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TS Challenge - 3

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Problem 1

- Push -

Problem 1

Implement the generic version of `Array.push`

```
type Result = Push<[1, 2], '3'> // [1, 2, '3']
```

Solution

```
type Push<T extends unknown[], U> = [...T, U];
```

```
// or
```

```
type Push<T extends readonly unknown[], U> = [...T, U];
```

Prerequisites

1. Generics
2. `any` / `unknown` type
3. Spread syntax

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Generics - Basic

A way to create reusable code that works with multiple types

```
type Foo<T> = {  
    bar: T  
};  
  
type FooString = Foo<string>;  
type FooNumber = Foo<number>;
```

Generics - Extends

Extends allows you to limit a generic type to a specific type

```
type Foo<T extends string> = {  
    bar: T  
};  
  
type FooString = Foo<string>; // OK  
type FooNumber = Foo<number>; // NG
```


Prerequisites

1. Generics

2. `any` / `unknown` type

3. Spread syntax

any

Allow all types, any operation

```
let value: any = "hello"; // ✓  
  
value = 42; // ✓: Any type can be assigned to 'any'.  
  
const bool: boolean = value; // ✓: 'any' can be assigned to any type without  
error.  
  
value.toUpperCase(); // ✓: No type checking
```

unknown

"Type-safe counterpart of any"

```
let value: unknown = "hello"; // ✓  
value = 42; // ✓: Any type can be assigned to 'unknown'.  
  
const num: number = value; // ✗: Cannot assign 'unknown' to 'number' directly.  
  
value.toString(); // ✗: Property 'toString' does not exist on type 'unknown'  
  
if (typeof value === "number") {  
    console.log(value.toString()); // ✓: with TypeGuard  
}
```

Prerequisites

1. Generics

2. `any` / `unknown` type

3. Spread syntax

Spread syntax - Basic

A syntax that expands elements of arrays and objects

```
const arr = [1, 2, 3];
```

```
const arr2 = [...arr, 4]; // expected to be [1, 2, 3, 4]
```

```
const arr3 = [0, ...arr]; // expected to be [0, 1, 2, 3]
```

```
const arr4 = [0, ...arr, 4]; // expected to be [0, 1, 2, 3, 4]
```

Spread syntax - Type

```
type Tuple = [number, boolean]
```

```
type ArrayType = [string, ...Tuple]; // [string, number, boolean]
```

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type Push<T extends unknown[], U> = [...T, U];
```

```
// or
```

```
type Push<T extends readonly unknown[], U> = [...T, U];
```


Problem 2

- Unshift -

Problem 2

Implement the type version of `Array.unshift`

```
type Result = Unshift<[1, 2], 0> // [0, 1, 2]
```

Solution

```
type Unshift<T extends unknown[], U> = [U, ...T];
```

```
// or
```

```
type Unshift<T extends readonly unknown[], U> = [U, ...T];
```

Problem 3

- Concat -

Problem 3

Implement the JavaScript `Array.concat` function in the type system.

```
// A type takes the two arguments.  
// The output should be a new array that includes inputs in ltr order  
  
type Result = Concat<[1], [2]> // expected to be [1, 2]
```

Solution

```
type Concat<T extends unknown[], U extends unknown[]>  
= [...T, ...U]
```

```
// or
```

```
type Concat<T extends readonly unknown[], U extends readonly unknown[]>  
= [...T, ...U]
```

Related Problem

- [Last of Array](#) -

Related Problem

Implement a generic `Last<T>` that takes an Array T and returns its last element.

```
type arr1 = ['a', 'b', 'c']  
type arr2 = [3, 2, 1]  
  
type tail1 = Last<arr1> // expected to be 'c'  
type tail2 = Last<arr2> // expected to be 1
```


Solution

- `[unknown, ...T]`
 - `T = [3, 2, 1]` becomes `[unknown, 3, 2, 1]`
- Without `[unknown, ...T]`
 - `[...T][T["length"]] = T[3]` is `undefined` (out of bounds.)

```
type Last<T extends unknown[]> = [unknown, ...T][T["length"]];
```

```
// or
```

```
type Last<T extends readonly unknown[]> = [unknown, ...T][T["length"]];
```