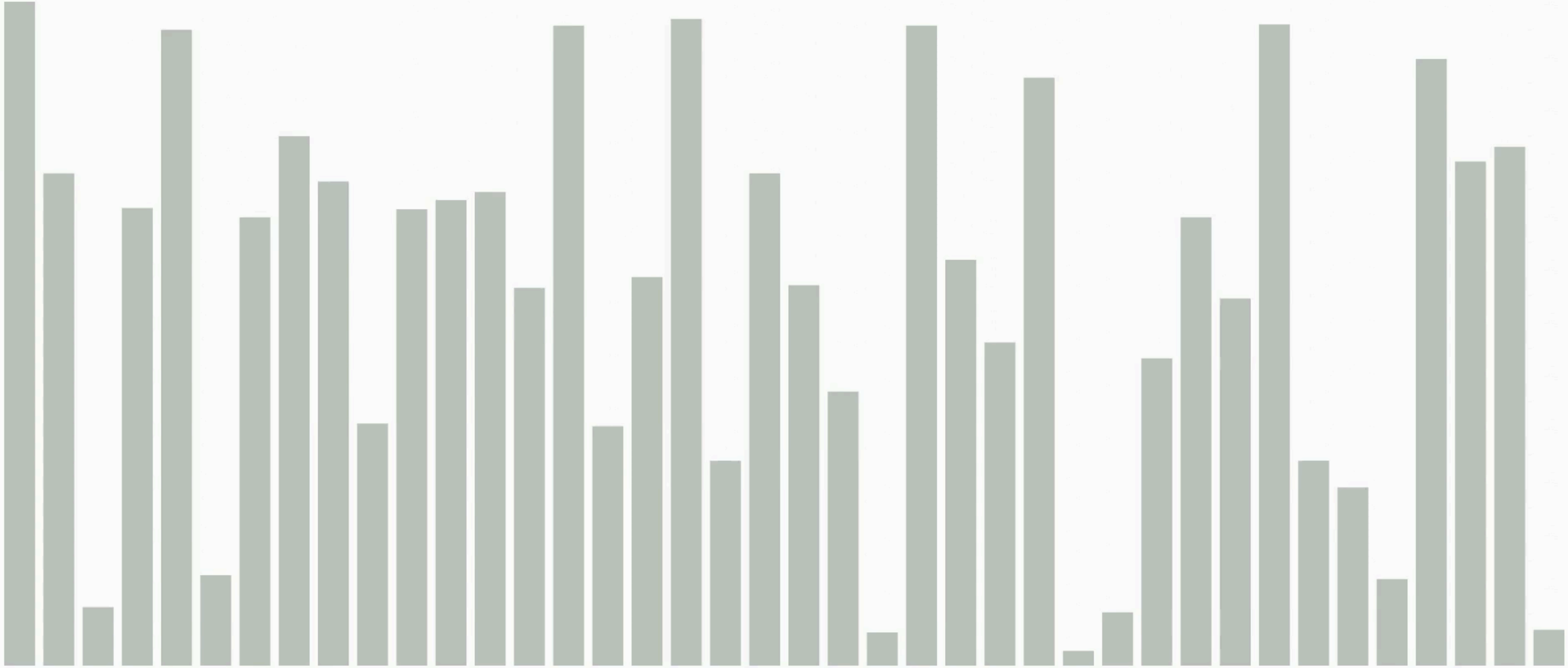
Mergesort



Structs

```
typedef struct
{
    string name;
    string number;
}
