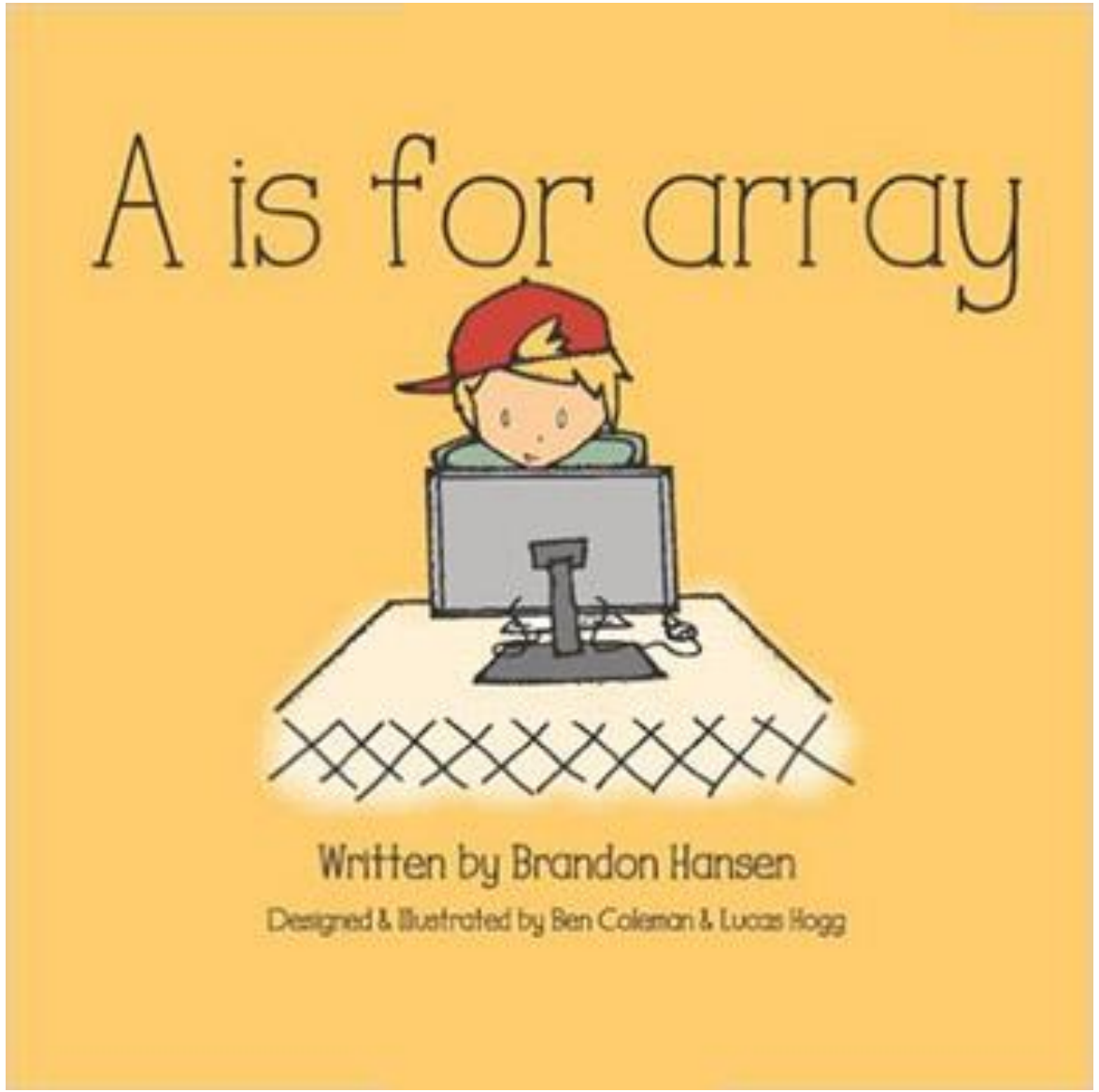
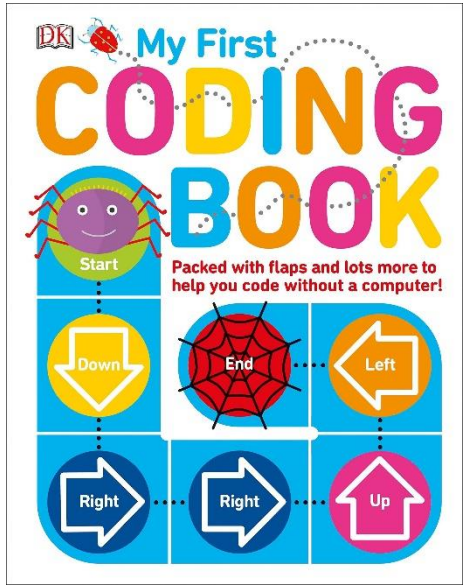
Unit 3: Algorithms

