Github: https://github.com/Jason-Jiaxin/cryptography-homework/tree/master/PA3

Blockchain test result and explanation

```
Block chain tests begin
Initialize Ledger
Block:0; Prev block hash:b'0'; Num transactions:1; Block hash:x8c|k'; Solution:0; Verified:
True
All user balance
User 2478377 Num: 10 Coins: {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
User 7904203 Num: 0 Coins: set()
User 3747079 Num: 0 Coins: set()

User 1 send coins[1, 2] to user 2 and coins[4, 5, 6] to user 3
Test: Valid transaction
Block is valid. Transactions processed:
Transaction sender:2478377; Receiver:7904203; Num coins:2; Coins:[1, 2]; Signature:1335357
Transaction sender:2478377; Receiver:3747079; Num coins:3; Coins:[4, 5, 6]; Signature:92993
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Transaction sender:7904203; Receiver:7904203; Num coins:10; Coins:[11, 12, 13, 14, 15, 16,
17, 18, 19, 20]; Signature:5714802
Block:0; Prev block hash:b'0'; Num transactions:1; Block hash:x8c|k'; Solution:0; Verified:
True
Block:1; Prev block hash:x8c|k'; Num transactions:3; Block hash:a\xd2'; Solution:308; Verif
ied:True
Transactions in queue
All user balance
User 2478377 Num: 5 Coins: {3, 7, 8, 9, 10}
User 7904203 Num: 12 Coins: {1, 2, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}
User 3747079 Num: 3 Coins: {4, 5, 6}

User 1 send coins[7] to user 2 and coins[3, 11] to user 3
Test: Invalid transaction: User try to send coins he not own
Not all transactions are valid. Block discarded. Valid transactions re-enter tq
Block:0; Prev block hash:b'0'; Num transactions:1; Block hash:x8c|k'; Solution:0; Verified:
True
Block:1; Prev block hash:x8c|k'; Num transactions:3; Block hash:a\xd2'; Solution:308; Verif
ied:True
Transactions in queue
Transaction sender:2478377; Receiver:7904203; Num coins:1; Coins:[7]; Signature:2919216
All user balance
User 2478377 Num: 5 Coins: {3, 7, 8, 9, 10}
User 7904203 Num: 12 Coins: {1, 2, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}
User 3747079 Num: 3 Coins: {4, 5, 6}

User 1 send coins[3] to user 2 and coins[3] to user 3
Test: Invalid transaction: User try to double spend
Not all transactions are valid. Block discarded. Valid transactions re-enter tq
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```
Block:0; Prev block hash:b'0'; Num transactions:1; Block hash:x8c|k'; Solution:0; Verified:
True
Block:1; Prev block hash:x8c|k'; Num transactions:3; Block hash:a\xd2'; Solution:308; Verif
ied:True
Transactions in queue
Transaction sender:2478377; Receiver:7904203; Num coins:1; Coins:[7]; Signature:2919216
Transaction sender:2478377; Receiver:7904203; Num coins:1; Coins:[3]; Signature:1041951
All user balance
User 2478377 Num: 5 Coins: {3, 7, 8, 9, 10}
User 7904203 Num: 12 Coins: {1, 2, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}
User 3747079 Num: 3 Coins: {4, 5, 6}
```

User 1 send coins[8] to user 2, user 3 modifies the receiver to user 3
```
Test: Invalid transaction: User try to modify the receiver of a valid transaction
signature invalid
Not all transactions are valid. Block discarded. Valid transactions re-enter tq
Block:0; Prev block hash:b'0'; Num transactions:1; Block hash:x8c|k'; Solution:0; Verified:
True
Block:1; Prev block hash:x8c|k'; Num transactions:3; Block hash:a\xd2'; Solution:308; Verif
ied:True
Transactions in queue
Transaction sender:2478377; Receiver:7904203; Num coins:1; Coins:[7]; Signature:2919216
Transaction sender:2478377; Receiver:7904203; Num coins:1; Coins:[3]; Signature:1041951
All user balance
User 2478377 Num: 5 Coins: {3, 7, 8, 9, 10}
User 7904203 Num: 12 Coins: {1, 2, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}
User 3747079 Num: 3 Coins: {4, 5, 6}
```

**User 1 generates a valid block, user 3 changes the last transaction to mint coin
s for user 3**
```
Test: Invalid transaction: User try to change transactions in a valid block
Block solution invalid. Block discarded. Transactions re-enter tq
Block:0; Prev block hash:b'0'; Num transactions:1; Block hash:x8c|k'; Solution:0; Verified:
True
Block:1; Prev block hash:x8c|k'; Num transactions:3; Block hash:a\xd2'; Solution:308; Verif
ied:True
Transactions in queue
Transaction sender:2478377; Receiver:7904203; Num coins:1; Coins:[7]; Signature:2919216
Transaction sender:2478377; Receiver:7904203; Num coins:1; Coins:[3]; Signature:1041951
All user balance
User 2478377 Num: 5 Coins: {3, 7, 8, 9, 10}
User 7904203 Num: 12 Coins: {1, 2, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}
User 3747079 Num: 3 Coins: {4, 5, 6}
```

Process the remaining 2 transactions in the queue
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Test: Valid transaction: Process remaining transactions in the queue
Block is valid. Transactions processed:
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```
Transaction sender:2478377; Receiver:7904203; Num coins:1; Coins:[7]; Signature:2919216
Transaction sender:2478377; Receiver:7904203; Num coins:1; Coins:[3]; Signature:1041951
Transaction sender:2478377; Receiver:2478377; Num coins:10; Coins:[71, 72, 73, 74, 75, 76,
77, 78, 79, 80]; Signature:0817711
Block:0; Prev block hash:b'0'; Num transactions:1; Block hash:x8c|k'; Solution:0; Verified:
True
Block:1; Prev block hash:x8c|k'; Num transactions:3; Block hash:a\xd2'; Solution:308; Verif
ied:True
Block:2; Prev block hash:a\xd2'; Num transactions:3; Block hash:i\x06'; Solution:192; Verif
ied:True
Transactions in queue
All user balance
User 2478377 Num: 13 Coins: {71, 8, 9, 10, 72, 73, 74, 75, 76, 77, 78, 79, 80}
User 7904203 Num: 14 Coins: {1, 2, 3, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}
User 3747079 Num: 3 Coins: {4, 5, 6}
```