person;
```

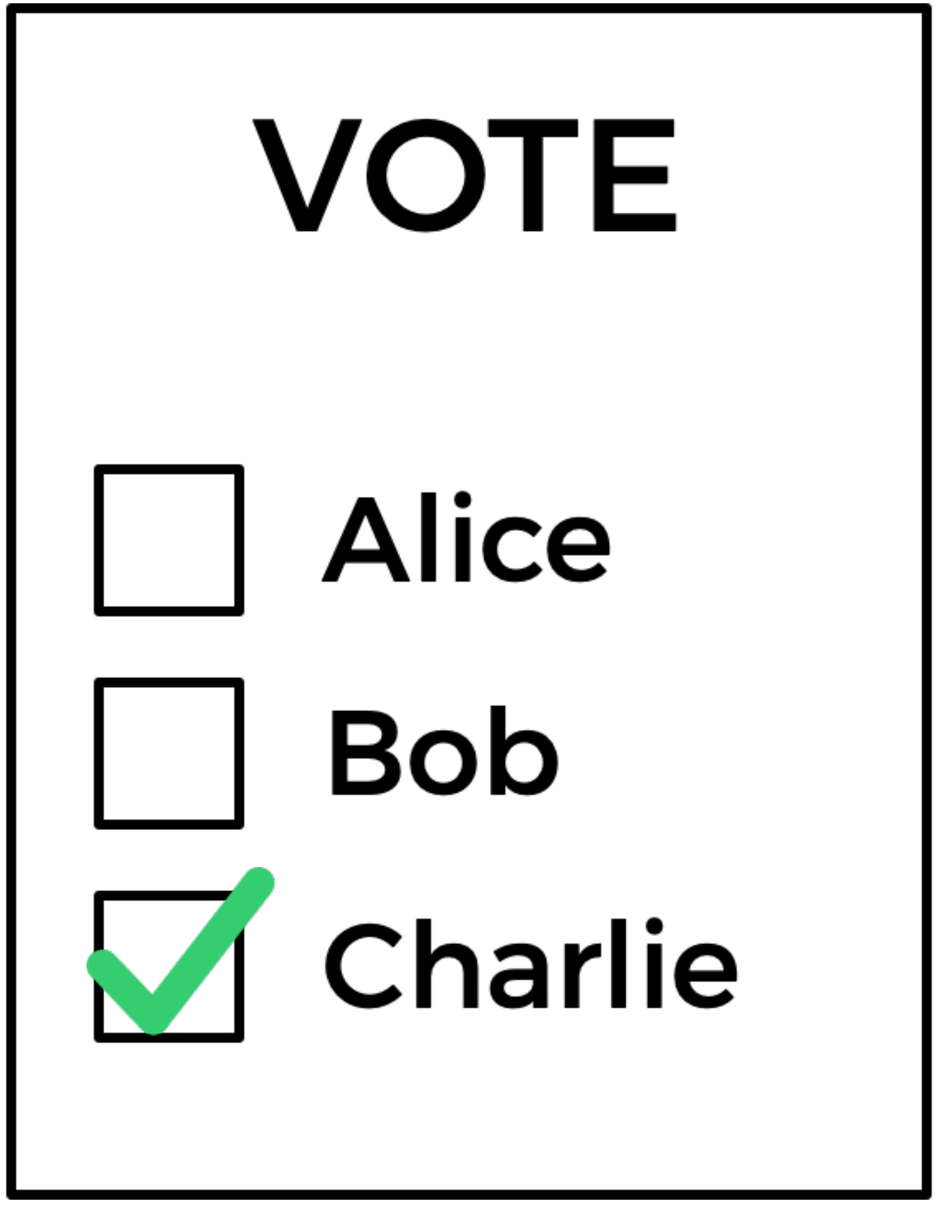
```
typedef struct
{
    string name;
    string number;
}
person;
```

