HW5 DiLiu UniswapV2 Rewrite

Github URL: https://github.com/DiLiuNEUexpresscompany/HW5DiLiuUniswapV2Rewrite

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Build Foundry

Installation via `Foundryup`

```
curl -L https://foundry.paradigm.xyz | bash
```

Then run:

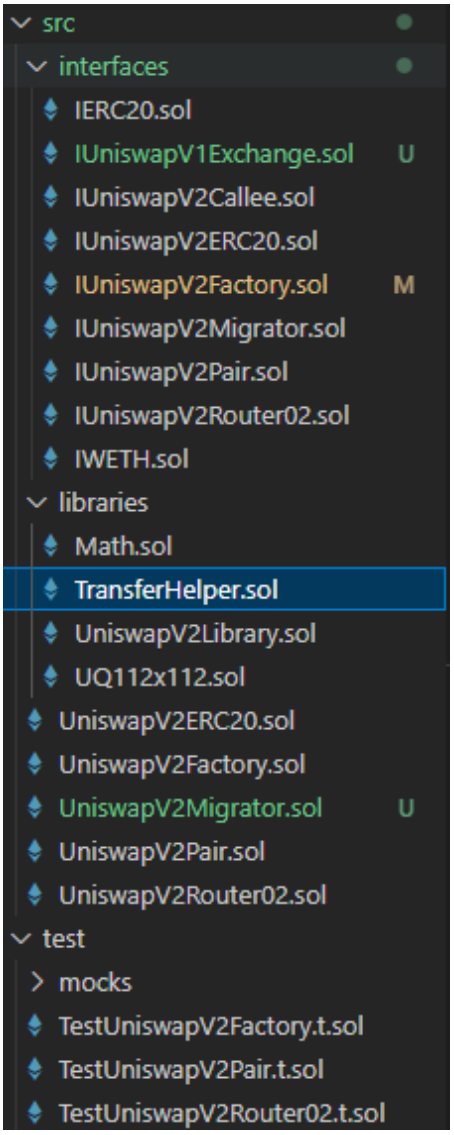
```
foundryup
```

Initialising a Foundry Project

```
forge init my-foundry-project
cd my-foundry-project
```

Solidity version: 0.8.13

Rewrite UniswapV2



File structure

interface

IERC20.sol

```sol
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.13;

interface IERC20 {
    function totalSupply() external view returns (uint256);
    function balanceOf(address account) external view returns (uint256);
    function transfer(address recipient, uint256 amount) external returns (bool);
    function approve(address spender, uint256 amount) external returns (bool);
    function transferFrom(address sender, address recipient, uint256 amount) externa
l returns (bool);
}
```

- Define **ERC-20 standard interfaces** for **token transfers** and **authorisations**.

IUniswapV2ERC20.sol

```
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.13;

interface IUniswapV2ERC20 {
    function totalSupply() external view returns (uint);
    function balanceOf(address owner) external view returns (uint);
    function approve(address spender, uint value) external returns (bool);
    function transferFrom(address sender, address recipient, uint value) external returns (bool);
}
```

- Defines the standard interface for **Uniswap V2 LP (Liquidity Provider) tokens**.
- Inherits ERC-20 and supports liquidity mining.

IUniswapV2Factory.sol

```
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.13;


interface IUniswapV2Factory {
    event PairCreated(address indexed token0, address indexed token1, address pair, uint);

    function feeTo() external view returns (address);
    function feeToSetter() external view returns (address);

    function getPair(address tokenA, address tokenB) external view returns (address pair);
    function allPairs(uint) external view returns (address pair);
    function allPairsLength() external view returns (uint);

    function createPair(address tokenA, address tokenB) external returns (address pair);

    function setFeeTo(address) external;
    function setFeeToSetter(address) external;

    function getExchange(address) external view returns (address);
}

```

- **Uniswap V2 factory contract** for creating new **Pairs**.
- Allows to query **existing Pair addresses**.

IUniswapV2Pair.sol

- **Core Liquidity Pool (Pair) contract** for the exchange, liquidity provision and destruction of LP tokens.
- Allows for **queries about reserves** and performs **token swaps**.

IUniswapV2Router02.sol

- Responsible for **token exchange** and **liquidity addition** logic.
- Allows functions such as `swapExactTokensForTokens`, `addLiquidity`, etc. to be performed.

IUniswapV2Migrator.sol

- After migration, users can provide liquidity in Uniswap V2.

IWETH.sol

```
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.13;

interface IWETH {
    function deposit() external payable;
    function withdraw(uint amount) external;
}
```

- Interface for `WETH` tokens.
- Allows **ETH and WETH to be converted to each other**.

IUniswapV1Exchange.sol

```
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.13;

interface IUniswapV1Exchange {
    function getEthToTokenInputPrice(uint256 eth_sold) external view returns (uint25
6);
    function getTokenToEthInputPrice(uint256 tokens_sold) external view returns (uin
t256);
    function ethToTokenSwapInput(uint256 min_tokens, uint256 deadline) external paya
ble;
    function tokenToEthSwapInput(uint256 tokens_sold, uint256 min_eth, uint256 deadl
ine) external;
}
```

- Provides the core interface to the Uniswap V1 exchange.
- Allows querying the ETH to token exchange ratio.
- Allows ETH → Token and Token → ETH exchange.

IUniswapV2Callee.sol

```solidity
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.13;

interface IUniswapV2Callee {
    function uniswapV2Call(address sender, uint amount0, uint amount1, bytes calldata data) external;
}
```

- Allows **External Contracts** to execute custom logic in **Uniswap V2 Lightning Loan** transactions.
- Specialised callback interface for **Flash Swap**.

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libraries

Math.sol

`Math.sol` is a Solidity maths library (Library) for performing **safe mathematical operations**. It provides basic mathematical operations such as addition, subtraction, and multiplication, as well as minimum (`min`) and square root (`sqrt`) calculations.

Due to version updates 0.8 and above do not need to consider the overflow problem, Solidity's own arithmetic symbols can be handled in version 0.8 and above.

TransferHelper.sol

`TransferHelper.sol` is a library of Solidity transfer tools for securely interacting with `ERC-20` tokens and `ETH`. It mainly provides secure `approve`, `transfer`, `transferFrom`, and `ETH` transfer methods.

UniswapV2ERC20.sol

Modification Points	Official Uniswap V2 version	Your modifications
Mathematical operations	Use `SafeMath`	Use `Math.sol`
ERC-20 Permit	use `EIP-2612`	same structure
Event Logging	Logic is the same	Logic is the same
Constructor	Compute `DOMAIN_SEPARATOR`	Same structure

UniswapV2Factory.sol

Feature	Your Version	Official Uniswap Version	Impact
`feeTo` variable	`public`	`public`	Identical
`feeToSetter` variable	`public`	`public`	Identical
`getPair` mapping	`public`	`public`	Identical
`allPairs` array	`public`	`public`	Identical
Constructor	`constructor(address _feeToSetter)`	`constructor(address _feeToSetter)`	Identical
`allPairsLength()`	`external view returns (uint)`	`external view returns (uint)`	Identical
`createPair()` logic	`require(tokenA != tokenB, 'IDENTICAL_ADDRESSES')`	`require(tokenA != tokenB, 'IDENTICAL_ADDRESSES')`	Identical

Feature	Your Version	Official Uniswap Version	Impact
`create2` deployment	Uses `assembly`	Uses `assembly`	Identical
Pair initialization	`IUniswapV2Pair(pair).initialize(token0, token1);`	`IUniswapV2Pair(pair).initialize(token0, token1);`	Identical
Reverse mapping for `getPair`	`getPair[token1][token0] = pair;`	`getPair[token1][token0] = pair;`	Identical
`setFeeTo()` function	Requires `feeToSetter` permission	Requires `feeToSetter` permission	Identical
`setFeeToSetter()` function	Requires `feeToSetter` permission	Requires `feeToSetter` permission	Identical

UniswapV2Pair.sol

Feature	Your Version	Official Uniswap Version	Impact
Inherits `IUniswapV2ERC20`	✅ Yes	✅ Yes	Identical
`Mint` event	✅ Yes	✅ Yes	Identical
`Burn` event	✅ Yes	✅ Yes	Identical
`Swap` event	✅ Yes	✅ Yes	Identical
`Sync` event	✅ Yes	✅ Yes	Identical
`MINIMUM_LIQUIDITY()` function	✅ Yes	✅ Yes	Identical
`factory()` function	✅ Yes	✅ Yes	Identical
`token0()` function	✅ Yes	✅ Yes	Identical
`token1()` function	✅ Yes	✅ Yes	Identical
`getReserves()` function	✅ Yes	✅ Yes	Identical
`price0CumulativeLast()` function	✅ Yes	✅ Yes	Identical
`price1CumulativeLast()` function	✅ Yes	✅ Yes	Identical
`kLast()` function	✅ Yes	✅ Yes	Identical
`mint()` function	✅ Yes	✅ Yes	Identical
`burn()` function	✅ Yes	✅ Yes	Identical
`swap()` function	✅ Yes	✅ Yes	Identical
`skim()` function	✅ Yes	✅ Yes	Identical
`sync()` function	✅ Yes	✅ Yes	Identical
`initialize()` function	✅ Yes	✅ Yes	Identical

UniswapV2Router02.sol

Feature	Your Version	Official Uniswap Version	Impact
Inherits `IUniswapV2ERC20`	✅ Yes	✅ Yes	Identical
`Mint` event	✅ Yes	✅ Yes	Identical
`Burn` event	✅ Yes	✅ Yes	Identical
`Swap` event	✅ Yes	✅ Yes	Identical
`Sync` event	✅ Yes	✅ Yes	Identical
`MINIMUM_LIQUIDITY()` function	✅ Yes	✅ Yes	Identical

Feature	Your Version	Official Uniswap Version	Impact
`factory()` function	✅ Yes	✅ Yes	Identical
`token0()` function	✅ Yes	✅ Yes	Identical
`token1()` function	✅ Yes	✅ Yes	Identical
`getReserves()` function	✅ Yes	✅ Yes	Identical
`price0CumulativeLast()` function	✅ Yes	✅ Yes	Identical
`price1CumulativeLast()` function	✅ Yes	✅ Yes	Identical
`kLast()` function	✅ Yes	✅ Yes	Identical
`mint()` function	✅ Yes	✅ Yes	Identical
`burn()` function	✅ Yes	✅ Yes	Identical
`swap()` function	✅ Yes	✅ Yes	Identical
`skim()` function	✅ Yes	✅ Yes	Identical
`sync()` function	✅ Yes	✅ Yes	Identical
`initialize()` function	✅ Yes	✅ Yes	Identical