Sheet 3.1: Array introduction & Big Oh Notation


A is for array
Written by Brandon Hansen
Designed & Illustrated by Ben Coleman & Lucas Hogg


<div class="go"
id="homesweet
homelife">
<title>
HTML
for Babies
</title>
Web Design for Babies™ Volume 01


DK
My First
CODING
BOOK
Packed with flaps and lots more to help you code without a computer!
Start
Down
End
Left
Right
Right
Up


BABY Loves
Coding!
Ruth Spiro
Illustrated by Irene Chan

```
int a[] = {5, 7, 23, 9, 0};
int b = 0;

int c[] = new int[5];
```

A card for you to write:

Array

- A group of variables stored under one name.
- After declaration, it has a constant length. All elements must be the same type.

- The grouping of variables under one name is useful because then a loop can go through all elements quickly.
- Many functions, like searching and sorting, are too difficult to code without a loop.

[“hip“,“hip“]

(hip hip array!)

Declaration

```
int a[]={5, 7, 23, 9, 0};
int b = 0;
```

[0]	[1]	[2]	[3]	[4]
5	7	23	9	0

Declaration

```
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int b = 0;
```

Array Memory Diagram

[0]	[1]	[2]	[3]	[4]
5	7	23	9	0

Declaration

```
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Array Memory Diagram

[0]	[1]	[2]	[3]	[4]
5	7	23	9	0

Index

Starts at 0, goes to a.length -1

Declaration

```
int a[]={5, 7, 23, 9, 0};
int b = 0;
```

Array Memory Diagram

Index

Starts at 0, goes to a.length -1

[0]	[1]	[2]	[3]	[4]
5	7	23	9	0

Element

```
int a[]={5, 7, 23, 9, 0};
```

What is a.length?

What is a.length()?

What is an Array Index Out of Bounds?

```
int a[]={5, 7, 23, 9, 0};
```

What is a.length?

What is a.length()?

What is an Array Index Out of Bounds?

5. The size of the array

```
int a[]={5, 7, 23, 9, 0};
```

What is a.length?

5. The size of the array

What is a.length()?

Nothing. That's a STRING function.

What is an Array Index Out of Bounds?

```
int a[]={5, 7, 23, 9, 0};
```

What is a.length?

5. The size of the array

What is a.length()?

Nothing. That's a STRING function.

What is an Array Index Out of Bounds?

a[345]. You pick an index that is too big.

```
int a[]={5, 7, 23, 9, 0};

//Print
TextView result = (TextView) findViewById (R.id.result);
String rev = "";

for(int i=0; i< a.length; i++)
    rev+= a[i] + " ";

result.setText(rev);
```

```
int a[]={5, 7, 23, 9, 0};

//Print
TextView result = (TextView) findViewById (R.id.result);
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Declare

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```

Declare

Find View

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result.setText(rev);
```

Declare

Find View

Make a String to hold answer

```
int a[]={5, 7, 23, 9, 0};
```

Declare

```
//Print
```

Find View

```
TextView result = (TextView) findViewById (R.id.result);
String rev = "";
```

Make a String to hold answer

```
for(int i=0; i< a.length; i++)
    rev+= a[i] + " ";

result.setText(rev);
```

Loop through array

```
int a[]={5, 7, 23, 9, 0};
```

Declare

```
//Print
```

Find View

```
TextView result = (TextView) findViewById (R.id.result);
String rev = "";
```

Make a String to hold answer

```
for(int i=0; i< a.length; i++)
    rev+= a[i] + " ";
```

Loop through array

```
result.setText(rev);
```

Show results on screen

```
int m[]={1, 8, 3, 4, 20};

//Print backwards
String rev = "";


for(int i=m.length-1; i>=0; i--)
    rev+=m[i]+" ";

result.setText(rev);
```

```
int m[]={1, 8, 3, 4, 20};

