README FOR COP5615 PROJECT 1

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To compile and run the code:

- To find the IP address of the system: ipconfig getifaddr en0
- Our module name is bitcoinmining
- Compilation: erl -name nikhil@192.168.0.115
- Compiling the module using the erl: c(bitcoinmining).
- Starting the server: bitcoinmining:initiate_server().
- Enter the input number of zeros: 4.
- For generating the coins: bitcoinmining:calculate_hash('nikhil@192.168.0.115',5).
- We get the statistics of CPU time, Real Time and Parallelism Ratio.

REQUIREMENTS TO BE INCLUDED:

1. Size of the work unit that you determined results in the best performance for your implementation and an explanation of how you determined it. The size of the work unit refers to the number of sub-problems that a worker gets in a single request from the boss.

In our program, the worker receives a mining request with a maximum quantity of coins to be mined. We spawn atmost 7 worker processes per node to mine bitcoins. We also monitor each worker process and restart it if it fails to guarantee that all worker processes remain operational.

2. The result of running the program and running time, CPU time and parallelism ratio for input 4.

   Our best output for input 4: We achieved the parallelism ratio of 3.54

```
(nikhil@192.168.0.115)1> c(mining).
{ok,mining}
(nikhil@192.168.0.115)2> mining:start_server().
Enter a number: 4.
Entered No.of leading zeroes : 4
{50964,50964}
(nikhil@192.168.0.115)3> mining:calc('nikhil@192.168.0.115',5).
Creating Worker
true
Got Coin
B : 1Coin : Hash ---> "nikhilkumarsingh;+w)RRpaeIPJWOHtoLL^u1Qd7qC5+vj2u(5G7+CsJrL9bfDu-waX!ej)FcLj9e$wn(x4qS5Y&k_v_kszdibPd8N#=o3pxwlkN+QC;WjXRQLO+-A%EHZrL-c8hH077@aH3CorDsi5sZd+6c_f&r;9NY$rnG-kzSijsQ7jhjn)7;&(ti69eZkY@Ef=!8DJiiHg+5wK2kjzEMz$9X;wY@D5Dh_c8CdCpPVu%4eiYD-NK4agtpI)%1mXf;3krAnA_Lnqxy2G8P7ALTDKXFkeEEclCHOv+7%sQ5nMj6N0duxIBcnc3f&pNhI2DBgV&9Ga$CA$%1S#6kQ;fBkuttM#1HkmtxpLP8Cfjwltomhqn(qB@E%Xb--=nsAU1sA1!n2R_L_zlkYaitdnhZ7HS!V1LBZ$fsYr9Dy_N)hWnRW3d8m#xmrwG1ZT@ntMSIr!ns9vY5wBogV)e5&BGgkJfCGzP!fL5AvbBUJ^LS8v#&2C^_lM+h!yNIKVx_Q7E"  :  "000032f519942453b16e642dcb180d10b52a0dd79718d8132280cbff18ebede4"
Got Coin
B : 2Coin : Hash ---> "nikhilkumarsingh;^fWHCK4=D(skDuoP4dqB&qG$dr6T@2SHJZPb39qw-os8z-iC!;1RxL&x$pTg(6XpGaKv2hozjAW&4Ulj41!aZV+SmsVi^Cn+kHd+!DxTA7edp+@_$HiiE6dw$jfhtPp)7QG$pFP_)qL3*gq4r7C@p%R(n0%Jju;a!w%Qlp)06oX-X6zkbMsR!6cg5$!wS7-Es0mBew9X7L^d@L*Lur*y5bQMB&48Wc6SoXgDjXdcQca_WJX3u#BMAIe=$ZZ@TXwt99z5^P2p%ru!bK3MtGaJ+u(IjdpX;eC;oM6uAGVzNQ5fSx^CBAPe=g_F8l3ZOu=%h1-FGk8%v8ob7@B4JU==*P&jZfsi27LlEV*leOMW&56AVLWg@(7lMbw5SihC3ZEHXCFQf_quKsS@xHb8MZjz!pY4E;#&jvSZKXJ8&&ASeEj#TeAL)vl8a#;4Y(4^)y$TT81-ISzd+8VXsWH6DNRpD#0jWJ0-MiQ%@&E=4nB*Lcmq9oexi+qo"  :  "00004da28ce88d035df74d80301ba88937ad8aad1b6eddc4c7c94c33ac4d8a76"
Got Coin
B : 3Coin : Hash ---> "nikhilkumarsingh;S6GR7*6#DRjd2x*cXSI3xt6au=WW+Yc!KCx;qEK#Yoa($*6ba1HnoRu^4mIpBk)A_vlhe6gn4Z*MWDZ5wQ!w5tgU15^khU+-r944rl;89s7Xtf=MwNi5MRizInX%P1AdYA$zZ1*0(oDd9aID9AYE8ROiQlfM;j&VnTTxSA$O1eFxLeWtaXVN3d*pbPuQFMMw+j6vhOyroh7kJ&di3Aj;jhe1isoLvhbgcm*ZiV8%N2=Jq8Bmc;K$BMJ=!WdF+)4ZD07*gJ!q72X$wqTnxg_(!H+u088iuywYj;wE_9xHI)+X)uEV2EZqk!F@$00vvc4aO-SJO(vAdiP3zl-U0M9A$!CwXc_w+Q2=jv@Hz0QDOfbrK308r!2z*yvwxnBDS;6*vM#e0vv)icMyLA=Na3fSt6-&S-HRDmKn7iUWYlwG(T=BMDo%taEvfN%MEAOtAUVSBsc*cVB$DDdXpBkWRaLv6gq=l^tgN#ft+T$m61*UcSVi%(66#r39"  :  "000020b250c488f863f0f976d16ed54d7621bdd9bf60043725d9e4ff5065dd01"
Got Coin
B : 4Coin : Hash ---> "nikhilkumarsingh;1C!h6^Q0vD1NUqbz=Qe$$xsn;tVV66CY&$d9%xslar(6FjU*SuY!bZW7rHie8CcP*SDqA998-N0mk1tONAl35i^EGaG#xtZ75odi($oEE6GZ0NgfmQLz=G2pTBoWHyGBtC;z_$#Fp!2Ub!@!&NLA#=MzQA9NMtIxlI2Z=jBn%R^Y6bkT_V*BW@@$yBi06y8+xQ;V&wwd8;TFZkuJ4C+_ZyWLIIiH@)U3N#0D9U^aG8T-zm3LI3SfCEQ+IkHjRiKnF$yv^XCbou2gj8IT#Yc0B!Mm7%SGTq1oYTCHp#;&(Bc@5(*xo#pw^w-06(fx#!5++@Kb1t1_RqA%B*NhAyjY2Lt+pzzSd%p$mIYCIHu;%eNKr%x$d^rdV-pQSf&Sbh(7M+Cv#ey1wRGeOdxJZ-mgVBX$-JS+mGd6qpW@!OtCS6%vX^mySP%^3+9^I;G_+p(;xmg;@+X!GfpHnZT7T=zR=mdoSKFOsG)%N#lpsz6#$j<u%*7FBQ4^"  :  "00008392b4e7c1e1694781dd5e135aafe8102be53da9d216b3f1dfb53e2d265b"
Got Coin
B : 5Coin : Hash ---> "nikhilkumarsingh;^k@e*0#pg=4nER^Vv4xZWTXkJU8PrVFBI!1B(WkVhVREa1@ewZBb0wyvhGbRH0iu^iNB6W^YDmtTZXQo%Y;0%mXpmfr^n84zuEBXp2VYqo=Hl1pF0-41vRH#iDms+jAT)KOSTWGED2!%-sN^)k9%;cwAbYFq$g@cnEEAr9C3EB6QSL4DgV_KjuCcinx!33d4ZSJ8BStK9nBL%zcL4%otuPsdJc80*x2)DA-Qs@bFK_%p8WrNTE7slM$QuuZm)!PaXuT^yCoq4R2Yx;&cm6=RNSAlXVmDPe;uf1ttV6kUHq2XIRIXEzfVwQXST=pBq^Z)^j^LX1Jp1z7W%4+Xmq!**SRO!wrPiJKeEO$dy2LSSoXvIGW&SgDaD=f#oYCy*T)lSMvSvDL--Hiz4K*$2+)Un9Nl_wK&*_cKjq(LgAaG$-=A@Thne%$5CS3CKHEbq7eQzMt%7BfzuwD0&VV%L_NNx#pEVlch&xw+^VanjHK!NttSkx(!C6(J"  :  "0000e2b47158f3794d30add28141dc7d0ab25abae7649bf0739688c6b9dbcdf5"
CPU TIME : 45441
 REAL TIME : 12833
 RATIO :3.540949115561443
```

