DISTRIBUTED OPERATING SYSTEM PRINCIPLES
PROJECT 1

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Compilation and Execution:

1. Extract the zip file.
2. cd to project1 directory.
3. Open the `erl` shell in this directory with `-name` and `-setcookie` CLI options.
    a. Eg Server: erl -name server@ipaddress -setcookie cookie_name
    b. Eg Client: erl -name worker@ipaddress -setcookie cookie_name
4. Compile the code files:
    a. c(miner).
    b. c(miner_server).
    c. c(miner_supervisor).
5. On the Server Machine, start the server with
    a. `miner_server:startServer(requiredNumberofZeroes)
6. On the Client/Worker Machine, start a worker with
    a. miner_supervisor:start('server@ipaddress',workerProcessCount)

Implementation:

We have implemented an Actor Model using erlang to mine bitcoins with the desired number of leading zeroes.

- Miner: Generates and finds bitcoins with the given input of zeroes.
- Miner_server: receives the input of a required number of zeroes, workers utilised.
- Miner_supervisor: Spawns actors and establishes a connection with the main server.

Work Unit:

Each worker receives 1 work unit size with one sub-problem of generating random strings of the desired length which will be used in generating SHA256 hashed strings and finding coins. The worker gets reassigned with an incremented value whenever a new worker is spawned allowing unique strings generation and that no two workers are hashing the same string.

For Input 4:

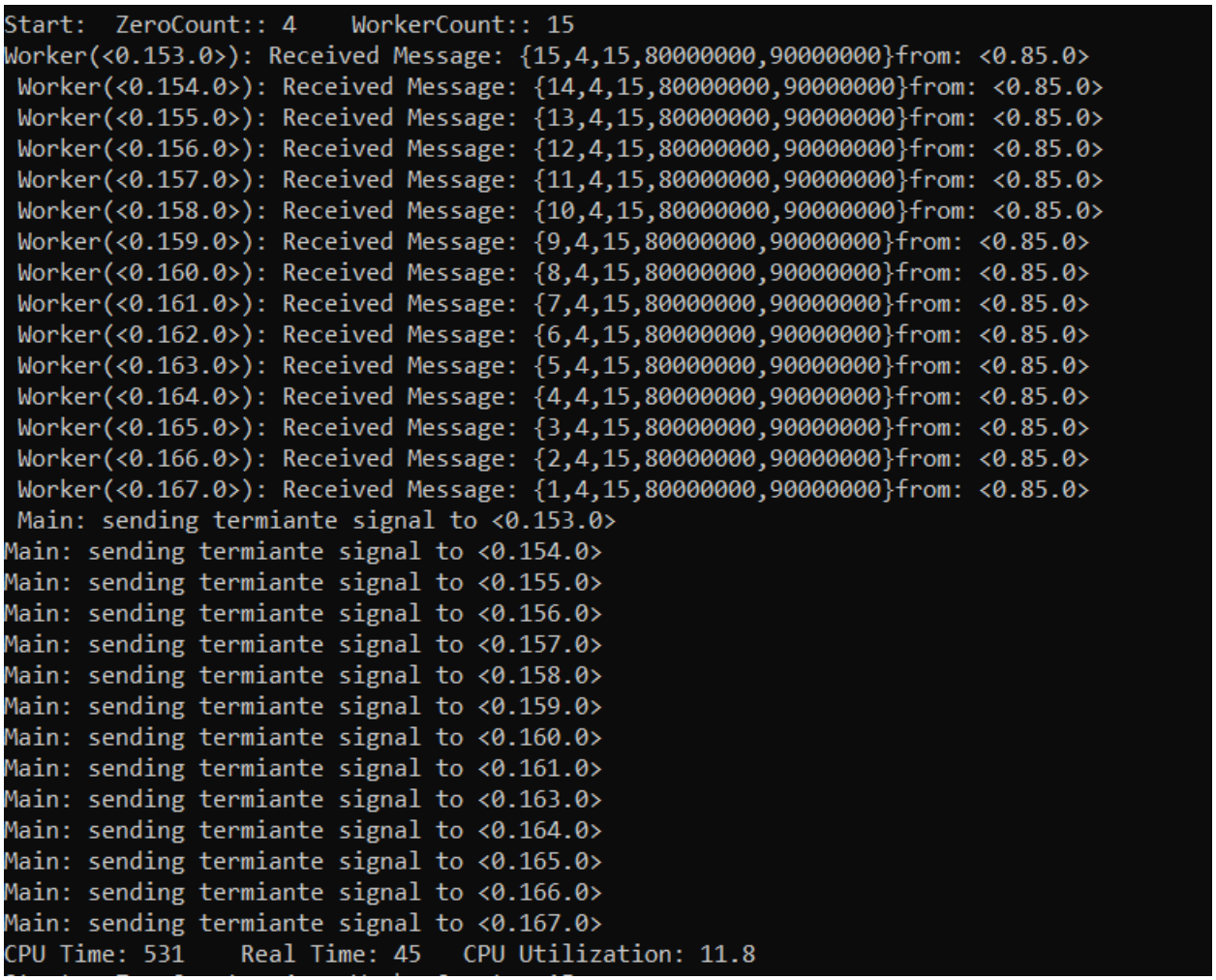
```
D:\Assignments_UF\Fall 2022\DOSP\project1_bitcoin\COP5615-DOSP-Project\project1>erl -name server@
192.168.0.118 -setcookie jayavidhi
Eshell V13.0.4  (abort with ^G)
(server@192.168.0.118)1> c(miner).
{ok,miner}
(server@192.168.0.118)2> c(miner_supervisor).
{ok,miner_supervisor}
(server@192.168.0.118)3> c(miner_server).
{ok,miner_server}
(server@192.168.0.118)4> miner_server:startServer(4).
"aditya.subramani;8G4 : 0000bbdded861577a88c3e3cb5c2678135fed5e9883adcc643051cf80a84b73e"
"aditya.subramani;1cz1W : 0000baec9cd82bd29b3cbdcdf2c9a23cd2d8559fb04cb436c2e17d0c637be1ca"
"aditya.subramani;2p0Di : 00004a25dfd68b0cc35f56b7ffedb0a773c72df0f13a06ae2bc36df0f1c1c791"
"aditya.subramani;3AYrL : 000051e26b2c4b2d2ae9062847acc98d90520e2b201f1493ec1f7fae66f27014"
"aditya.subramani;4NjdL : 00008b194d6418d9397b40cb043d69530148ce701b9578f2261e059a8c010ae1"
"aditya.subramani;5ZM18 : 00004889040d122cd43a82d5c6bd4bd4f999e55b17be23c61ab2968278f60e31"
```