//Print backwards
String rev = "";

for(int i=m.length-1; i>=0; i--)
    rev+=m[i]+" ";

result.setText(rev);
```

Length is 5, Last place is 4

Include 0

Down By 1

```
                0 1 2 3 4 5 6 7 8  9 10 11 12 13 14 15
int sort[]={1,2,3,5,5,6,7,8,9,11,13,13,17,20,20,21};

String repeat = "";

for(int i=0; i<sort.length-1; i++){


     if(sort[i]==sort[i+1])

          repeat+= sort[i]+" ";

}

result.setText(repeat);
```

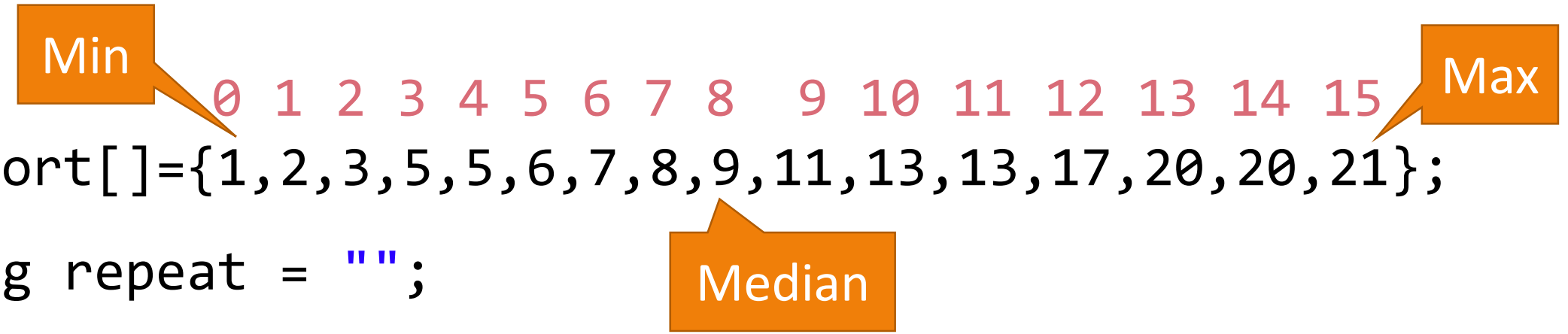
Note that the array is sorted!

```
                0 1 2 3 4 5 6 7 8  9 10 11 12 13 14 15
int sort[]={1,2,3,5,5,6,7,8,9,11,13,13,17,20,20,21};
String repeat = "";
for(int i=0; i<sort.length-1; i++){

    if(sort[i]==sort[i+1])
        repeat+= sort[i]+" ";
}
result.setText(repeat);
```

```
                0 1 2 3 4 5 6 7 8  9 10 11 12 13 14 15
int sort[]={1,2,3,5,5,6,7,8,9,11,13,13,17,20,20,21};

String repeat = "";

for(int i=0; i<sort.length-1; i++){

                  3       4

     if(sort[i]==sort[i+1])

          repeat+= sort[i]+" ";

}

result.setText(repeat);
```

```
                0 1 2 3 4 5 6 7 8  9 10 11 12 13 14 15
int sort[]={1,2,3,5,5,6,7,8,9,11,13,13,17,20,20,21};

String repeat = "";

for(int i=0; i<sort.length-1; i++){


    if(sort[i]==sort[i+1])

        repeat+= sort[i]+" ";

}

result.setText(repeat);
```

In a sorted array, what is the minimum, max, median?




```
int sort[]={1,2,3,5,5,6,7,8,9,11,13,13,17,20,20,21};
String repeat = "";
for(int i=0; i<sort.length-1; i++){

