

COMP1531

✓ Correctness - Exceptions

Lecture 5.3

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In This Lecture

- **Why?** 🤔
 - Finding more graceful ways to deal with errors makes your program more robust
- **What?** 📄
 - Exceptions
 - Raising & Catching Exceptions



Dealing With Problems

The simplest way to deal with problems at run-time...

Just crash

```
1 import prompt from 'prompt-sync';
2 const promptFn = prompt();
3
4 function sqrt(x: number) {
5   if (x < 0) {
6     console.error('Error Input < 0');
7     process.exit(1);
8   }
9   return Math.pow(x, 0.5);
10 }
11
12 const input = promptFn('Please enter a number: ');
13 console.log(sqrt(parseInt(input)));
```

[5.3_just_crash.ts](#)

Not very clean though.




Dealing With Problems

However, if we throw an exception 🤪 we start to get into a new territory of programming.

```
1 import prompt from 'prompt-sync';
2 const promptFn = prompt();
3
4 function sqrt(x: number) {
5   if (x < 0) {
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7   }
8   return Math.pow(x, 0.5);
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5.3_exception1.ts


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5.3_exception1.ts

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11 const input = promptFn('Please enter a number: ');
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```

[5.3_exception1.ts](#)

Let's take a step back...

Exceptions

An **exception** is an action that disrupts the normal flow of a program. This action is often representative of an error being thrown. Exceptions are ways that we can elegantly recover from errors.

Exceptions

Exceptions are a particular method of ensuring **software safety**. Different languages have different conventions for managing unexpected runtime events.

Javascript relies on Exceptions for the majority of error handling. Unlike C, which has no exceptions



Easier To Ask Forgiveness Than Permission

- EAFP is the javascript convention for handling errors.
- It encourages you to assume something will work and just have an exception handler to deal with anything that might go wrong
- Pros:
 - Can simplify the core logic
 - Multiple different sorts of errors can be handled with one except block
- Cons:
 - Makes code non-structured
 - Harder to reason what code will be executed.



Look Before You Leap

- LBYL is a convention for avoiding errors in popular languages like C
- Unlike EAFP it encourages you to check that something can be done before you do it
- Pros:
 - Doesn't require exceptions
 - Code is structured and therefore easier to reason about
- Cons:
 - Core logic can be obscured by error checks

Exception Examples

This program is good in that it throws an exception, but we aren't handling it.

```
1 import prompt from 'prompt-sync';
2 const promptFn = prompt();
3
4 function sqrt(x: number) {
5     if (x < 0) {
6         throw new Error('Error Input < 0');
7     }
8     return Math.pow(x, 0.5);
9 }
10
11 const input = promptFn('Please enter a number: ');
12 console.log(sqrt(parseInt(input)));
```

5.3_exception1.ts

Exception Examples

This program is good in that it throws an exception, but we aren't handling it.

```
1 import prompt from 'prompt-sync';
2 const promptFn = prompt();
3
4 function sqrt(x: number) {
5   if (x < 0) {
6     throw new Error('Error Input < 0');
7   }
8   return Math.pow(x, 0.5);
9 }
10
11 try {
12   const input = promptFn('Please enter a number: ');
13   console.log(sqrt(parseInt(input)));
14 } catch (err) {
15   console.error(`Error when inputting! ${err}`);
16   const input = promptFn('Please enter a number: ');
17   console.log(sqrt(parseInt(input)));
18 }
```

5.3_exception2.ts

Exception Examples

Or we could make this even more robust

```
1 import prompt from 'prompt-sync';
2 const promptFn = prompt();
3
4 function sqrt(x: number) {
5   if (x < 0) {
6     throw new Error('Error Input < 0');
7   }
8   return Math.pow(x, 0.5);
9 }
10
11 let success = false;
12 while (!success) {
13   try {
14     const input = promptFn('Please enter a number: ');
15     console.log(sqrt(parseInt(input)));
16     success = true;
17   } catch (err) {
18     console.error(`Error when inputting! ${err}`);
19   }
20 }
```

5.3_exception3.ts

Exception Examples

- Key points:
 - Exceptions carry data
 - When exceptions are thrown, normal code execution stops

```
1 function sqrt(x: number) {
2   if (x < 0) {
3     throw new Error('Error Input < 0');
4   }
5   return Math.pow(x, 0.5);
6 }
7
8 if (process.argv.length === 3) {
9   try {
10    console.log(sqrt(parseInt(process.argv[2])));
11    console.log('Never called if error!');
12  } catch (err) {
13    console.error(`Error when inputting! ${err}`);
14  }
15 }
```

5.3_throw_catch.ts



Testing With Exceptions

We can use `jest`'s `toThrowError` function to test if functions are appropriately throwing exceptions.

```
1 function sqrt(x: number) {
2   if (x < 0) {
3     throw new Error('Error Input < 0');
4   }
5   return Math.pow(x, 0.5);
6 }
7
8 export { sqrt };
```

5.3_sqrt.ts

```
1 import { sqrt } from './5.2_sqrt';
2
3 describe('sqrt correctness', () => {
4   test('deals with valid bases', () => {
5     expect(sqrt(4)).toEqual(2);
6     expect(sqrt(2)).toBeCloseTo(1.414213, 5);
7   });
8   test('throws error on negatives', () => {
9     // Note that these require a function, not result
10    expect(() => sqrt(-2)).toThrow('Error: Input < 0');
11    expect(() => sqrt(-5)).toThrowError('Error: Input < 0');
12  });
13 });
```

5.3_catch.test.ts

Feedback



Or go to the [form here](#).