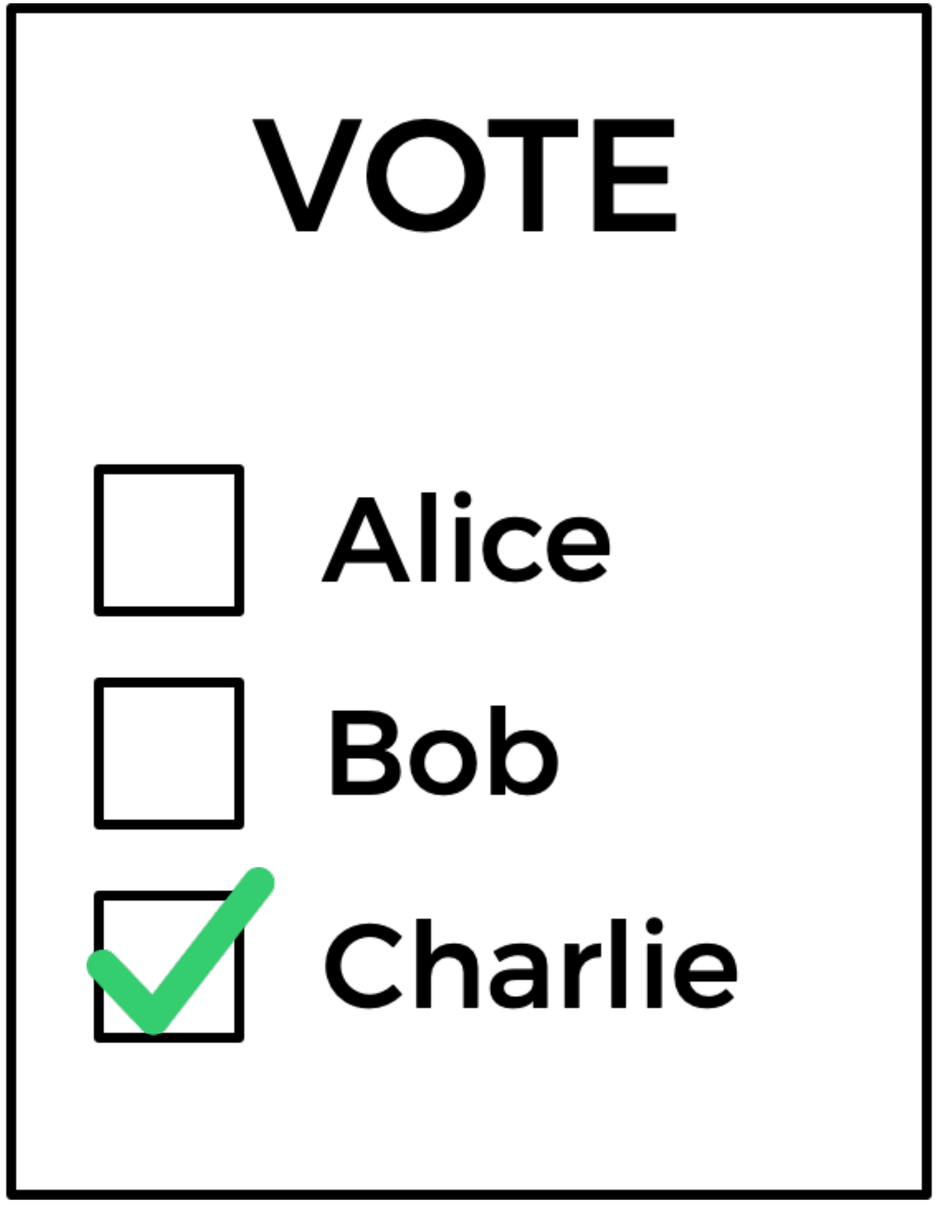
```
person p;

p.name = "Emma";

p.number = "555-0100";
```

