SKKRYPTO

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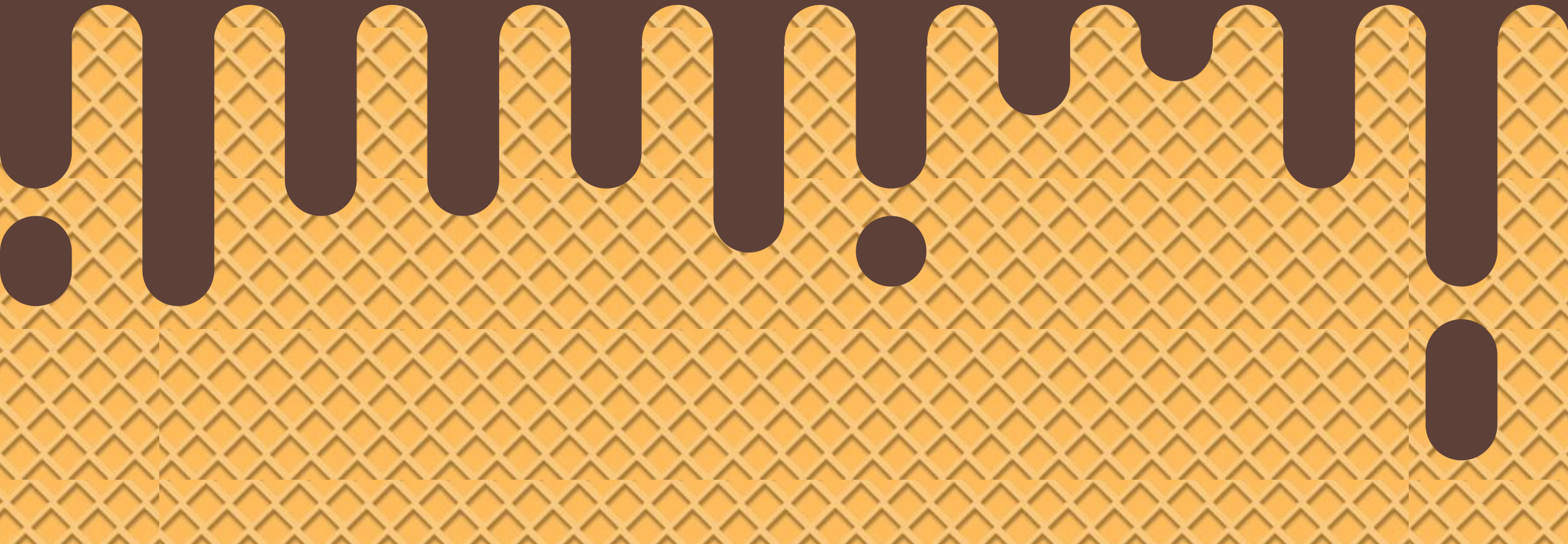
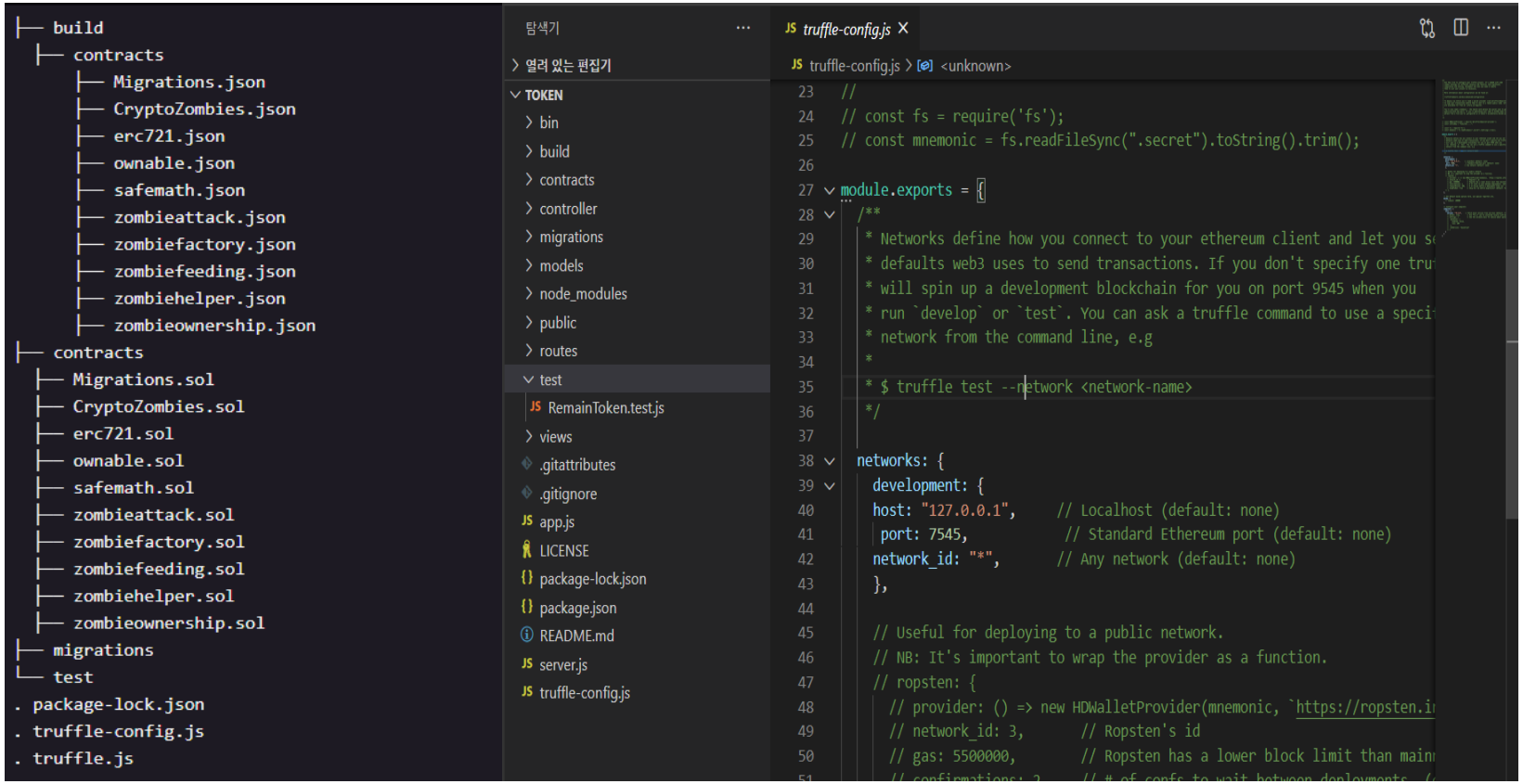
Testing Smart Contracts with Truffle

