Testing

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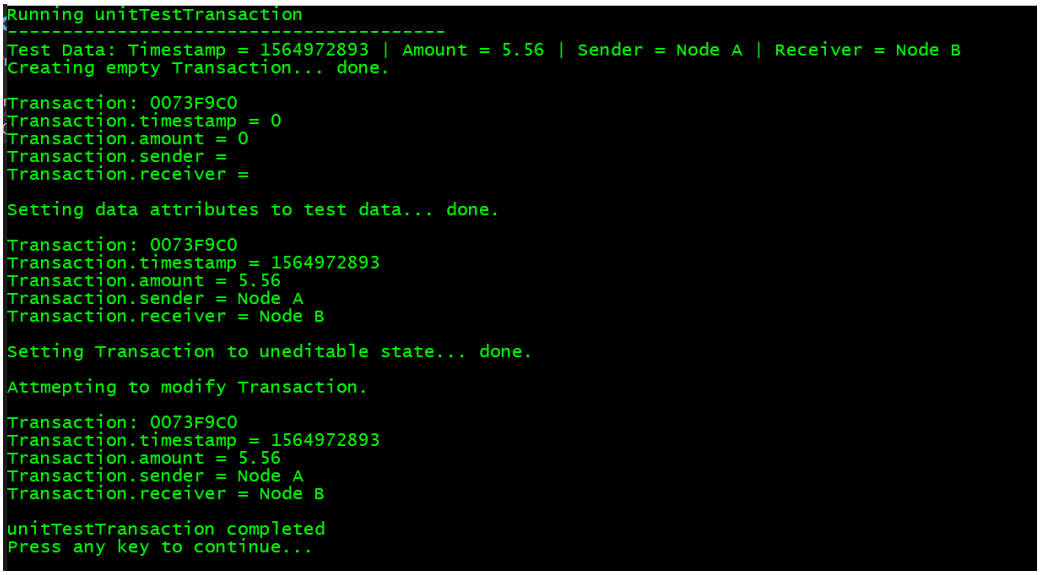
Unit Tests

Transaction

- confirm that all Transaction attributes are set to the correct passed values in the test
- confirm that Transaction attributes cannot be modified after executing makeConstant() method

Results:



Block

- confirm that the constructor creates a Block instance with correct attribute values
- confirm that CalculateHash() produces a hash string with the correct Nonce
- confirm that the GetData() method returns a Transaction instance with the correct values
- confirm that copying a Block copies all attribute values (hash can vary for improved encryption)

Results:

```
Running unitTestBlock
---------------------------------------
Test Data: Time: 0 | Amount: 328.99 | Sender: Node A | Receiver: Node B

Creating a Block holding the Transaction data:  done.

Block hash: 06cf2d09a0e5c47b704ed96466e12f58fb6c05e4b6f79e7f0fa16399aced6cf0
Block: 06cf2d09a0e5c47b704ed96466e12f58fb6c05e4b6f79e7f0fa16399aced6cf0
Data: Timestamp: 0, Amount: 328.99 crypto, sender: Node A, receiver: Node B

Creating a second Block with the same data
Block 2 hash: 06cf2d09a0e5c47b704ed96466e12f58fb6c05e4b6f79e7f0fa16399aced6cf0

Copying a Block from Block 1...
Block: 06cf2d09a0e5c47b704ed96466e12f58fb6c05e4b6f79e7f0fa16399aced6cf0
Data: Timestamp: 0, Amount: 328.99 crypto, sender: Node A, receiver: Node B

unitTestBlock completed
Press any key to continue...
```

Blockchain

- confirm that the constructor creates a Blockchain with only an origin block
- confirm that adding a Block to the chain creates a new last Block in the chain with the desired Transaction attributes, and the size of the chain increases