Problem Set 3

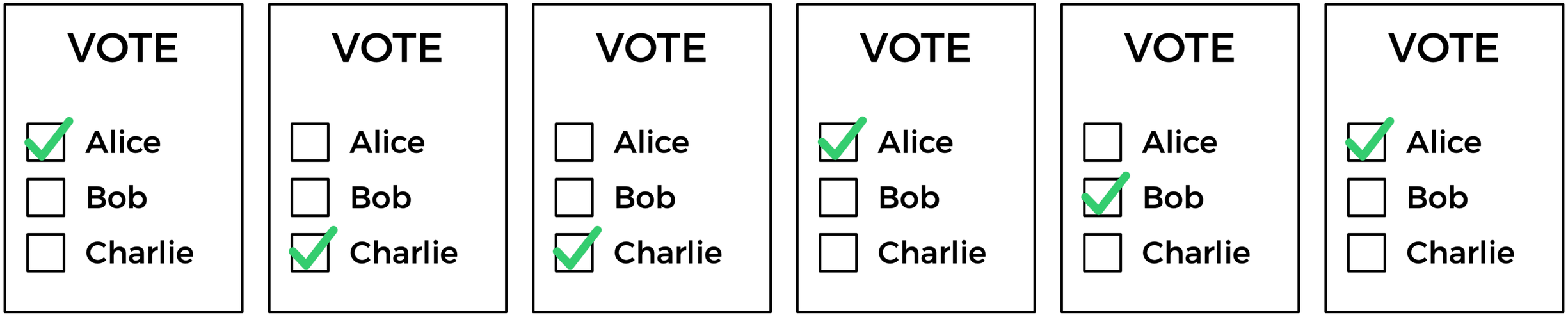
Problem Set 3

- Plurality
- One of:
    - Runoff
    - Tideman

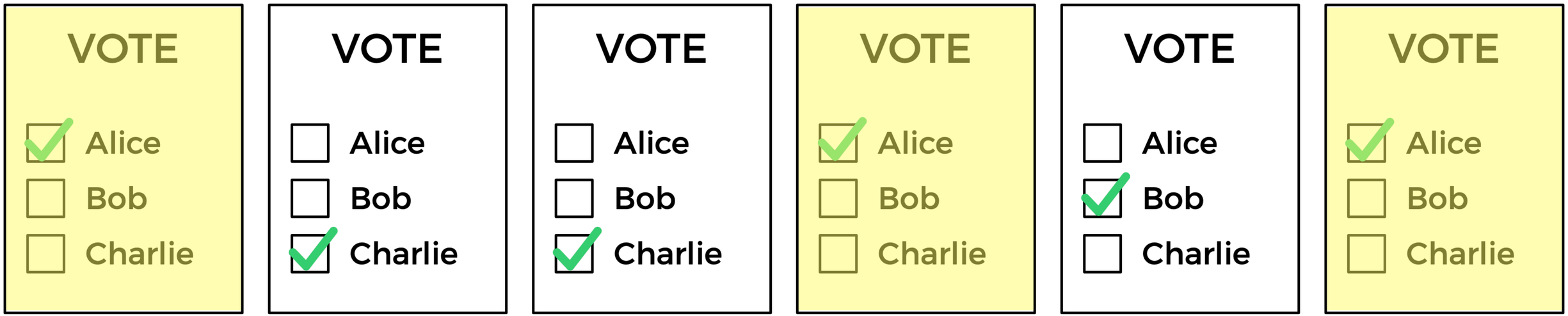

VOTE
Alice
Bob
Charlie


VOTE
Alice
Bob
Charlie

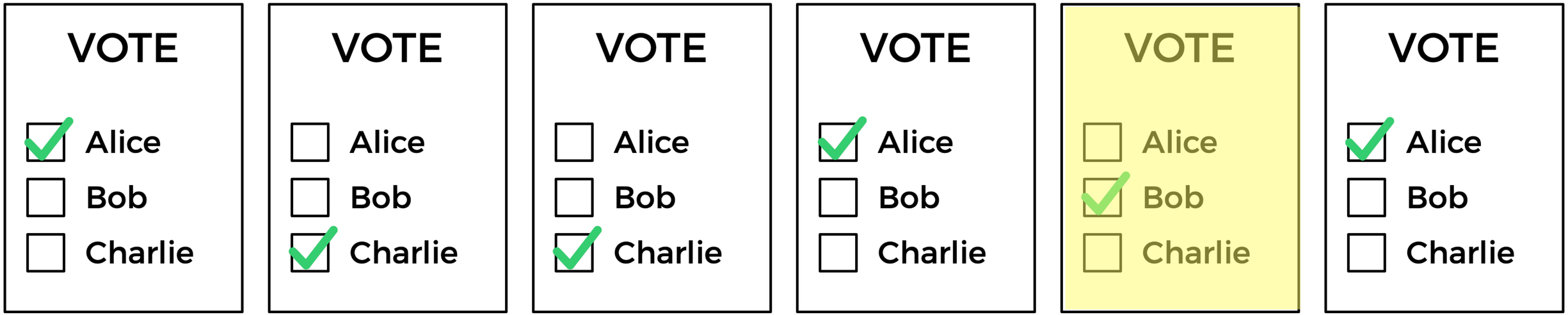
name	Alice	Bob	Charlie
votes			



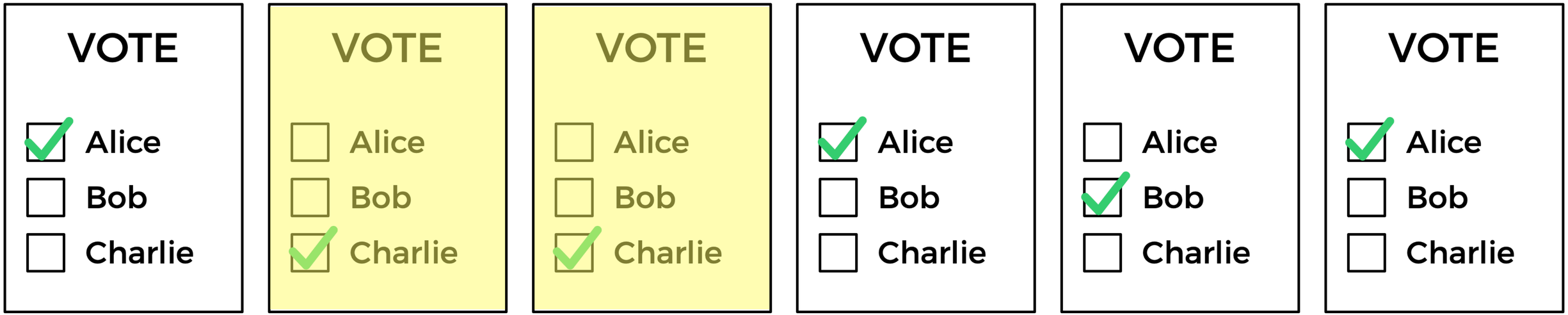
name	Alice	Bob	Charlie
votes	3		



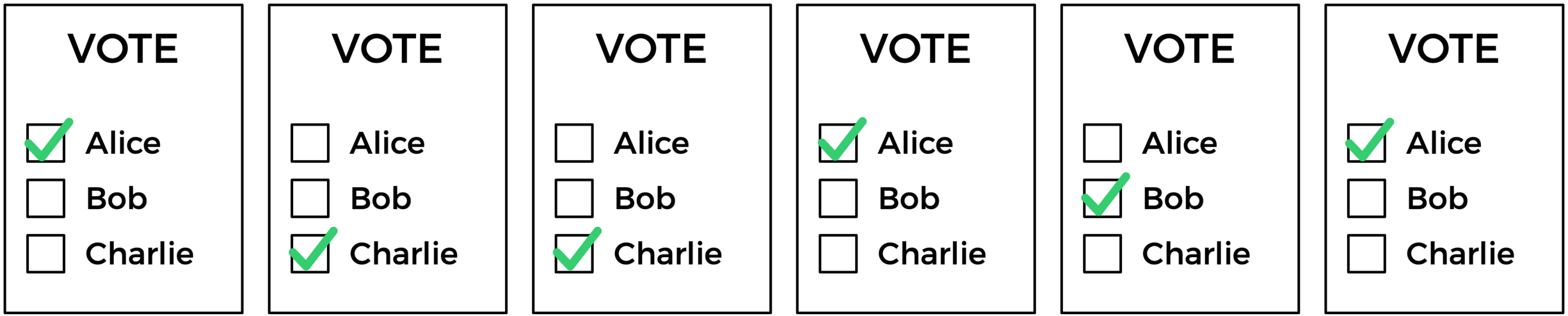
name	Alice	Bob	Charlie
votes	3	1	



name	Alice	Bob	Charlie
votes	3	1	2



name	Alice	Bob	Charlie
votes	3	1	2



```
typedef struct
{
    string name;
    int votes;
}
candidate;

candidate candidates[MAX];
```

name	Alice
votes	3

name	Alice	Bob	Charlie
votes	3	1	2

candidates[0]

name	Alice	Bob	Charlie
votes	3	1	2

candidates[1]

name	Alice	Bob	Charlie
votes	3	1	2

candidates[2]

name	Alice	Bob	Charlie
votes	3	1	2

```
candidates[2].name
```

name	Alice	Bob	Charlie
votes	3	1	2

```
candidates[2].votes
```

Part Three

Lab

This is CS50.