5기 배준호



Solidity Tutorial

CH1. Getting Setup



1. touch test/CryptoZombies.js

2. Truffle, Mocha, Chai

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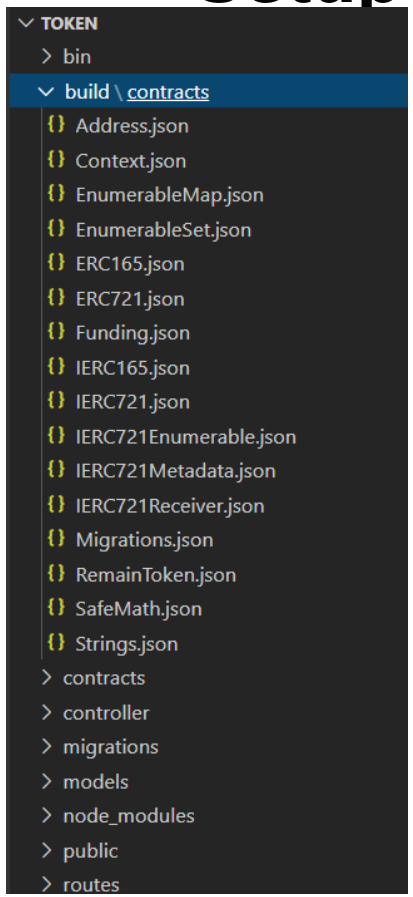
CH3. Getting Setup




```
1  const CryptoZombies = artifacts.require("CrptoZombies");
2
3  contract("CryptoZombies", (accounts)=> {
4      it("should be able to recieve Ethers",() => {
5
6      })
7  })
```

2. CyptoZombies = artifacts.require("CryptoZombies")
=> CryptoZombies라는 build artifacts를 가져온다. Contract abstractions 반환

1. build/contracts : 컨트랙트가 컴파일 되면 컴파일러가 json 형식의 build artifacts를 만듬
-> 테스트 할 때 이 build artifacts를 가져온다.

