TypeScript Class Notes

AltSchool Africa

Are you ready to learn TypeScript? Press `space` on your keyboard →

What is TypeScript?

TypeScript is a strongly typed programming language that builds on JavaScript, giving you better tooling at any scale.

Read more about TypeScript?

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TypeScript understands JavaScript and uses type inference to give you great tooling without additional code

Read more about TypeScript?

Table of Content

What are the things we will be covering?

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The Basics

- Static type-checking
- Non-exception Failures
- Types for Tooling
- tsc, the TypeScript compiler
- Emitting with Errors
- Explicit Types
- Erased Types
- Downleveling
- Strictness
- noImplicitAny
- strictNullChecks

TypeScript Compiler `tsc`

- The TypeScript compiler is a tool that takes TypeScript code and turns it into JavaScript code.

- The TypeScript compiler can be installed as a Node.js package.

- The TypeScript compiler can be run from the command line.

- The TypeScript compiler can be configured using a configuration file.

- The TypeScript compiler can be used to compile multiple files.

- The TypeScript compiler can be used to compile a project.

```
npm install -g typescript

tsc hello.ts

tsc --noEmitOnError hello.ts

tsc --init
```

tsconfig.json

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- Emitting with Errors: You can use the noEmitOnError flag to prevent the TypeScript compiler from emitting JavaScript code if there are any errors.

- Explicit Types: You can use the noImplicitAny flag to prevent TypeScript from inferring the any type.

tsconfig.json

- Erased Types: You can use the noUnusedLocals and noUnusedParameters flags to prevent TypeScript from emitting JavaScript code if there are any unused variables or parameters.

```
{
  "compilerOptions": {
    "strict": true,
    "noImplicitAny": true,
    "strictNullChecks": true,
    "target": "ES5",
    "noEmitOnError": true
  }
}
```

Everyday Types

The primitives, any, Type annotations on variables, Functions, Object types, Union Types, Type Aliases, Interfaces, Type Assertions, Literal Types, null and undefined, Enums

```
let person: string | number = "OjoT99";

if (typeof person === "string") {
  person.split("T");
} else {
  // only number
  // person.toFixed(2);
}

let age: number = 99;

let isAltSchoolStudent = false;
let nothing = null;
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```typescript
let person: string | number = "helloTtypescript";

let result: number[] = person.split("T");
  Type 'string[]' is not assignable to type 'number[]'.
    Type 'string' is not assignable to type 'number'.
//  //^?

console.log(result);
console.log("Hello", "AltSchool");
```

functions

```
function greeter(fn: (a: string) => void) {
  fn("Hello, World");
}

function printToConsole(s: string) {
  console.log(s);
}

greeter(printToConsole);
```

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```
type DescribableFunction = {
  description: string;
  (someArg: number): boolean;
};
function doSomething(fn: DescribableFunction) {
  console.log(fn.description + " returned " + fn(6));
}

function myFunc(someArg: number) {
  return someArg > 3;
}
myFunc.description = "default description";

doSomething(myFunc);
```

```
default description returned true
```

Peek into Generics

```typescript
// Inside ./snippets/external.ts
export function emptyArray<T>(length: number) {
  return Array.from<T>({ length })
}
```

Put `emptyArray` function to work

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// Inside ./snippets/external.ts
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Put `emptyArray` function to work

```
import { emptyArray } from './external'                                    ▷

console.log(emptyArray<number>(10).reduce(fib => [...fib, fib.at(-1)! + fib.at(-2)!], [1, 1]))

[1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144]
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```typescript
function firstElement<Type>(arr: Type[]): Type | undefined {
  return arr[0];
}
// Note that we didn't have to specify Type in this sample.
// The type was inferred - chosen automatically - by TypeScript.
let s1 = firstElement([1, 2, 4, 5])
let s2 = firstElement(['hello', 'dance'])
```

Solve this using TS Generics

```typescript
function getRandomNumberElement(items: number[]): number {
  let randomIndex = Math.floor(Math.random() * items.length);
  return items[randomIndex];
}

let randyValue = getRandomNumberElement(['ayo', 'ade', 'ojo', 'jerry'])

console.log(randyValue)
```

```
ojo
```

```typescript
function map<Input, Output>(arr: Input[], func: (arg: Input) => Output): Output[] {
  return arr.map(func);
}

// Parameter 'n' is of type 'string'
// 'parsed' is of type 'number[]'
const parsed = map(["1", "2", "3"], (n) => parseInt(n));
```

```typescript
function map<Input, Output>(arr: Input[], func: (arg: Input) => Output): Output[] {
  return arr.map(func);
}

// Parameter 'n' is of type 'string'
// 'parsed' is of type 'number[]'
const parsed = map(["1", "2", "3"], (n) => parseInt(n));
```

```typescript
function longest<Type extends { length: number }>(a: Type, b: Type) {
  if (a.length >= b.length) {
    return a;
  } else {
    return b;
  }
}

// longerArray is of type 'number[]'
const longerArray = longest([1, 2], [1, 2, 3]);
// longerString is of type 'alice' | 'bob'
const longerString = longest("alice", "bob");
// Error! Numbers don't have a 'length' property
const notOK = longest(10, 100);
```

Argument of type 'number' is not assignable to parameter of type '{ length: number; }'.

