CIS 371 Web Application Programming

TypeScript V

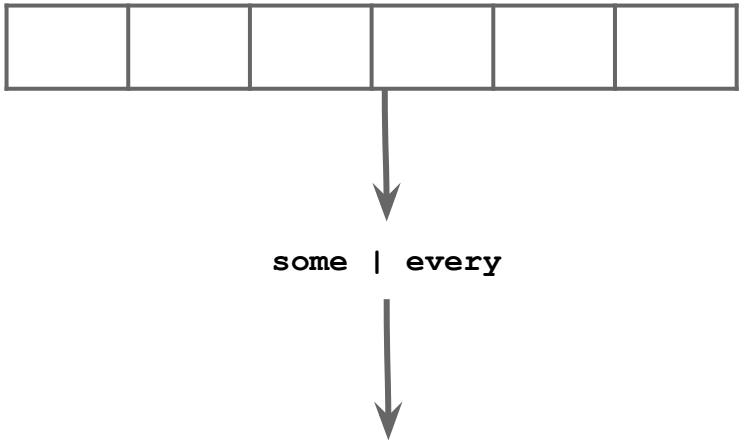
Lecturer: Dr. Yong Zhuang

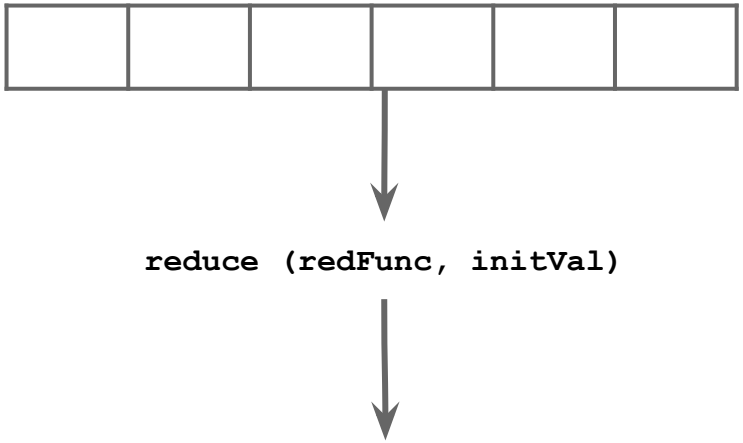
Based on the original version by Professor Hans Dulimarta.

Recall

- Functions as Arguments (to another Fn) : High-order functions
  - Array.some()
  - Array.every()
  - Array.forEach()
  - Array.find(), Array.findIndex()
  - Array.filter()
  - Array.map() ,Array.flatmap()

Introducing: Array.reduce()





Not limited to only boolean output!!!

Array.reduce(): sum of values

```
const scores = [23, -31, 17, 31, 19];
const computeSum = (accumulator: number, currentValue: number): number => {
  return accumulator + currentValue;
};

const totalScore = scores.reduce(computeSum);
console.log("Total ", totalScore); // Total 59
```

pos	accumulator	currentValue	return
1	23	-31	-8
2	-8	17	9
3	9	31	40
4	40	19	59

- *Acc is initialized from the first array item*
- *Work begins at position 1*

Array.reduce(): sum of values (with initial value)

```
const scores = [23, -31, 17, 31, 19];
const computeSum = (accumulator: number, currentValue: number): number => {
  return accumulator + currentValue;
};

const totalScore = scores.reduce(computeSum, 2000);
console.log("Total ", totalScore); // Total 2059
```

pos	accumulator	currentValue	return
0	2000	23	2023
1	2023	-31	1992
2	1992	17	2009
3	2009	31	2040
4	2040	19	2059

- *Acc is initialized from the initial value*
- *Work begins at position 0*

Array.reduce(): shortest river name(with initial value)

```
const rivers = ["Amazon", "Mississippi", "Nile", "YangTze", "Yenisei"];
const shorterOf = (accumulator: string, currentValue: string): string => {
  if (currentValue.length < accumulator.length) return currentValue;
  else return accumulator;
};

const riverName = rivers.reduce(shorterOf, "Yellow");
console.log("Shortest ", riverName); // Nile
```

pos	accumulator	currentValue	return
0	Yellow	Amazon	Yellow
1	Yellow	Mississippi	Yellow
2	Yellow	Nile	Nile
3	Nile	YangTze	Nile
4	Nile	Yenisei	Nile

- *Acc is initialized from the provided value*
- *Work begins at position 0*

Array.reduce(): shortest river name(with initial value)

```
const rivers = ["Amazon", "Mississippi", "Nile", "YangTze", "Yenisei"];
const shorterOf = (accumulator: string, currentValue: string): string => {
  if (currentValue.length < accumulator.length) return currentValue;
  else return accumulator;
};

const riverName = rivers.reduce(shorterOf, "Roe");
console.log("Shortest ", riverName); // ?
```

pos	accumulator	currentValue	return
0	Roe	Amazon	Roe
1	Roe	Mississippi	Roe
2	Roe	Nile	Roe
3	Roe	YangTze	Roe
4	Roe	Yenisei	Roe