3. contract() 메소드를 통해 group test 진행 가능
   - describe라는 Mocha의 메서드를 확장. Accounts 제공
   - "contract('이름', '콜백')"
4. it("테스트 설명", "콜백")

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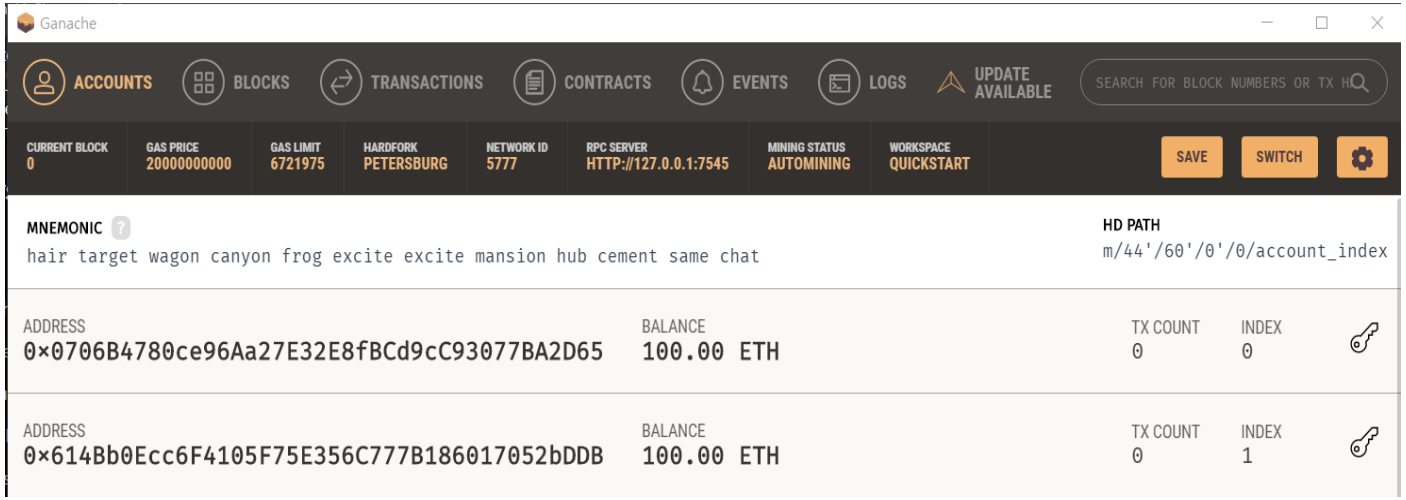
CH4. The First Test

```
1  const CryptoZombies = artifacts.require("CryptoZombies");
2  contract("CryptoZombies", (accounts) => {
3      //1. initialize `alice` and `bob`
4      let [alice, bob] = accounts;
5      it("should be able to create a new zombie", async () => { //2 & 3. Replace t
6      })
7  })
8
```



1. 가나슈로부터 account를 받아와 alice와 bob으로 할당

2. Async 키워드 추가하여 콜백 실행

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CH4. The First Test

test/CryptoZombies.js

```
1  const CryptoZombies = artifacts.require("CryptoZombies");
2  const zombieNames = ["Zombie 1", "Zombie 2"];
3  contract("CryptoZombies", (accounts) => {
4      let [alice, bob] = accounts;
5      it("should be able to create a new zombie", async () => {
6          const contractInstance = await CryptoZombies.new();
7      })
8  })
9
```