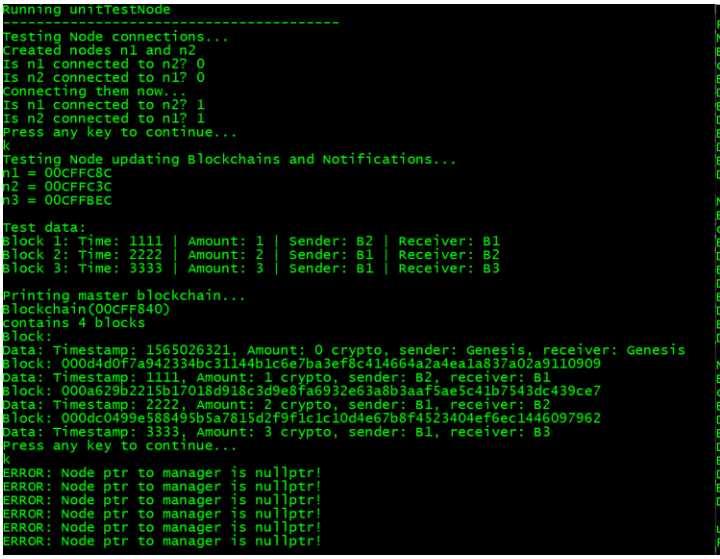
Results:

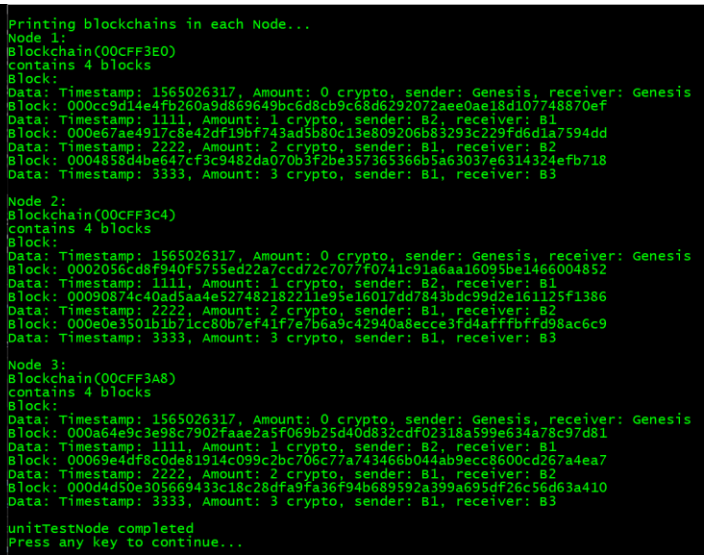
```
Running unitTestBlockchain
---------------------------------------

Test data:
Block 1: Time: 1111 | Amount: 1 | Sender: B2 | Receiver: B1
Block 2: Time: 2222 | Amount: 2 | Sender: B1 | Receiver: B2
Block 3: Time: 3333 | Amount: 3 | Sender: B1 | Receiver: B3

Created a Blockchain
Blockchain size: 1 (should be 1)

Added blocks to chain... (New size should be 4)
Blockchain(00B9F59C)
contains 4 blocks
Block:
Data: Timestamp: 1565010501, Amount: 0 crypto, sender: Genesis, receiver: Genesis
Block: 0004a48b1454765cc4fc2a4706159ad366a70ae51367f160b6a2739a2ed104b7
Data: Timestamp: 1111, Amount: 1 crypto, sender: B2, receiver: B1
Block: 000824a7d3df09ccbce4bf9c9745b334fd02129cd2346ed39c78149ec78f6597
Data: Timestamp: 2222, Amount: 2 crypto, sender: B1, receiver: B2
Block: 00022181a519a03e8edebf3ce474ae184c3aa44cf3dc0e718e20c42c3c77db11
Data: Timestamp: 3333, Amount: 3 crypto, sender: B1, receiver: B3

unitTestBlockchain completed
Press any key to continue...
```