    if(sort[i]==sort[i+1])
        repeat+= sort[i]+" ";
}
result.setText(repeat);
```

A card for you to write:

Big Oh Notation

- A method of measuring the speed of an algorithm
- We don't measure speed with time, because that is hardware dependant
- Format = O(n)
    - O stands for Order
    - n is the length of the array

A card for you to write:

Big Oh Speeds

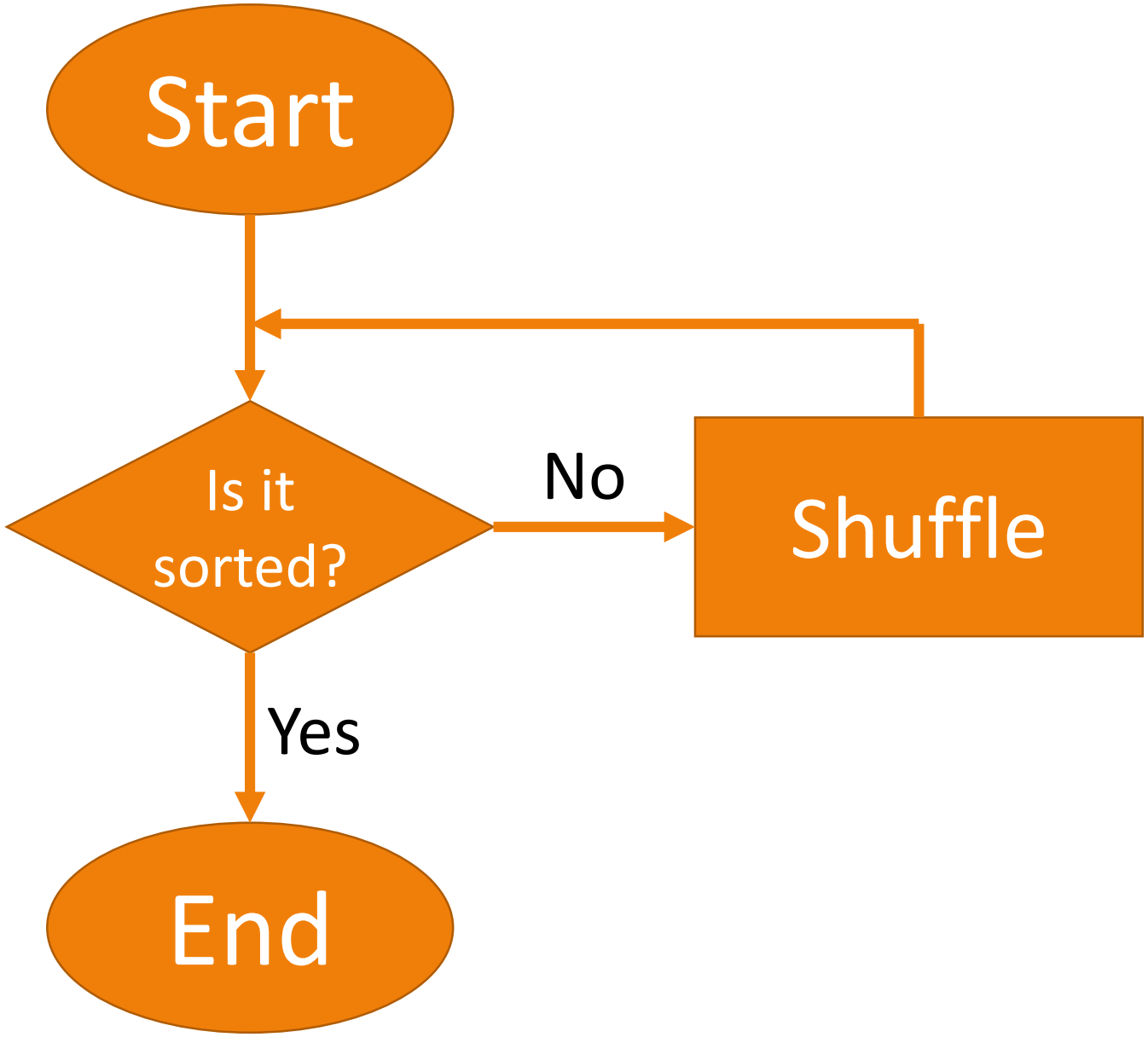
- O(1) – constant time; fastest
- O(log n) – generally: recursive
- O(n) – linear; generally: one loop
- O(n log n) – loop + recursion
- O(n^2) – quadratic, generally: loop inside a loop
- O(n^3) – cubic; loop in a loop in a loop
- O(n!)

A card for you to write:

Algorithm Speeds

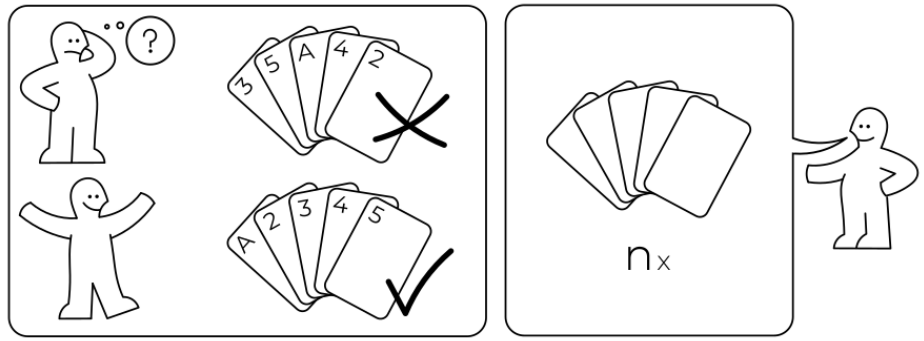
- O(1) – swap two values, size of a array
