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TS Challenge - 2

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Problem 1

- Length of Tuple -

Problem 1

Create a generic `Length`, pick the length of the tuple

```
type tesla = ['tesla', 'model 3', 'model X', 'model Y']
type spaceX = ['FALCON 9', 'FALCON HEAVY', 'DRAGON', 'STARSHIP', 'HUMAN
SPACEFLIGHT']

type teslaLength = Length<tesla>  // expected 4
type spaceXLength = Length<spaceX> // expected 5
```

Solution

```ts
// Solution 1
type Length<T extends any[]> = T["length"];

// Solution 2
type Length<T extends Array<any>> = T["length"];

// Solution 3
type Lentgh<T extends unknown[]> = T["length"];
```

Which is the prefer solution ?

```ts
// Solution 1
type Length<T extends any[]> = T["length"];

// Solution 2
type Length<T extends Array<any>> = T["length"];

// Solution 3
type Lentgh<T extends unknown[]> = T["length"];
```

Best solution

```ts
type Lentgh<T extends unknown[]> = T["length"];
```

Prerequisites

1. `any` / `unknown` type
2. Generics
3. index access types

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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. `any` / `unknown`
2. Generics
3. index access types

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. `any` / `unknown`
2. Generics
3. index access types

index access types

Can get the type of a specific key in object

```
interface Todo = {
  title: string;
  description: string;
}

type Title = Todo["title"]; // string
```

In Addition, it can access properties in TypeScript type definitions.

```ts
type Length<T extends unknown[]> = T.length;    // NG

type Length<T extends unknown[]> = T['length']; // OK
```

Problem 1

Create a generic `Length`, pick the length of the tuple

```
type tesla = ['tesla', 'model 3', 'model X', 'model Y']
type spaceX = ['FALCON 9', 'FALCON HEAVY', 'DRAGON', 'STARSHIP', 'HUMAN
SPACEFLIGHT']

type teslaLength = Length<tesla>  // expected 4
type spaceXLength = Length<spaceX> // expected 5
```

Best solution

```ts
type Lentgh<T extends unknown[]> = T["length"];
```

Problem 2

- Tuple to Object -

Problem 2

transform it into an object type and the key / value must be in the provided array.

```ts
const tuple = ['tesla', 'model 3', 'model X', 'model Y'] as const

type result = TupleToObject<typeof tuple>

// expected
{
  'tesla': 'tesla',
  'model 3': 'model 3',
  'model X': 'model X',
  'model Y': 'model Y'
}
```

Solution

it works, but we should avoid using `any` type

```ts
type TupleToObject<T extends readonly any[]> = {
  [K in T[number]]: K
}
```

Solution

```ts
type TupleToObject<T extends readonly PropertyKey[]> = {
  [K in T[number]]: K
}
```

Prerequisites

1. `as const` (const assertion)
2. `PropertyKey` type
3. Mapped Types
4. `T[number]` (Tuple)

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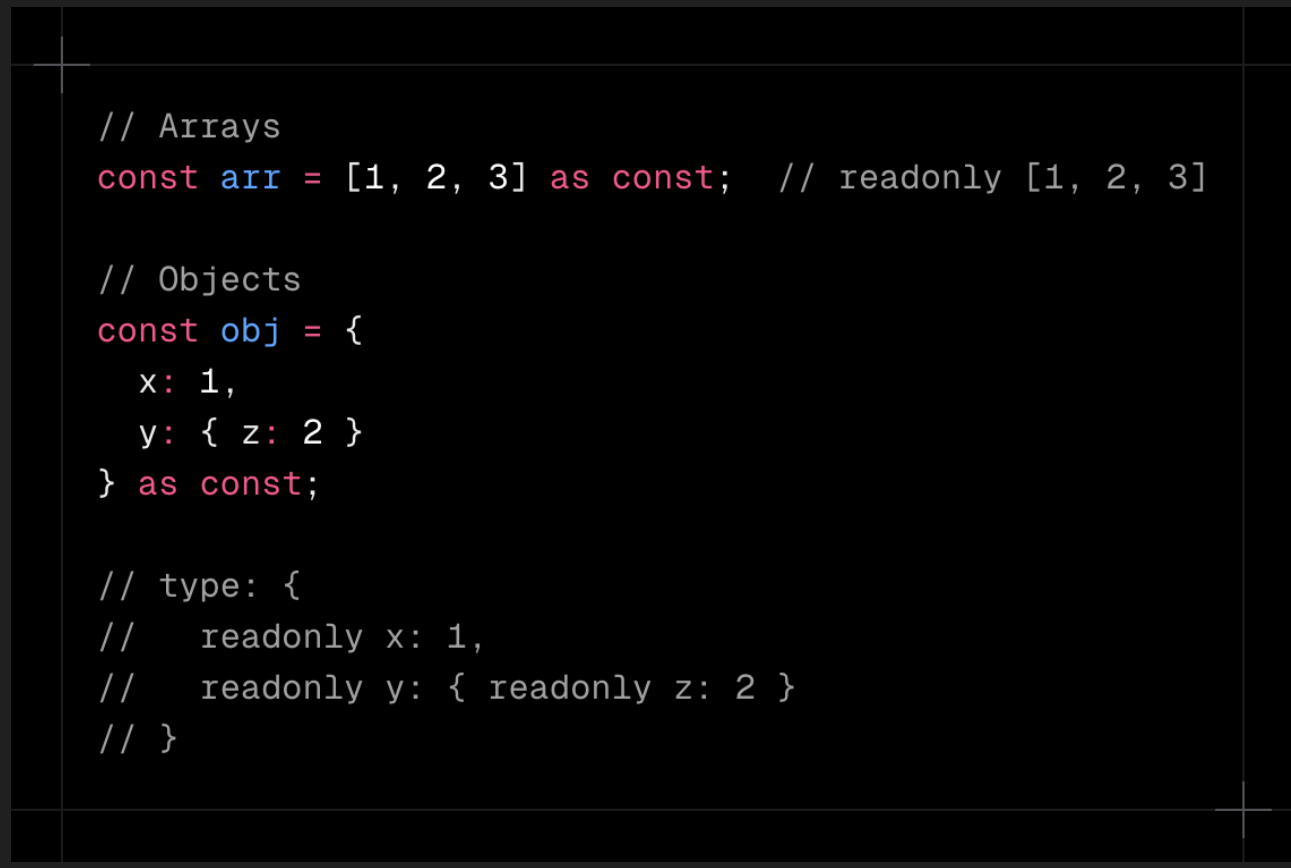
`as const`