Array.reduce() with initial value

```
const rivers = ["Amazon", "Mississippi", "Nile", "YangTze", "Yenisei"];
const shorterLen = (accumulator: number, currentValue: string): number => {
  if (currentValue.length < accumulator) return currentValue.length;
  else return accumulator;
};
// Use 37 to initialize riverLen
const riverLen = rivers.reduce(shorterLen, 37);
console.log("Shortest ", riverLen); // 4
```

pos	accumulator(num)	currentValue(str)	return(num)
0	37	Amazon	6
1	6	Mississippi	6
2	6	Nile	4
3	4	YangTze	4
4	4	Yenisei	4

- *Type of acc and curr may be different*
- *Type of acc and type of initial value must match*
- *Type of acc determines the type of return*

Array.reduce()

```
let myArray: Array<XYZ>;
```

```
function myFunction(prev: XYZ, curr: XYZ): XYZ {
  // More code here
  return _______;
}
const result: XYZ = myArray.reduce(myFunction);
```

without initial value?

```
function myFunction(prev: resultType, curr: XYZ): resultType {
  // More code here
  return _______;
}
const initValue: resultType = _______;
const result: resultType = myArray.reduce(myFunction, initValue);
```

Reduce: Array of objects

```ts
type River = {
  name: string;
  countries: Array<string>; // the river passes thru these countries
  lenInMiles: number; // river length in miles
};
```

```ts
const waters: Array<River> = [
  {
    name: "Amazon",
    countries: ["Brazil", "Columbia", "Peru"],
    lenInMiles: 4132,
  },
  { name: "Nile", countries: ["Egypt"], lenInMiles: 4388 },
  { name: "Mississippi", countries: ["US"], lenInMiles: 2340 },
  {
    name: "Mekong",
    countries: ["China", "Myanmar", "Laos", "Thailand", "Vietnam"],
    lenInMiles: 2703,
  },
  { name: "Ganges", countries: ["India", "Bangladesh"], lenInMiles: 1560 },
];
```

The name of the longest river?

```
type River = {
  name: string;
  countries: Array<string>;
  lenInMiles: number;
};
```

Practice

The name of the longest river?

```
type River = {
  name: string;
  countries: Array<string>;
  lenInMiles: number;
};
```

```
function lengthCompare(prev: River, curr: River): River {
  if (prev.lenInMiles > curr.lenInMiles) return prev;
  else return curr;
}
let winner: River;
winner = waters.reduce(lengthCompare);
console.log(winner.name);
```

Practice

```
let winner: River;
winner = waters.reduce((prev: River, curr: River): River => {
  if (prev.lenInMiles > curr.lenInMiles) return prev;
  else return curr;
});
console.log(winner.name);
```

What is the length of the longest river (in miles)?

```
type River = {
  name: string;
  countries: Array<string>;
  lenInMiles: number;
};
```

Practice

What is the length of the longest river (in miles)?

```
type River = {
  name: string;
  countries: Array<string>;
  lenInMiles: number;
};
```

```
function compLength(prev: River, curr: River): River {
  if (prev.lenInMiles > curr.lenInMiles) return prev;
  else return curr;
}
let winner: River;
winner = waters.reduce(compLength);
console.log("Longest mile is", winner.lenInMiles);
```

Practice

```
function compRivLen(prev: number, curr: River): number {
  if (prev > curr.lenInMiles) return prev;
  else return curr.lenInMiles;
}
let winner: number;
winner = waters.reduce(compRivLen, Number.MIN_VALUE);
console.log("Longest mile is", winner);
```

Which river flows through the most countries?

```
type River = {
  name: string;
  countries: Array<string>;
  lenInMiles: number;
};
```

Practice

Which river flows through the most countries?

```
type River = {
  name: string;
  countries: Array<string>;
  lenInMiles: number;
};
```

```
function countryCompare(prev: River, curr: River): River {
  if (prev.countries.length > curr.countries.length) return prev;
  else return curr;
}
let winner: River;
winner = waters.reduce(countryCompare);
console.log(winner.name);
```

Practice

```
let winner: River;
winner = waters.reduce((prev: River, curr: River): River => {
  if (prev.countries.length > curr.countries.length) return prev;
  else return curr;
});
console.log(winner.name);
```

Some examples

How many green shapes?

```
shapes.filter((s) => s.color === "green").length;
```

How many equilateral triangles?

```
shapes.filter(
  (s) =>
    s.numSides === 3 &&
    s.sideDims[0] === s.sideDims[1] &&
    s.sideDims[1] === s.sideDims[2]
).length;

shapes
  .filter((s) => s.numSides === 3)
  .filter(
    (s) => s.sideDims[0] === s.sideDims[1] && s.sideDims[1] === s.sideDims[2]
  ).length;
```

Largest perimeter?

```
shapes
  .map((shp) => {
    let perimeter = 0;
    // Compute perimeter
    return perimeter;
  })
  .reduce((acc: number, curr: number) => {
    if (acc > curr) return acc;
    else return curr;
  });
```