1. 일반적으로 테스트는
   1) Setup
   2) Act
   3) Assert
   의 단계를 거침

2. Set up
현재 컨트랙트를 불러오기는 했지만 abstract일뿐, 실제 테스트를 위해서는 객체를 만들어줘야함!

3. Await
Block chain과 소통하기 때문에 await 키워드 추가

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CH5. The First Test

test/CryptoZombies.js

```
1  const CryptoZombies = artifacts.require("CryptoZombies");
2  const zombieNames = ["Zombie 1", "Zombie 2"];
3  contract("CryptoZombies", (accounts) => {
4      let [alice, bob] = accounts;
5
6
7      it("should be able to create a new zombie", async () => {
8          const contractInstance = await CryptoZombies.new();
9          const result = await contractInstance.createRandomZombie(zombieNames[0], {from: alice});
10         assert.equal(result.receipt.status, true);
11         assert.equal(result.logs[0].args.name,zombieNames[0]);
12     })
13
14
15 })
16
```

1. result
- 새로 생성한 컨트랙트의 인스턴스로부터 컨트랙트의 메서드 실행
- Await 키워드 잊지 않기
- {}안에 from : alice가 msg.sender
- Truffle에서 log를 생성 해줘서 resul에 담김!
- Txhash 등등 다양한 값을 가져올 수 있음!
- 데이터 저장으로 사용가능! (컨트랙트에서 접근은 불가능)

2. Assert
- Assert라는 built-in 메서드를 통해 검사

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CH6. Keeping the Fun

test/CryptoZombies.js | test/helpers/utils.js

```
1  const CryptoZombies = artifacts.require("CryptoZombies");
2  const utils = require("./helpers/utils");
3  const zombieNames = ["Zombie 1", "Zombie 2"];
4  contract("CryptoZombies", (accounts) => {
5      let [alice, bob] = accounts;
6      let contractInstance;
7      beforeEach(async () => {
8          contractInstance = await CryptoZombies.new();
9      });
10     it("should be able to create a new zombie", async () => {
11         const result = await contractInstance.createRandomZombie(zombieNames[0], {from: alice});
12         assert.equal(result.receipt.status, true);
13         assert.equal(result.logs[0].args.name,zombieNames[0]);
14     })
15     it("should not allow two zombies", async () => {
16     })
17 })
18
```

```
afterEach(async () => {
    await contractInstance.kill();
});
```

```
function kill() public onlyOwner {
    selfdestruct(owner());
}
```

1. beforeEach :
- 테스트 코드를 작성할 때 매번 컨트랙트의 인스턴스를 선언해야 한다면 매우 번거로움
- 테스트 전에 실행되는 beforeEach에서 컨트랙트 인스턴스를 새로 선언.

2. Selfdestruct()
- contract.new()를 사용하면 트러플은 매번 이 커트랙트를 배포함.
- 만약 계속해서 컨트랙트가 배포된다면 비효율적임.
- Selfdestruct()를 통해서 스마트 컨트랙트가 스스로를 지울 수 있게 할 수 있다.
- afterEach를 사용해 매번 테스트가 끝날때마다 스스로를 없엘 수 있음.

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CH7. Keeping the Fun

```
1  const CryptoZombies = artifacts.require("CryptoZombies");
2  const utils = require("./helpers/utils");
3  const zombieNames = ["Zombie 1", "Zombie 2"];
4  contract("CryptoZombies", (accounts) => {
5      let [alice, bob] = accounts;
6      let contractInstance;
7      beforeEach(async () => {
8          contractInstance = await CryptoZombies.new();
9      });
10     it("should be able to create a new zombie", async () => {
11         const result = await contractInstance.createRandomZombie(zombieNames[0], {from: alice});
12         assert.equal(result.receipt.status, true);
13         assert.equal(result.logs[0].args.name,zombieNames[0]);
14     })
15     it("should not allow two zombies", async () => {
16         await contractInstance.createRandomZombie(zombieNames[0], {from: alice});
17         await utils.shouldThrow(contractInstance.createRandomZombie(zombieNames[1], {from: alice}));
18     })
19 })
20
```

```
async function shouldThrow(promise) {
  try {
    await promise;
    assert(true);
  }
  catch (err) {
    return;
  }
assert(false, "The contract did not throw.");

}

module.exports = {
  shouldThrow,
};
```

