Bitcoin Basics

Bitcoin Network and Storage

1. Explain the function of the memory pool in the Bitcoin network.

2. We have two investors, Alice and Bob. Alice is day trading Bitcoin as a hobby, and Bob has bought some Bitcoin as part of his children's college funds. For each, argue whether they should use a hot or cold wallet and suggest a specific wallet as an example.

3. Payment channels such as Lightning Network on Bitcoin are known as Layer-2 (L2) solutions. Briefly explain why these solutions are called L2, and list two potential drawbacks.

Transaction-based Ledger

1. Consider the following transactions in a transaction-based ledger like Bitcoin. Check if the transactions are valid. If valid, calculate the balance of each person.

(a)

0	Txin: ∅ Txout: 25.0 → Bob
1	Txin: 0[0] Txout: 12.0 → Bob, 5.0 → Carol, 8.0 → Alice signed by Bob
2	Txin: 1[2] Txout: 4.0 → Carol, 4.0 → Alice signed by Alice
3	Txin: 1[1] Txout: 2.0 → Carol, 3.0 → Alice signed by Carol

(b)

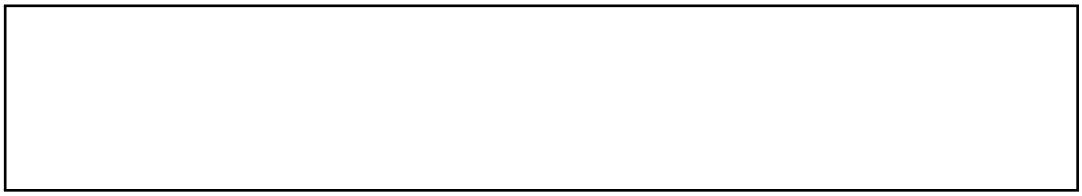
0	Txin: ∅ Txout: 12.5 → Bob
1	Txin: 0[0] Txout: 2.0 → Alice, 8.0 → Bob, 2.5 → Carol signed by Bob
2	Txin: ∅ Txout: 12.5→ Alice
3	Txin: 2[0] Txout: 10.0 → Alice, 2.0 → Bob, 2.5 → Alice signed by Alice

(c)

0	Txin: ∅ Txout: 25.0 → Alice
1	Txin: 0[0] Txout: 24.0 → Bob signed by Alice
2	Txin: 1[0] Txout: 7.0 → Bob, 12.0 → Alice, 3.0 → Carol signed by Bob
3	Txin: 2[1] Txout: 2.0 → Bob, 7.0 → Carol, 3.0 → Alice signed by Alice
4	Txin: 3[1] Txout: 4.0 → Carol, 3.0 → Alice signed by Carol

(d)

0	Txin: Ø Txout: 25.0 → Carol
1	Txin: 0[0] Txout: 6.0 → Bob, 6.0 → Alice, 13.0 → Carol signed by Carol
2	Txin: 1[1] Txout: 2.0 → Bob, 4.0 → Alice signed by Bob
3	Txin: 1[2] Txout: 3.0 → Bob, 7.0 → Carol, 3.0 → Alice signed by Carol



2. Below is the representation of four transactions in the Bitcoin network where Alice receives Bitcoins from two different miners. Transaction fees are ignored.

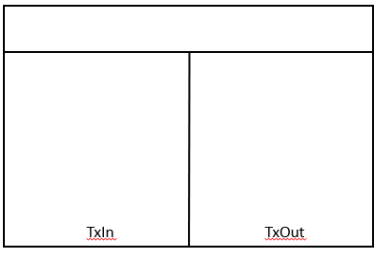
Tx #0	
TxIn	TxOut: 12,5 → Miner 1

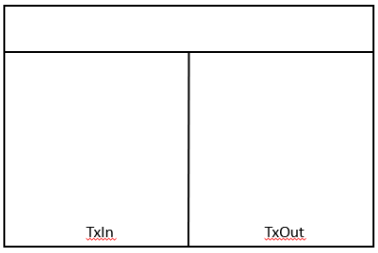
Tx #1	
TxIn: #0[0]	TxOut: 3,0 → Bob 1,0 → Carol 5,0 → Alice 3,5 → Miner 1

