

Code -

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import hashlib

class Node:
    def __init__(self, hash_value, value=None, left=None, right=None):
        self.hash_value = hash_value
        self.value = value
        self.left = left
        self.right = right

def create_merkle_tree(hashes, values):
    if len(hashes) == 1:
        return Node(hashes[0], values[0])
    else:
        return Node(hashlib.sha256("".join(hashes).encode()).hexdigest(), values,
                    create_merkle_tree(hashes[:len(hashes)//2], values[:len(values)//2]),
                    create_merkle_tree(hashes[len(hashes)//2:], values[len(values)//2:]))

def print_merkle_tree(tree):
    if tree.left:
        print_merkle_tree(tree.left)
    if tree.right:
        print_merkle_tree(tree.right)
    print("Hash value:", tree.hash_value, "Transactions:", tree.value)

number_of_transactions = int(input("Enter the number of transactions: "))

transactions = []
hashes = []

for i in range(number_of_transactions):
    transaction = input("Enter the transaction: ")
    transactions.append(transaction)
    hashes.append(hashlib.sha256(transaction.encode()).hexdigest())

if len(transactions) % 2 != 0:
    transactions.append(transactions[-1])
    hashes.append(hashes[-1])

merkle_tree = create_merkle_tree(hashes, transactions)

print_merkle_tree(merkle_tree)
```

Output -

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PS E:\Mikil\BE\Sem 8\Labs\Blockchain Lab\Lab 1> python -u "e:\Mikil\BE\Sem 8\Labs\Blockchain Lab\Lab 1\merkle_tree.py"
Enter the number of transactions: 5
Enter the transaction: Alice gave Rs. 200 to Bob
Enter the transaction: Bob gave Rs. 500 to Dave
Enter the transaction: Dave gave Rs. 100 to Eve
Enter the transaction: Eve gave Rs. 300 to Alice
Enter the transaction: Roo gave Rs. 50 to Bob
Hash value: a12ffcfbf500ee9e089bfe6996c324d513931bf8980315c1bb0d409218158fc0 Transactions: Alice gave Rs. 200 to Bob
Hash value: 35e47f1ecec97e51624c1277debb379603001c17c9b201ac72195af9dd52bf7e Transactions: Bob gave Rs. 500 to Dave
Hash value: d9dc48e2d8d6fffd54e0407a8577f14bd8dfd82026f1934f7ad9605e9ed3e323 Transactions: Dave gave Rs. 100 to Eve
Hash value: 0ce113da1b296c5a985562bdb38b68b8061b784b47f260c4dab82d5a5675abb4 Transactions: ['Bob gave Rs. 500 to Dave', 'Dave gave Rs. 100 to Eve']
Hash value: c2cc07fdc8b5faf855bb5b9f492b57901aa0e33ec44a1a3d4aac027fc23b67be Transactions: ['Alice gave Rs. 200 to Bob', 'Bob gave Rs. 500 to Dave', 'Dave gave Rs
. 100 to Eve']
Hash value: c3389c1ae52386e2352cee571212303c49e6c9aaee51ec3d6841dfa5ad9b9e71 Transactions: Eve gave Rs. 300 to Alice
Hash value: 9d02109ff442ce155d149151486cb58f77d373551a388ca71c8b20a7f12b21d0 Transactions: Roo gave Rs. 50 to Bob
Hash value: 9d02109ff442ce155d149151486cb58f77d373551a388ca71c8b20a7f12b21d0 Transactions: Roo gave Rs. 50 to Bob
Hash value: decfcec6c69cacb08f674f75177eae8d1912aef34728c4f8070c2cfa770bebbba Transactions: ['Roo gave Rs. 50 to Bob', 'Roo gave Rs. 50 to Bob']
Hash value: 9729e900c8c6ee1422a45f000fd3fc51a8c76b1f314cedf7010eb81bda0ef315 Transactions: ['Eve gave Rs. 300 to Alice', 'Roo gave Rs. 50 to Bob', 'Roo gave Rs. 5
0 to Bob']
Hash value: 3e057c760a984a3190ba83e456d2e4e98f5267da2bea85814474efd1268925fc Transactions: ['Alice gave Rs. 200 to Bob', 'Bob gave Rs. 500 to Dave', 'Dave gave Rs
. 100 to Eve', 'Eve gave Rs. 300 to Alice', 'Roo gave Rs. 50 to Bob', 'Roo gave Rs. 50 to Bob']
PS E:\Mikil\BE\Sem 8\Labs\Blockchain Lab\Lab 1>
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