```
function minimumLength<Type extends { length: number }>(
  obj: Type,
  minimum: number
): Type {
  if (obj.length >= minimum) {
    return obj;
  } else {
    return { length: minimum };
  }
}

// 'arr' gets value { length: 6 }
const arr = minimumLength([1, 2, 3], 6);
// and crashes here because arrays have
// a 'slice' method, but not the returned object!
console.log(arr.slice(0));
```

TypeError: arr.slice is not a function

```
function combine<Type>(arr1: Type[], arr2: Type[]): Type[] {
  return arr1.concat(arr2);
}

// const arr = combine([1, 2, 3], ["hello"]);
const arr = combine<string | number>([1, 2, 3], ["hello"]);

console.log(arr)
```

```
[1, 2, 3, "hello"]
```

```
function merge<T, U>(firstObject: T, secondObject: U): T & U {
  return {
    ...firstObject,
    ...secondObject,
  };
}

type Result<T extends Function> = T extends (...args: never[]) => infer R
  ? R
  : never;

let res35 = merge({ name: "ade" }, { age: 99 });
console.log(res35)
let res37 = merge({ school: "AltSchool" }, { job: "cleaner" });
console.log(res37)
```

```
{
  "name": "ade",
  "age": 99
}
{
  "school": "AltSchool",
  "job": "cleaner"
}
```

```
type FuncWithOneObjectArgument<P extends { [x: string]: any }, R> = (
  props: P
) => R;

type DestructuredArgsOfFunction<
  F extends FuncWithOneObjectArgument<any, any>
> = F extends FuncWithOneObjectArgument<infer P, any> ? P : never;

const myFunction = (props: { x: number; y: number }): string => {
  return "OK";
};

const props: DestructuredArgsOfFunction<typeof myFunction> = {
  x: 1,
  y: 2
};
```

Guideline to writing good generics

Guideline to writing good generics

- Push Type Parameters Down

Guideline to writing good generics

- Push Type Parameters Down
- Use Fewer Type Parameters

```typescript
function filter1<Type>(arr: Type[], func: (arg: Type) => boolean): Type[] {
  return arr.filter(func);
}

function filter2<Type, Func extends (arg: Type) => boolean>(
  arr: Type[],
  func: Func
): Type[] {
  return arr.filter(func);
}

const val = filter1([1, 2, 3, 4], n => n % 2 === 0)
const val2 = filter2([1, 2, 3, 4], n => n % 2 === 0)
```

Guideline to writing good generics

- Push Type Parameters Down
- Use Fewer Type Parameters

```typescript
function filter1<Type>(arr: Type[], func: (arg: Type) => boolean): Type[] {
  return arr.filter(func);
}

function filter2<Type, Func extends (arg: Type) => boolean>(
  arr: Type[],
  func: Func
): Type[] {
  return arr.filter(func);
}

const val = filter1([1, 2, 3, 4], n => n % 2 === 0)
const val2 = filter2([1, 2, 3, 4], n => n % 2 === 0)
```

- Type Parameters(Or any annotation used) Should Appear Twice

function overloading

```typescript
function add3(a: number, b: number): number;
function add3(a: string, b: string): string;
function add3(a: any, b: any): any {
  return a + b;
}

add3("na", "me");
add3(99, 78);
let name2: any = "wale";
let age2: any = 99;
add3(name2, age2);
```

Enums

```
enum Role {
  ADMIN,
  CLIENT,
  SUPERADMIN,
}

type User = {
  id: string;
  // enum
  role: Role;
  // union types
  // role: "CLIENT" | "ADMIN" | "SUPERADMIN";
  name: string;
  address: string;
};
```

```
enum Role { ADMIN, CLIENT, SUPERADMIN, };
type User = { id: string; role: Role; name: string; address: string; };
// union types // role: "CLIENT" | "ADMIN" | "SUPERADMIN";

function checkUserRole(user: User): string {
  const { role } = user;
  if (role === Role.ADMIN) {
    return "admin";
  } else if (role === Role.CLIENT) {
    return "client";
  }
  // Role.SUPERADMIN;
  return "superadmin";
}

let userAltSchool: User = {
  id: "001",
  role: Role.ADMIN,
  name: "ade ojo",
  address: "lagos",
};

let resultAltSchool = checkUserRole(userAltSchool);
console.log(resultAltSchool);
```

```
admin
```

Type Manipulation

Type Manipulation

- keyof

Type Manipulation

- keyof
- typeof

Type Manipulation

- keyof
- typeof
- indexed access types

Type Manipulation

- keyof
- typeof
- indexed access types
- conditional types

Type Manipulation

- keyof
- typeof
- indexed access types
- conditional types
- mapped types

Type Manipulation

- keyof
- typeof
- indexed access types
- conditional types
- mapped types
- template-literal-types