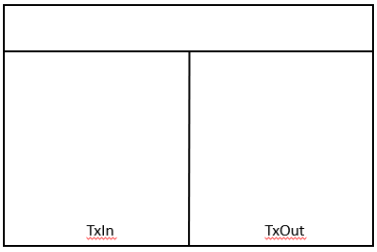
Tx #2	
TxIn	TxOut: 12,5 → Miner 2

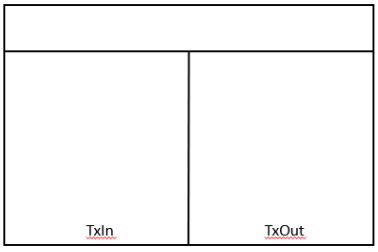
Tx #3	
TxIn: #2[0]	TxOut: 3,0 → Alice 2,0 → Bob 7,5 → Miner 2

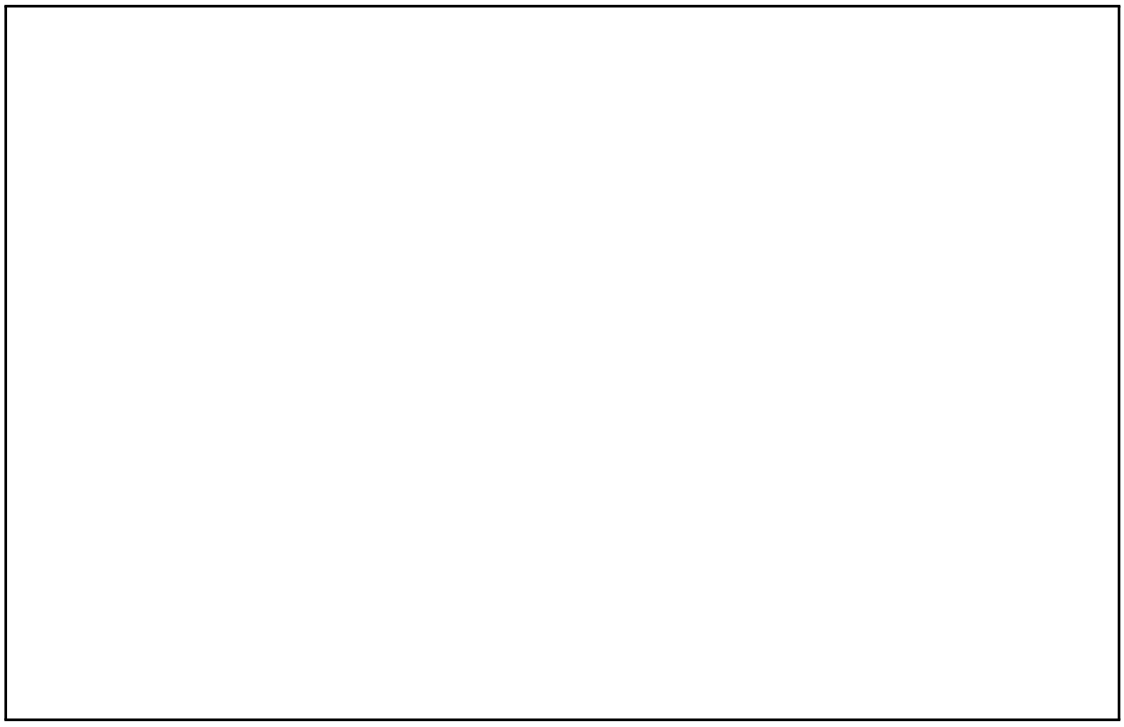
Alice now wants to make two payments. She wants to transfer Carol 6,0 BTC and Bob 0,5 BTC. Draw the necessary transactions for Alice using the notation of diagram above.











3. Bitcoin clients and exchanges provide "block explorers" that allow users to search transactions, blocks, addresses, and other relevant blockchain network information. One of the well-known Bitcoin block explorers is `https://blockchair.com/bitcoin/`.

   Visit the block explorer and find the following information for the Bitcoin blockchain:

   (a) What is the current hash rate?

   (b) What was the all time peak value of unconfirmed transactions and when has it occurred? You might also take a look here: `https://www.blockchain.com/explorer`

   (c) There is no objectively correct number to the previous question. Explain why.

   (d) Find the transaction *a1075db55d416d3ca199f55b6084e2115b9345e16c5cf302fc80e9d5fbf5d48d*. Fill the following information:

      i. Block of the transaction:

      ii. Sender and the receiver:

iii. The value of the transaction:

iv. What is particular about this transaction?