Node

- confirm that getters and setters work
- confirm that when calling node1.addConnection(node2) then both nodes are connected to one another
- confirm Nodes correctly modify their Blockchains and Blockchains have correct Transaction data
- confirm that a Node does not crash the program when a DataManager is not connected
    - instead an appropriate error message is printed

Results:

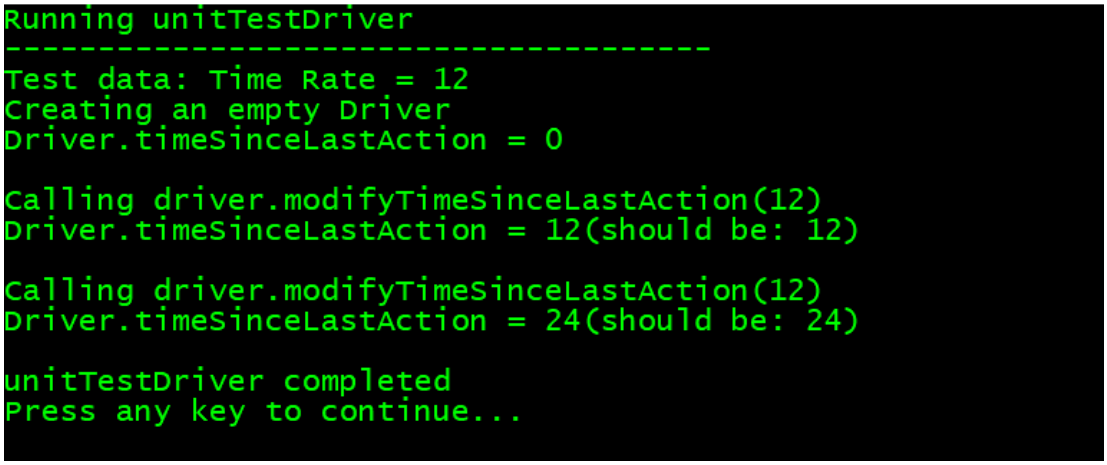




Driver

- confirm that getters and setters work

Results:



DataManager

-confirm that getters and setters work

Results:

```
Running unitTestDataManager
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Test Data: Initial Amount: 11.25 | Initial Transactions: 0 | Initial Nodes: 3
CryptoRate: 3.5 | New Nodes: 2 | Time Rate: 10
End Amount: 14.75 | End Transactions: 1 | End Nodes: 5

Created empty DataManager
DataManager: 0113FC44
DataManager.totalCrypto = 0
DataManager.totalTransactions = 0
DataManager.cryptoPerMine = 0
DataManager.totalNodes = 0
DataManager.timeRate = 0
DataManager.timePassed = 0

Setting DataManager initial values
DataManager: 0113FC44
DataManager.totalCrypto = 11.25
DataManager.totalTransactions = 0
DataManager.cryptoPerMine = 3.5
DataManager.totalNodes = 3
DataManager.timeRate = 10
DataManager.timePassed = 0

Modifying DataManager values
DataManager: 0113FC44
DataManager.totalCrypto = 14.75
DataManager.totalTransactions = 1
DataManager.cryptoPerMine = 3.5
DataManager.totalNodes = 5
DataManager.timeRate = 10
DataManager.timePassed = 10

unitTestDataManager completed
Press any key to continue...
```

Model

- confirm that when a given Event type is passed to the Model, that it takes the corresponding action