Worker Count	CPU Time	Real-Time	CPU Utilization
4	688	164	4.19
7	984	154	6.47
10	282	24	11.75
15	531	45	11.8

```
(worker@192.168.0.118)4> miner_supervisor:start('server@192.168.0.118',4)
.
Start:  ZeroCount:: 4    WorkerCount:: 4
Worker(<0.107.0>): Received Message: {4,4,4,0,10000000}from: <0.85.0>
 Worker(<0.108.0>): Received Message: {3,4,4,0,10000000}from: <0.85.0>
 Worker(<0.109.0>): Received Message: {2,4,4,0,10000000}from: <0.85.0>
 Worker(<0.110.0>): Received Message: {1,4,4,0,10000000}from: <0.85.0>
 Main: sending termiante signal to <0.108.0>
Main: sending termiante signal to <0.109.0>
Main: sending termiante signal to <0.110.0>
CPU Time: 312    Real Time: 139          CPU Utilization: 2.2446043165467624
Start:  ZeroCount:: 4    WorkerCount:: 4
Worker(<0.112.0>): Received Message: {4,4,4,20000000,30000000}from: <0.85.0>
 Worker(<0.113.0>): Received Message: {3,4,4,20000000,30000000}from: <0.85.0>
 Worker(<0.114.0>): Received Message: {2,4,4,20000000,30000000}from: <0.85.0>
 Worker(<0.115.0>): Received Message: {1,4,4,20000000,30000000}from: <0.85.0>
 Main: sending termiante signal to <0.112.0>
Main: sending termiante signal to <0.113.0>
Main: sending termiante signal to <0.115.0>
CPU Time: 688    Real Time: 164          CPU Utilization: 4.195121951219512
```

```
Start:  ZeroCount:: 4    WorkerCount:: 7
Worker(<0.107.0>): Received Message: {7,4,7,40000000,50000000}from: <0.85.0>
 Worker(<0.108.0>): Received Message: {6,4,7,40000000,50000000}from: <0.85.0>
 Worker(<0.109.0>): Received Message: {5,4,7,40000000,50000000}from: <0.85.0>
 Worker(<0.110.0>): Received Message: {4,4,7,40000000,50000000}from: <0.85.0>
 Worker(<0.111.0>): Received Message: {3,4,7,40000000,50000000}from: <0.85.0>
 Worker(<0.112.0>): Received Message: {2,4,7,40000000,50000000}from: <0.85.0>
 Worker(<0.113.0>): Received Message: {1,4,7,40000000,50000000}from: <0.85.0>
 Main: sending termiante signal to <0.107.0>
Main: sending termiante signal to <0.108.0>
Main: sending termiante signal to <0.109.0>
Main: sending termiante signal to <0.110.0>
Main: sending termiante signal to <0.111.0>
Main: sending termiante signal to <0.113.0>
CPU Time: 984    Real Time: 152          CPU Utilization: 6.473684210526316
```

```
Start:  ZeroCount:: 4    WorkerCount:: 10
Worker(<0.123.0>): Received Message: {10,4,10,60000000,70000000}from: <0.85.0>
 Worker(<0.124.0>): Received Message: {9,4,10,60000000,70000000}from: <0.85.0>
 Worker(<0.125.0>): Received Message: {8,4,10,60000000,70000000}from: <0.85.0>
 Worker(<0.126.0>): Received Message: {7,4,10,60000000,70000000}from: <0.85.0>
 Worker(<0.127.0>): Received Message: {6,4,10,60000000,70000000}from: <0.85.0>
 Worker(<0.128.0>): Received Message: {5,4,10,60000000,70000000}from: <0.85.0>
 Worker(<0.129.0>): Received Message: {4,4,10,60000000,70000000}from: <0.85.0>
 Worker(<0.130.0>): Received Message: {3,4,10,60000000,70000000}from: <0.85.0>
 Worker(<0.131.0>): Received Message: {2,4,10,60000000,70000000}from: <0.85.0>
 Worker(<0.132.0>): Received Message: {1,4,10,60000000,70000000}from: <0.85.0>
 Main: sending termiante signal to <0.123.0>
Main: sending termiante signal to <0.124.0>
Main: sending termiante signal to <0.125.0>
Main: sending termiante signal to <0.127.0>
Main: sending termiante signal to <0.128.0>
Main: sending termiante signal to <0.129.0>
Main: sending termiante signal to <0.130.0>
Main: sending termiante signal to <0.131.0>
Main: sending termiante signal to <0.132.0>
CPU Time: 282    Real Time: 24   CPU Utilization: 11.75
```



Coin with most 0s
Number of zeroes: 7
Coin: "aditya.subramani;9lGZF :
0000000fcd87c4b49079781f49625b89dbaf97826dec4d06b674883a86ad79cd"

The largest number of working machines used to run code: 2 (Windows 11 and macOS)