- O(log n) – binary search
- O(n) – max, min, average, print, linear search
- O(n log n) – merge sort, quick sort
- O(n^2) – bubble sort, selection sort
- O(n!) – Bogo sort

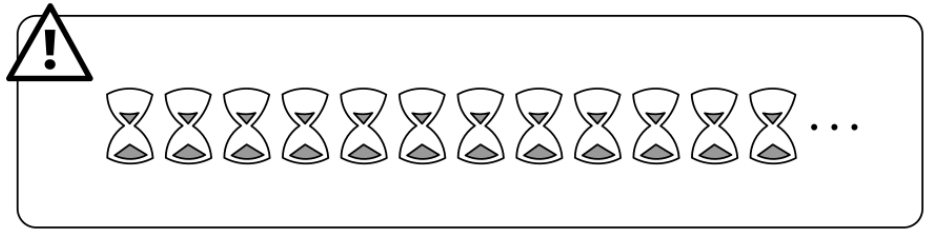
BogoSort:



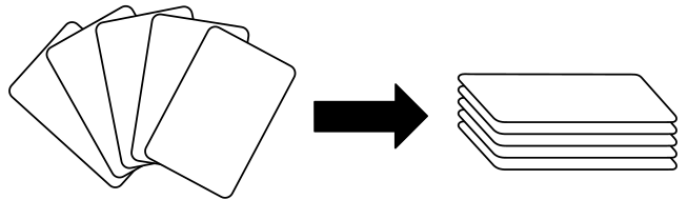
BOGO SÖRT

idea-instructions.com/bogo-sort/
v1.1, CC by-nc-sa 4.0





1



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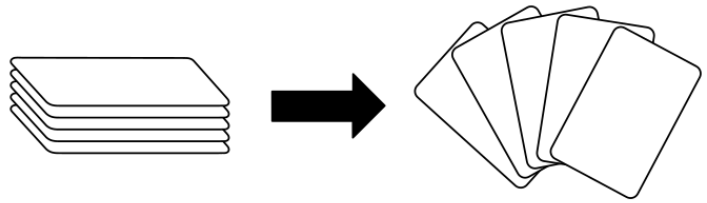

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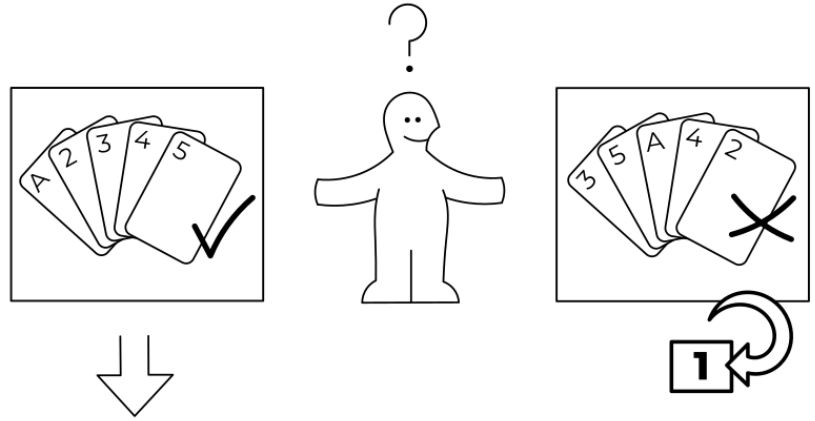

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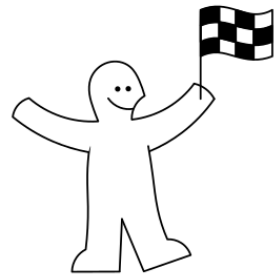

How do you shuffle an array?

Do this many times:

- Pick a Random Place
- Pick another Random Place
- Swap them