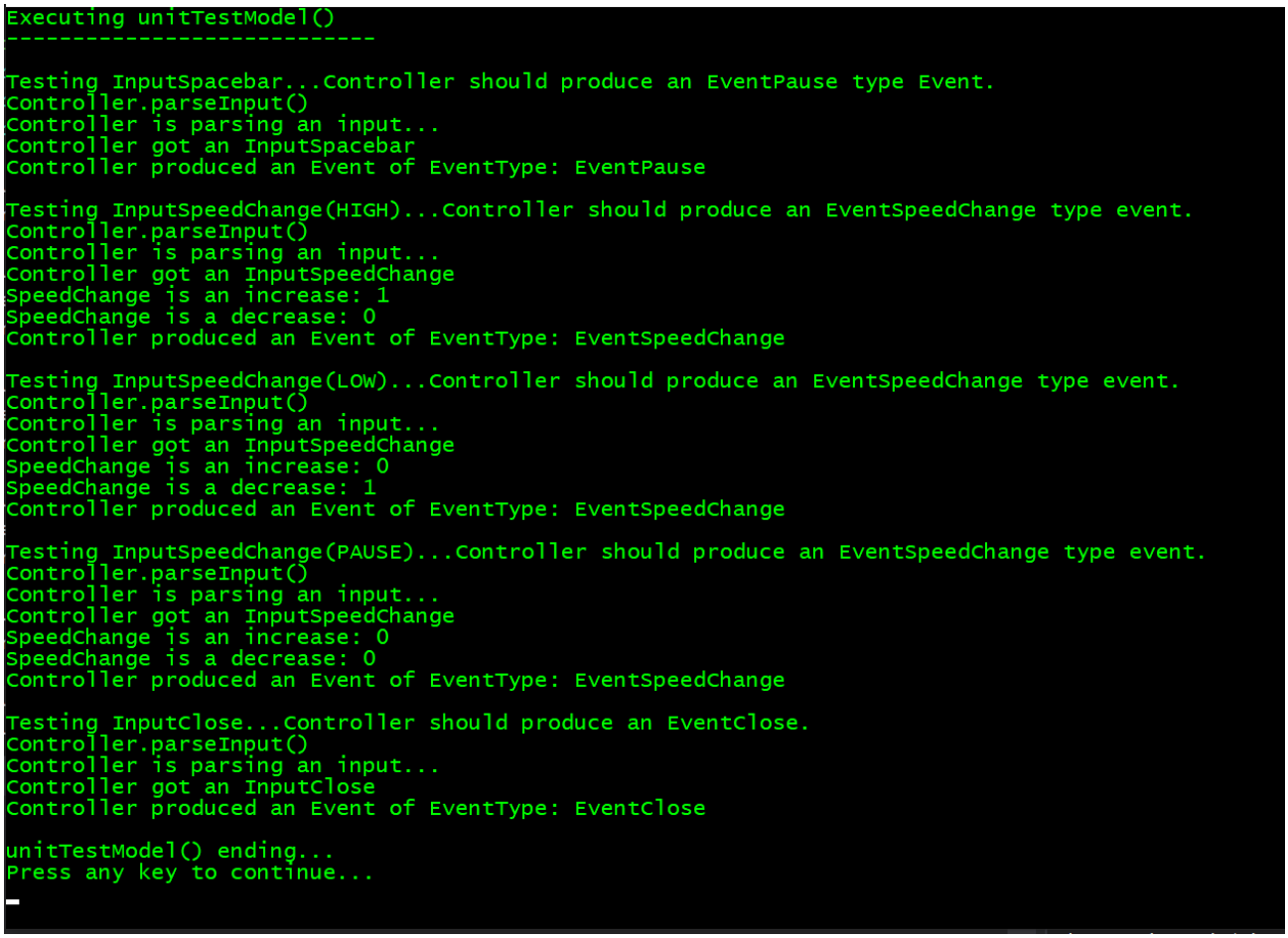
Results:

```
Executing unitTestModel()
-------------------------
Model.running = 1 (should be 1)

Pausing Model...Model.takeEvent()
Model.update()
Model is processing an event...
Model.updateModel()
Model.Event = EventPause
Model is pushing a Notice to Viewer...
 done.
Model.running = 0 (should be 0)

Now unpausing Model...
Model.takeEvent()
Model.update()
Model is processing an event...
Model.updateModel()
Model.Event = EventPause
Model is pushing a Notice to Viewer...
...done.
Model.running = 1 (should be 1)

Increasing Model speed...
Model.takeEvent()
Model.update()
Model is processing an event...
Model.updateModel()
Model.Event = EventSpeedChange
Model parsed Event = EventSpeedChange(SPEEDUP)
Model is pushing a Notice to Viewer...
...done.

Decreasing Model speed...
Model.takeEvent()
Model.update()
Model is processing an event...
Model.updateModel()
Model.Event = EventSpeedChange
Model parsed Event = EventSpeedChange(SLOWDOWN)
Model is pushing a Notice to Viewer...
..done.
unitTestModel() ending...
Press any key to continue...
```