- 우리의 테스트 코드는 “스마트 컨트랙트가 에러를 내면 “ 통과하게 할 것이기 때문에, 로직을 shouldThrow와 같이 작성
- 코드를 간결하고 이쁘게 관리하기 위해 다른 파일로 빼냄

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CH8. Zombie Transfer

```
xcontext("with the single-step transfer scenario", async () => {
    it("should transfer a zombie", async () => {
      // start here.
    })
})
xcontext("with the two-step transfer scenario", async () => {
    it("should approve and then transfer a zombie when the approved address calls transferForm", async () => {
      // TODO: Test the two-step scenario.  The approved address calls transferFrom
    })
    it("should approve and then transfer a zombie when the owner calls transferForm", async () => {
       // TODO: Test the two-step scenario.  The owner calls transferFrom
     })
```

- Context 메서드 : 시나리오를 위한 그룹 테스트시 사용

- It or context 앞에 x를 붙이면 트러플이 얘네를 패스하고 테스트 진행

```
with the single-step transfer scenario
  - should transfer a zombie
with the two-step transfer scenario
  - should approve and then transfer a zombie when the owner calls transferForm
  - should approve and then transfer a zombie when the approved address calls trar
```

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CH9. ERC 721 Transfer –Single Step Scenario

```
xcontext("with the single-step transfer scenario", async () => {
    it("should transfer a zombie", async () => {
      // start here.
    })
})
xcontext("with the two-step transfer scenario", async () => {
    it("should approve and then transfer a zombie when the approved address calls transferForm", async () => {
      // TODO: Test the two-step scenario.  The approved address calls transferFrom
    })
    it("should approve and then transfer a zombie when the owner calls transferForm", async () => {
       // TODO: Test the two-step scenario.  The owner calls transferFrom
     })
```

- Context 메서드 : 시나리오를 위한 그룹 테스트시 사용

- It or context 앞에 x를 붙이면 트러플이 얘네를 패스하고 테스트 진행

```
with the single-step transfer scenario
  - should transfer a zombie
with the two-step transfer scenario
  - should approve and then transfer a zombie when the owner calls transferForm
  - should approve and then transfer a zombie when the approved address calls trar
```

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CH9. ERC 721 Transfer –Single Step Scenario

```
context("with the single-step transfer scenario", async () => {
    it("should transfer a zombie", async () => {
        const result = await contractInstance.createRandomZombie(zombieNames[0], {from: alice});
        const zombieId = result.logs[0].args.zombieId.toNumber();
        await contractInstance.transferFrom(alice, bob, zombieId, {from: alice});
        const newOwner = await contractInstance.ownerOf(zombieId);
        assert.equal(newOwner, bob);
    })
})
xcontext("with the two-step transfer scenario", async () => {
```

- Context 앞에 x 지우기!
- 지금까지 쓴 내용 그대로.

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CH10. ERC 721 Transfer –Two Step Scenario

```
context("with the single-step transfer scenario", async () => {
    it("should transfer a zombie", async () => {
        const result = await contractInstance.createRandomZombie(zombieNames[0], {from: alice});
        const zombieId = result.logs[0].args.zombieId.toNumber();
        await contractInstance.transferFrom(alice, bob, zombieId, {from: alice});
        const newOwner = await contractInstance.ownerOf(zombieId);
        assert.equal(newOwner, bob);
    })
})
xcontext("with the two-step transfer scenario", async () => {
```

- Context 앞에 x 지우기!
- 지금까지 쓴 내용 그대로.

CH10. ERC 721 Transfer –Two Step Scenario

```
context("with the two-step transfer scenario", async () => {
    it("should approve and then transfer a zombie when the approved address calls transferForm", async () => {
        const result = await contractInstance.createRandomZombie(zombieNames[0], {from: alice});
        const zombieId = result.logs[0].args.zombieId.toNumber();
        await contractInstance.approve(bob, zombieId, {from: alice});
        await contractInstance.transferFrom(alice, bob, zombieId, {from: bob});
        const newOwner = await contractInstance.ownerOf(zombieId);
        assert.equal(newOwner,bob);
    })
```

- Two-step 중 첫번 째 case! : alice가 bob에게 approve하고, bob이 alice의 좀비를 가져오는 시나리오
- 좀비의 주인이 bob으로 잘 바뀌었는지 확인.