Our recent output for input 4

```
nikhilkumarsingh@Nikhils-MacBook-Air Desktop % erl -name nikhil@192.168.0.115
Erlang/OTP 25 [erts-13.0.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:1] [jit] [dtrace]

Eshell V13.0.4  (abort with ^G)
(nikhil@192.168.0.115)1> c(bitcoinmining).
{ok,bitcoinmining}
(nikhil@192.168.0.115)2> bitcoinmining:initiate_server().
Input number of leading zeroes: 4.
Entered No.of leading zeroes : 4
{38880,38880}
(nikhil@192.168.0.115)3> bitcoinmining:calculate_hash('nikhil@192.168.0.115',5).
Creating Worker Nodes
true
Mined a Coin
Bitcoin : 1Coin : Hash Value ---> "nikhilkumarsinghmaTDaEwh1Fbzb)D=bv#P"  :  "0000b964e1b3a5befabb9371b0b1fb073afea8e801ebd07680cc2134d460347"
Mined a Coin
Bitcoin : 2Coin : Hash Value ---> "nikhilkumarsinghrB==J*p0Gcl5_2#II!a9"  :  "0000826a861c88b03598bb61e02733af6c63f138121f72f012a359fd6b4a909e"
Mined a Coin
Bitcoin : 3Coin : Hash Value ---> "nikhilkumarsinghFSoSbURlJ6s)Yw;aQzm$"  :  "00002acda8fe53090471ca2a13ea46197f137686315d1d22a38a22975c5a7a52"
Mined a Coin
Bitcoin : 4Coin : Hash Value ---> "nikhilkumarsinghm_y0CjXZd)xQ_H6%qT)x"  :  "0000dc294a8a359fb057adbf2635429e4da9910ae643d0a7aa04bba7e00e5360"
Mined a Coin
Bitcoin : 5Coin : Hash Value ---> "nikhilkumarsinghlH647;JM&#cd@_iY=oYz"  :  "0000637df53fcc53306753b9b369ec7d4b599592ee16ed8c2733e3416aa02ed8"
CPU TIME : 1722
 REAL TIME : 606
 PARALLELISM  RATIO :2.8415841584158414
```

3. **The coin with the most 0s we managed to find is 7.**

4. The largest number of working machines we were able to run our code with is 7.

CONCLUSION:

In this project we used erlang to achieve concurrency(AKKA Model) and perform bitcoin mining by spawning worker clients and running them on multiple codes achieving parallelism. We observed that our system can handle at the most 7 working machines thus generating coins with 7 preceding zeros. We defined worker actors as workers and the boss actor as server. Thus implementing all the requirements for this project.