Controller

- confirm that when a given Input type is received by the Controller, then it creates the corresponding Event type

Results:



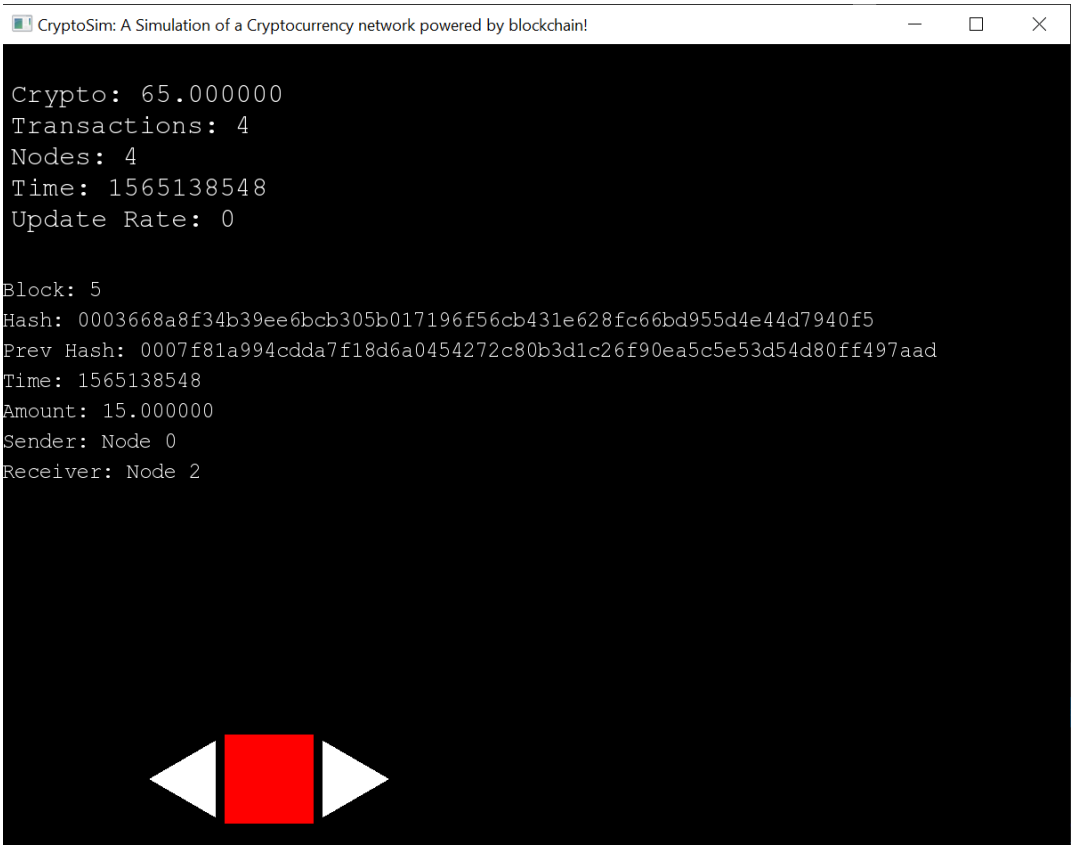
System Testing

Model – Viewer – Controller system

- To pass testing, all acceptance cases must be true:
    1. When the user clicks the square pause button, the Simulation either pauses and the button turns red or it unpauses and the button turns green. If the simulation is paused, no changes to the Model are made.
        True
    2. When the user hits the spacebar, the Simulation either pauses and the button turns red or it unpauses and the button turns green. If the simulation is paused, no changes to the Model are made.
        True