Makes the variable readonly deeply with literal types



```ts
// Arrays
const arr = [1, 2, 3] as const;  // readonly [1, 2, 3]

// Objects
const obj = {
  x: 1,
  y: { z: 2 }
} as const;

// type: {
//   readonly x: 1,
//   readonly y: { readonly z: 2 }
// }
```

Prerequisites

1. `as const` (const assertion)
2. **`PropertyKey` type**
3. Mapped Types
4. `T[number]` (Tuple)

`PropertyKey`

- `PropertyKey` is union type: `string | number | symbol`
  - In TypeScript, object can only have 3 types of values as keys: `string`, `number` and `symbol`

```ts
// ✅
type TupleToObject<T extends readonly (string | number | symbol)[]> = {
  [K in T[number]]: K
}

// ✅ + Readablity
type TupleToObject<T extends readonly PropertyKey[]> = {
  [K in T[number]]: K
}
```

Prerequisites

1. `as const` (const assertion)
2. `PropertyKey` type
3. **Mapped Types**
4. `T[number]` (Tuple)

Mapped Types

Can create a new object type based on a union of keys

```
type TodoKeys = "title" | "description";

type Todo = {
  [K in TodoKeys]: string
};

// It is same as follows;
type Todo = {
  title: string;
  description: string;
};
```

Prerequisites

1. `as const` (const assertion)
2. `PropertyKey` type
3. Mapped Types
4. `T[number]` (Tuple)

What it Tuple

- a special Array type
- Has a fixed length
- Has specific types for each elements

```
type MyTuple = [string, number, boolean];

const example: MyTuple = ["hello", 42, true];
```

`T[number]`

allows you to extract the union of the types of all elements of the tuple

```ts
type T = [string, number, boolean];

type TypeAtIndex0 = T[0]; // string
type TypeAtIndex1 = T[1]; // number
type TypeAtIndex2 = T[2]; // boolean

type ElementTypes = T[number]; // string | number | boolean
```

`T[number]` with const assertion

```ts
const tuple = ["tesla", "model 3", "model X", "model Y"] as const;

// Type of 'tuple' with readonly & literal types
type T = typeof tuple; // readonly ["tesla", "model 3", "model X", "model Y"];

T[number]; // "tesla" | "model 3" | "model X" | "model Y"
```

Problem 2

transform it into an object type and the key / value must be in the provided array.

```ts
const tuple = ['tesla', 'model 3', 'model X', 'model Y'] as const

type result = TupleToObject<typeof tuple>

// expected
{
  'tesla': 'tesla',
  'model 3': 'model 3',
  'model X': 'model X',
  'model Y': 'model Y'
}
```

Best solution

```ts
type Lentgh<T extends unknown[]> = T["length"];
```

Related Problem

- Tuple to Union -

Related Problem

Implement a generic TupleToUnion<T> which covers the values of a tuple to its values union.

```
type Arr = ['1', '2', '3']

type Test = TupleToUnion<Arr> // expected to be '1' | '2' | '3'
```

Solution

- **`unknown` is the best choise in this case**
  - `unknown` permits any element types (e.g., `boolean`)
  - `PropertyKey` permits only `string | number | symbol` types

```ts
type TupleToUnion<T extends unknown[]> = T[number];
```