ECE 8930: Blockchain Technology and Web 3.0

Project 2

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Q How to run the code -
Make sure python3 is installed on the computer.
Then run the following command -

```
python3 casper.py
```

Q About the code and its output

Below code creates the validator data structure so that we can store ids and votes. It also hard codes the 10 rounds for the Casper FFG consensus and also determines the stake deposit each validator will have.

```
class Validator:
    def __init__(self, id, deposit):
        self.id = id
        self.deposit = deposit
    def cast_vote(self, cur_n):
        return cur_n * 2 + 1 if random.random() < 0.5 else cur_n * 2 + 2



#as defined in the assignment.
rounds = 10

#creating all the validators given to us.
deposits = [500, 100, 300, 250, 150, 500, 600, 350, 200, 150]
validators = [Validator(idx, deposit) for idx, deposit in enumerate(deposits)]

#Calculating total stake to calculate who has majority.
total_deposit = sum(v.deposit for v in validators)
```

The following code creates the checkpoint tree.

```
tree = {i: [] for i in range(2 ** (rounds + 1) - 1)}
blockchain = []
finalized_validators = {}

for round in range(rounds):
    votes = {}

    for valids in validators:
        vote = valids.cast_vote(round)
        votes[vote] = votes.get(vote, 0) + valids.deposit
        if vote in tree:
            tree[vote].append(valids.id)
```

Following code prints the blockchain thus formed and supermajority links their respective validator IDs.

```
print("\n")
print(" .PRINTING THE SUPERMAJORITY LINKS, THEIR VALIDATORS AND THE BLOCKCHAIN THUS FORMED.")
print("-------- \n")

for checkpoint in blockchain:
    validator_ids = finalized_validators[checkpoint]
    print(f"Validators IDs who all finalized checkpoint {checkpoint} are : {validator_ids}\n")
    print("-------- \n")

print("Blockchain thus formed by the 10 supermajority links: ")
print(">>>>>>",blockchain,"<<<<<<<")
print("=======================================================")
```

—---------- OUTPUT —----------

Running the casper algorithm.

```
C:\Users\Necro\Desktop>python3 casper.py
```

Following shows outputs of the code run three times.

1)

```
 .PRINTING THE SUPERMAJORITY LINKS, THEIR VALIDATORS AND THE BLOCKCHAIN THUS FORMED.
--------

Validators IDs who all finalized checkpoint 2 are : [0, 3, 4, 6, 8]

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Validators IDs who all finalized checkpoint 3 are : [0, 1, 2, 3, 4, 5, 6]

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Validators IDs who all finalized checkpoint 5 are : [0, 2, 3, 5, 6, 7, 8]

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Validators IDs who all finalized checkpoint 7 are : [0, 1, 2, 3, 7, 8, 9]

--------

Validators IDs who all finalized checkpoint 9 are : [0, 4, 5, 6, 8]

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Validators IDs who all finalized checkpoint 12 are : [0, 1, 2, 4, 6, 8]

--------

Validators IDs who all finalized checkpoint 13 are : [0, 1, 2, 4, 7, 9]

--------

Validators IDs who all finalized checkpoint 16 are : [0, 2, 3, 5, 7, 8, 9]

--------

Validators IDs who all finalized checkpoint 18 are : [0, 3, 5, 6, 7]

--------

Validators IDs who all finalized checkpoint 19 are : [0, 5, 6, 7, 8, 9]

--------

Blockchain thus formed by the 10 supermajority links:
>>>>>> [2, 3, 5, 7, 9, 12, 13, 16, 18, 19] <<<<<<<
```

2)

```
 .PRINTING THE SUPERMAJORITY LINKS, THEIR VALIDATORS AND THE BLOCKCHAIN THUS FORMED.
--------

Validators IDs who all finalized checkpoint 2 are : [0, 1, 2, 5, 7]

--------

Validators IDs who all finalized checkpoint 3 are : [3, 5, 6, 7, 9]

--------

Validators IDs who all finalized checkpoint 5 are : [1, 2, 3, 5, 7, 8, 9]

--------

Validators IDs who all finalized checkpoint 8 are : [3, 4, 5, 6, 7, 9]

--------

Validators IDs who all finalized checkpoint 10 are : [0, 1, 4, 5, 7, 8, 9]

--------

Validators IDs who all finalized checkpoint 12 are : [0, 1, 2, 5, 9]

--------

Validators IDs who all finalized checkpoint 13 are : [0, 2, 3, 4, 5, 6]

--------

Validators IDs who all finalized checkpoint 15 are : [0, 2, 3, 4, 5, 9]

--------

Validators IDs who all finalized checkpoint 18 are : [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]

--------

Validators IDs who all finalized checkpoint 20 are : [0, 1, 3, 5, 7, 9]

--------

Blockchain thus formed by the 10 supermajority links:
>>>>>> [2, 3, 5, 8, 10, 12, 13, 15, 18, 20] <<<<<<<
```

3)

```
 .PRINTING THE SUPERMAJORITY LINKS, THEIR VALIDATORS AND THE BLOCKCHAIN THUS FORMED.
--------

Validators IDs who all finalized checkpoint 2 are : [3, 5, 6, 7, 8, 9]

--------

Validators IDs who all finalized checkpoint 4 are : [0, 2, 3, 5, 9]

--------

Validators IDs who all finalized checkpoint 5 are : [0, 2, 5, 6, 7]

--------

Validators IDs who all finalized checkpoint 7 are : [1, 3, 4, 6, 7, 8]

--------

Validators IDs who all finalized checkpoint 9 are : [0, 2, 5, 6, 7, 9]

--------

Validators IDs who all finalized checkpoint 11 are : [0, 1, 2, 5, 9]

--------

Validators IDs who all finalized checkpoint 14 are : [3, 4, 6, 7, 8, 9]

--------

Validators IDs who all finalized checkpoint 16 are : [0, 3, 5, 7]

--------

Validators IDs who all finalized checkpoint 17 are : [0, 1, 2, 3, 5, 7, 9]

--------

Validators IDs who all finalized checkpoint 19 are : [0, 1, 3, 6, 8, 9]

--------

Blockchain thus formed by the 10 supermajority links:
>>>>>> [2, 4, 5, 7, 9, 11, 14, 16, 17, 19] <<<<<<<
```