Contact Information

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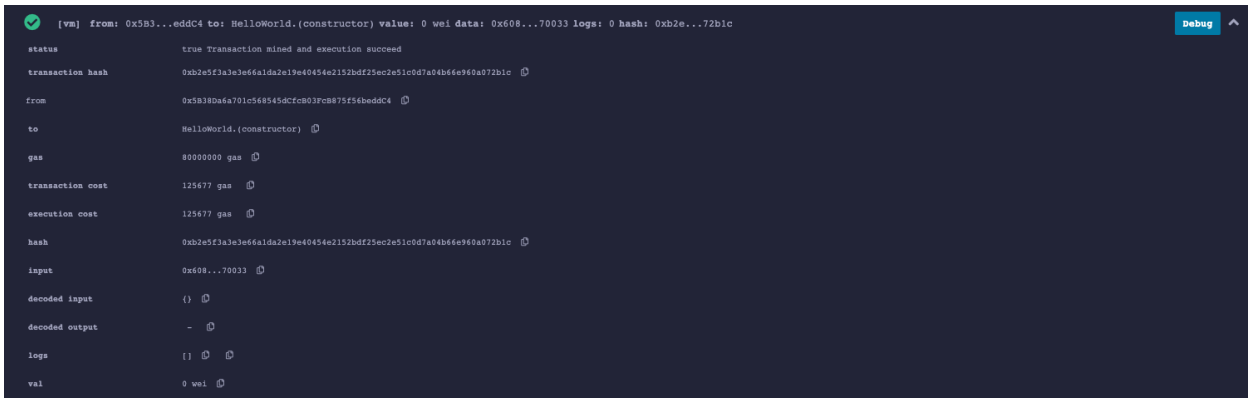
Question 1: Hello World

Github Link: https://github.com/markusmak/zku_background/blob/main/hello_world.sol

Code Snippet

```
// SPDX-License-Identifier: GPL-3.0
pragma solidity >=0.4.16 <0.9.0;


// Create Hello World contract
contract HelloWorld {

    // Declare unsigned integer
    uint integer;

    // Set function to set the unsigned integer
    function setInteger(uint x) public {
        integer = x;
    }

    // Get funciton to retrieve the unsigned integer
    function getInteger() public view returns (uint) {
        return integer;
    }

}
```

Contract Deployment



Question 2: Ballot

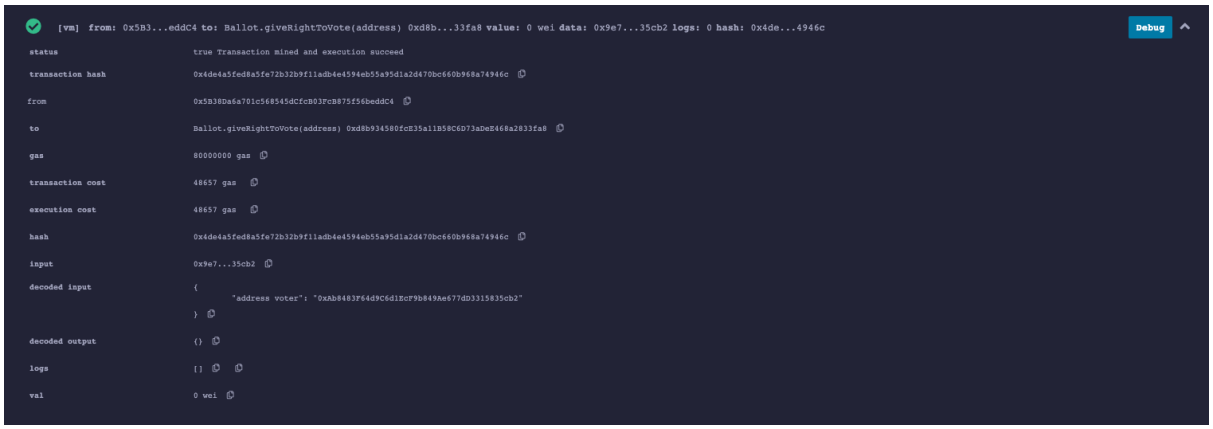
Github Link: https://github.com/markusmak/zku_background/blob/main/ballot.sol

Code Snippet

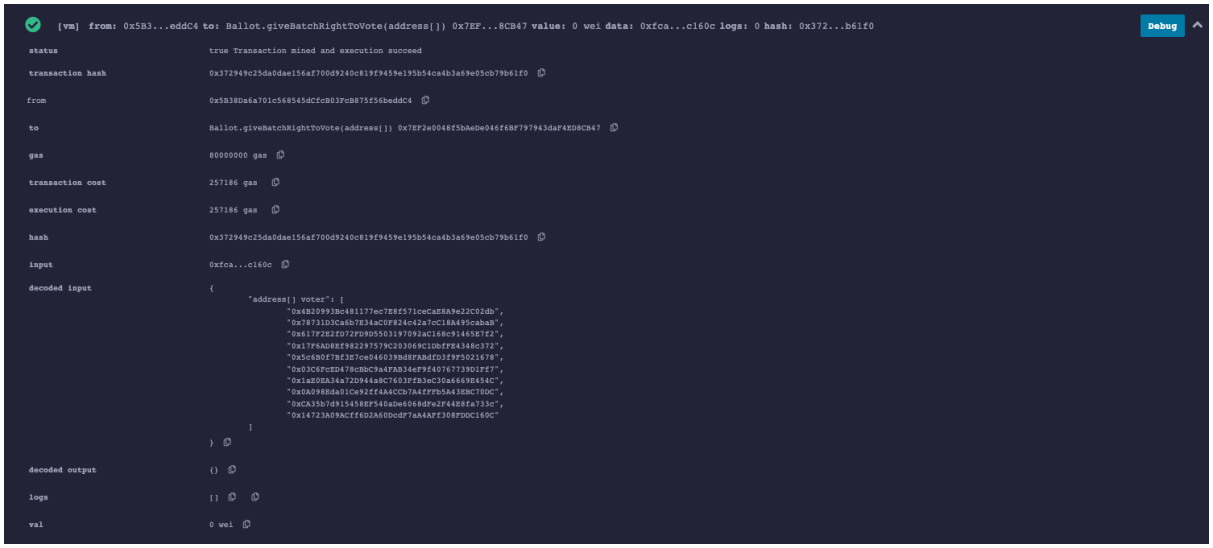
```
51      // batch give rights to vote by chairperson
52      function giveBatchRightToVote(address[] memory voter) external {
53          // save gas by running chairperson check only once
54          require(
55                  msg.sender == chairperson,
56                  "Only chairperson can give right to vote."
57              );
58          // set loop to iterate through individual voter
59          for (uint i = 0; i < voter.length; i++) {
60              // remove voter voted check to avoid unnecessary revert and improve gas
61              require(voters[voter[i]].weight == 0);
62              voters[voter[i]].weight = 1;
63          }
64      }
```

Contract Deployment

Function call - giveRightToVote



Function call - giveBatchRightToVote (10 addresses)



Gas Analysis

giveRightToVote - 48657 gas
giveBatchRightToVote - 257186 gas
giveBatchRightToVote per address gas = 257186/10 = 25718.6

Gas saved = (48657 - 25718.6) / 48657 = **47%**