CH11. ERC 721 Transfer –Two Step Scenario

```
    it("should approve and then transfer a zombie when the owner calls transferForm", async () => {
        const result = await contractInstance.createRandomZombie(zombieNames[0], {from: alice});
        const zombieId = result.logs[0].args.zombieId.toNumber();
        await contractInstance.approve(bob, zombieId, {from: alice});
        await contractInstance.transferFrom(alice, bob, zombieId, {from: alice});
        const newOwner = await contractInstance.ownerOf(zombieId);
        assert.equal(newOwner,bob);
    })
```

- Two-step 중 두번 째 case! : alice가 bob에게 approve하고, alice가 alice의 좀비를 bob에게 보내는 시나리오

- 차이는 transfer from의 msg.sender가 누군지만 다를뿐!

- 좀비의 주인이 bob으로 잘 바뀌었는지 확인.

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CH12. Zombie Attack

```
it("zombies should be able to attack another zombie", async () => {
    let result;
    result = await contractInstance.createRandomZombie(zombieNames[0], {from: alice});
    const firstZombieId = result.logs[0].args.zombieId.toNumber();
    result = await contractInstance.createRandomZombie(zombieNames[1], {from: bob});
    const secondZombieId = result.logs[0].args.zombieId.toNumber();
    //TODO: increase the time
    await time.increase(time.duration.days(1));
    await contractInstance.attack(firstZombieId, secondZombieId, {from: alice});
    assert.equal(result.receipt.status, true);
})
```

- Zombie attack은 위의 코드대로 실행하면 cooldown으로 인해 attack이 실패
- Time Travel 필요!

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CH12. Zombie Attack (Time Travel)

```
async function increase(duration) {

    //first, let's increase time
    await web3.currentProvider.sendAsync({
        jsonrpc: "2.0",
        method: "evm_increaseTime",
        params: [duration], // there are 86400 seconds in a day
        id: new Date().getTime()
    }, () => {});

    //next, let's mine a new block
    web3.currentProvider.send({
        jsonrpc: '2.0',
        method: 'evm_mine',
        params: [],
        id: new Date().getTime()
    })

}
```

- Web3 메서드를 이용해 블록체인과 소통
- Evm_increaseTime 요청을 보내고, evm_mine을 시작하면 다음 블록에 찍힌 타임스탬프를 하루 늦게 찍는 것이 가능.

```
const duration = {

    seconds: function (val) {
        return val;
    },
    minutes: function (val) {
        return val * this.seconds(60);
    },
    hours: function (val) {
        return val * this.minutes(60);
    },
    days: function (val) {
        return val * this.hours(24);
    },
}

module.exports = {
    increase,
    duration,
};
```

- 시간 단위를 초로 변환

Solidity Tutorial

CH13. Chai

Once you've finished this lesson, feel free check out their guides to further your knowledge.

That said, let's take a look at the three kinds of assertion styles bundled into `Chai`:

- *expect*: lets you chain natural language assertions as follows:

```
let lessonTitle = "Testing Smart Contracts with Truffle";
expect(lessonTitle).to.be.a("string");
```

- *should*: allows for similar assertions as `expect` interface, but the chain starts with a `should` property:

```
let lessonTitle = "Testing Smart Contracts with Truffle";
lessonTitle.should.be.a("string");
```

- *assert*: provides a notation similar to that packaged with node.js and includes several additional tests and it's browser compatible:

```
let lessonTitle = "Testing Smart Contracts with Truffle";
assert.typeOf(lessonTitle, "string");
```

```
    //TODO: replace with expect
    expect(result.receipt.status).to.equal(true);
})
```

- Npm install chai
- var expect = require('chai').expect;

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CH14. Chai

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```
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```
    //TODO: replace with expect
    expect(result.receipt.status).to.equal(true);
})
```

- Npm install chai
- var expect = require('chai').expect;