    3. When the user clicks the left arrow or right arrow buttons to the sides of the pause button, the Simulation modifies its update rate to be either faster (displayed rate decreases in value if right arrow clicked) or slower (displayed rate increase sin value if left arrow clicked)
        True
    4. When enough time has passed since the last Simulation update and the Sim is not paused, then the Simulation Driver takes an action and the Viewer screen updates accordingly.
        True
    5. When the user presses the escape key, the program shuts down.
        True
    6. When the user clicks the X in the top right corner of the display window, the program shuts down.
        True

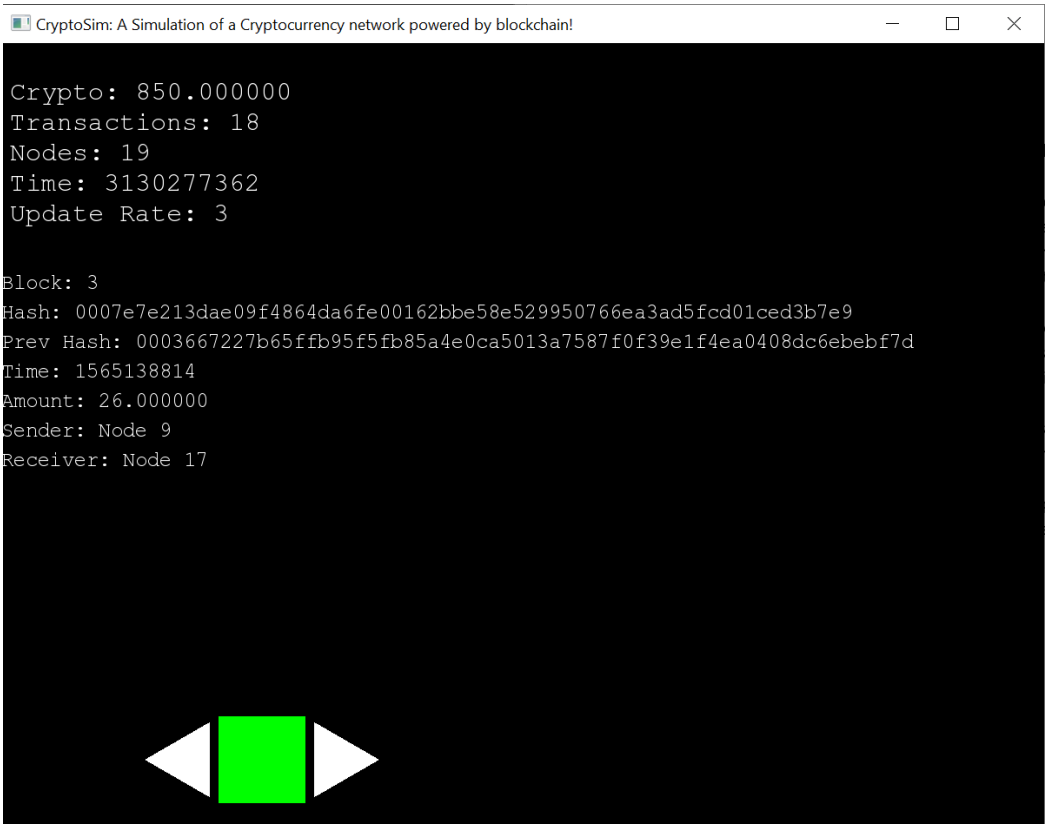
Result screenshots on the following pages.

1. Paused state:



2. Running state:

3. Sim with Increased Speed:



4. Sim with Decreased Speed: