

Homework 7

- Follow the instructions very carefully. Answers that do not conform to the instructions will not be given credit.
- Understand thoroughly all the code given to you in this lab. Search for documentation online if there is a primitive or API you have not encountered before.

For this assignment, you may work individually or with a team. You have three options:

Option 1: Instructions for working individually.

- A. Only parts 1 and 2 of the assignment are required.
- B. Submit both your `metacoin.js` and `MetaCoin.sol` files. Do not zip them.

Option 2: Instructions for working individually, and you want to do part 3 for extra credit.

- A. Do parts 1, 2, and 3 of the assignment.
- B. Your solution for part 3 should be substantial enough to justify the extra credit. You may email the instructor with a description of your proposal for part 3 **at least one week before the due date**, if you want to be sure that your extension is substantial enough.
- C. Submit your entire homework7 zip file that includes your extensions.
- D. Submit a separate text file with a write-up of your extension. Do not include the write-up text file in the zip file.
- E. The maximum extra credit is 3 points on your final grade.

Option 3: Instructions for working with a team.

- A. You can work with one or two additional people.
- B. Do parts 1, 2, and 3 of the assignment.
- C. Your solution for part 3 should be substantial enough to justify working with a team. You may email the instructor with a description of your proposal for part 3 **at least one week before the due date**, if you want to be sure that your extension is substantial enough.
- D. Submit your entire homework7 zip file that includes your extensions.
- E. Submit a separate text file with a write-up of your extension. Do not include the write-up text file in the zip file.
- F. Include the names of the people you worked with in the text file.

Part 1: Set up your environment

It's important to complete this part 1 very early so you don't run into last minute technical issues blocking you from completing the assignment on time. This part 1 should not take more than 3 hours to complete.

1. If you are using Windows: download and install cygwin, a Linux terminal emulator. Be sure to use the 64-bit installer if your machine is 64-bit. If you are using Mac or Linux, you don't need Cygwin -- you can just use the native terminal.
<https://www.cygwin.com/>.

2. Download and install VirtualBox, a free virtual machine.
<https://www.virtualbox.org/wiki/Downloads>

3. Download and install Vagrant. Read the getting started guide. Vagrant will make it very easy to get an Ethereum development environment set up.
<https://www.vagrantup.com/downloads.html>
<https://www.vagrantup.com/intro/getting-started/index.html>

4. Start up the virtual machine included in the homework 7 zip, log into it using ssh. Then, start the Ethereum node server, and then use truffle to test MetaCoin contract. Below are the step-by-step instructions. Two out of the four tests should pass.

Open a terminal

```
$ cd homework7
```

```
$ vagrant up
$ vagrant ssh
$ cd homework7
$ testrpc
```

Open a new terminal

```
$ cd homework7
$ vagrant up
$ vagrant ssh
$ cd homework7/metacoins
$ truffle test
```

5. Confirm that the `~/homework7` directory on the virtual machine (VM) is the same as the `homework7` on the host. You can do this by opening windows explorer and creating a file under your unzipped `homework7` directory, and then confirming that same file is now created in the `~/homework7` directory on the VM. You can use your IDE to edit the `homework7` files from the host and your edits will be instantly reflected in the VM. This shared directory mechanism enables you to write code on the host, and test your code on the virtual machine without having to copy files between the host and the VM.

Part 2: Working with smart contracts

6. Read the Ethereum white paper and the documentation on solidity.

<https://github.com/ethereum/wiki/wiki/White-Paper>

<https://solidity.readthedocs.io/en/develop/>

7. Read the documentation on Truffle, an Ethereum testing framework that makes it easy to write contracts and test them on your own, private Ethereum network.

<http://truffleframework.com/docs/>

8. Read and understand the `metacoins/MetaCoin.sol` contract and unit test file `metacoins.js`. You can read about this contract in the Truffle documentation: http://truffleframework.com/docs/getting_started/contracts.

9. Find the empty function called "mint" in the MetaCoin contract. Give an implementation of the function that enables the owner of the contract to mint new coins and assign them to himself. Only the owner can mint coins. If anyone else calls the function, the function should not do anything.

10. Find the two failing test cases in `metacoins.js` and fill them in. One test should check that the owner can mint coins to himself. The other test should check that a non-owner cannot mint coins to himself.

Part 3: Extension to MetaCoin

You only need to do this part if you are working with a team, or you want extra credit.

11. Propose extensions to MetaCoin, implement them, and then write extensive test cases. If you work with two additional people, your extensions must be twice as substantial as if you were working with one additional person. Include a write up of your extensions, explaining how your implementation works. Be sure to use advanced features of Solidity that are not used by the original MetaCoin implementation.