Test and Coverage

Build

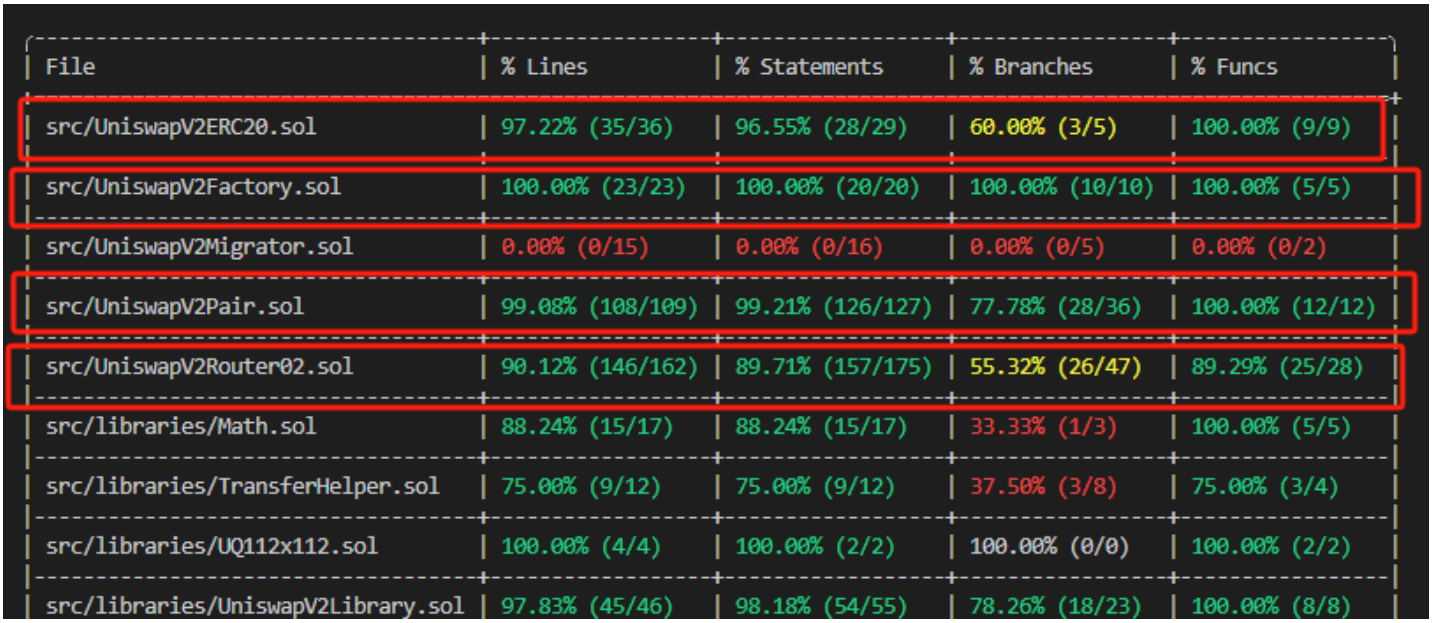
```
$ forge build
```

Test

```
$ forge test -vvv
```

Coverage

```
$ forge coverage
```



File	% Lines	% Statements	% Branches	% Funcs
src/UniswapV2ERC20.sol	97.22% (35/36)	96.55% (28/29)	60.00% (3/5)	100.00% (9/9)
src/UniswapV2Factory.sol	100.00% (23/23)	100.00% (20/20)	100.00% (10/10)	100.00% (5/5)
src/UniswapV2Migrator.sol	0.00% (0/15)	0.00% (0/16)	0.00% (0/5)	0.00% (0/2)
src/UniswapV2Pair.sol	99.08% (108/109)	99.21% (126/127)	77.78% (28/36)	100.00% (12/12)
src/UniswapV2Router02.sol	90.12% (146/162)	89.71% (157/175)	55.32% (26/47)	89.29% (25/28)
src/libraries/Math.sol	88.24% (15/17)	88.24% (15/17)	33.33% (1/3)	100.00% (5/5)
src/libraries/TransferHelper.sol	75.00% (9/12)	75.00% (9/12)	37.50% (3/8)	75.00% (3/4)
src/libraries/UQ112x112.sol	100.00% (4/4)	100.00% (2/2)	100.00% (0/0)	100.00% (2/2)
src/libraries/UniswapV2Library.sol	97.83% (45/46)	98.18% (54/55)	78.26% (18/23)	100.00% (8/8)

LCOV - code coverage report

Current view: top level - src/src
Test: lcov.info
Test Date: 2025-03-09 18:38:30

	Coverage	Total	Hit
Lines:	94.5 %	330	312
Functions:	94.4 %	54	51

Filename	Line Coverage ≎			Function Coverage ≎		
	Rate	Total	Hit	Rate	Total	Hit
UniswapV2ERC20.sol	97.2 %	36	35	100.0 %	9	9
UniswapV2Factory.sol	100.0 %	23	23	100.0 %	5	5
UniswapV2Pair.sol	99.1 %	109	108	100.0 %	12	12
UniswapV2Router02.sol	90.1 %	162	146	89.3 %	28	25

Generated by: LCOV version 2.0-1