(base) billy@Kawarjeets-Air assginment1 % for f in nbody_*.py; do python -m cProfile -s cumulative $f; done
-0.16908926275527025
-0.16905240492390494
-0.1690147440452967
-0.16902307738080996
-0.16907985939167475
-0.16908378513403594
-0.16904612370294356
-0.1690141632287565
-0.169027786059668
-0.16908371256962812
-0.16908078067626844
-0.16904474158016541
-0.16901196403206928
-0.16903317301080156
-0.1690878399948368
-0.16908019793584073
-0.16904027123721807
-0.16900666759843433
-0.16903859940008237
-0.1690927820263301
-0.16907709741615898
-0.1690318157474176
-0.16900365578741586
-0.16904872400309137
-0.16909656666615996
-0.16907120739396314
-0.16902491372611023
-0.16900540285625235
-0.16906150844187284
-0.16909732952327508
-0.16906445026910183
-0.16901977601920565
-0.16900878373304162
-0.169069429960914
-0.16909369812504424
-0.1690577655084966
-0.16901607122930815
-0.16901202092860457
-0.16907695909884457
-0.16909176966912898
-0.16905402040530781
-0.16901235909922357
-0.16901736033371176
-0.16908474596855333

-0.16909035534671 79
-0.1690483845287476
-0.169006630340714
-0.1690233536742349
-0.1690912414950933
-0.16908618459853578
-0.1690401551753759
-0.16900291923549599
-0.16903287494401295
-0.16909558331068023
-0.16908055117112683
-0.16903390308611693
-0.16900274590717324
-0.169044593002153
-0.16909854774648347
-0.169074996973905
-0.16902883385611475
-0.16900287426059443
-0.1690534499390132
-0.16909778695823155
-0.16906885423546958
-0.16902288517126238
-0.16900341116390946
-0.1690632320282464
-0.16909793327529532
-0.16906372791447294
-0.16901758963649074
-0.16900762655228374
-0.16907413362658358
-0.1690966701275339
-0.16905715253829579
-0.16901176533640827
-0.1690131654189057
-0.16908223578131068
-0.1690918842 8377536
-0.1690491567288394
-0.1690084483624549
-0.1690205713597522
-0.16908716660203624
-0.16908658831402987
-0.16904412116919318
-0.1690074067381597
-0.1690293205067914
-0.1690918027627932
-0.16908292959391336
-0.16903991544245178

-0.1690052254059413
-0.16903656773671472
-0.1690941031888828
-0.16907846621158512
-0.16903274720857253
-0.16900284987914624
-0.1690462807512239
-0.16909717678662617
-0.16907293588676073
-0.1690262858527701
        34003806 function calls in 27.246 seconds

   Ordered by: cumulative time

   ncalls tottime percall cumtime percall filename:lineno(function)
       1   0.000   0.000   27.246   27.246 {built-in method builtins.exec}
       1   0.000   0.000   27.246   27.246 nbody_1.py:1(<module>)
       1   0.001   0.001   27.246   27.246 nbody_1.py:145(nbody)
     100   25.779   0.258   27.241   0.272 nbody_1.py:73(advance)
 20002000   0.856   0.000   0.856   0.000 {method 'append' of 'list' objects}
 14001401   0.606   0.000   0.606   0.000 {method 'keys' of 'dict' objects}
     100   0.003   0.000   0.003   0.000 {built-in method builtins.print}
     200   0.002   0.000   0.002   0.000 nbody_1.py:108(report_energy)
       1   0.000   0.000   0.000   0.000 {method 'disable' of '_lsprof.Profiler' objects}
       1   0.000   0.000   0.000   0.000 nbody_1.py:128(offset_momentum)

-0.16908926275527025
-0.16905240492390494
-0.1690147440452967
-0.16902307738080996
-0.16907985939167475
-0.16908378513403594
-0.16904612370294356
-0.1690141632287565 6
-0.169027786059668
-0.16908371256962812
-0.16908078067626844
-0.16904474158016541
-0.16901196403206928
-0.1690331730108015 6
-0.1690878399948368
-0.16908019793584073
-0.16904027123721807
-0.16900666759843433
-0.16903859940008237

-0.1690927820263301
-0.16907709741615898
-0.1690318157474176
-0.16900365578741586
-0.16904872400309137
-0.169096566666615996
-0.16907120739396314
-0.16902491372611023
-0.16900540285625235
-0.16906150844187284
-0.16909732952327508
-0.16906445026910183
-0.16901977601920565
-0.16900878373304162
-0.169069429960914
-0.16909369812504424
-0.1690577655084966
-0.16901607122930815
-0.16901202092860457
-0.16907695909884457
-0.169091769966912898
-0.16905402040530781
-0.16901235909922357
-0.16901736033371176
-0.16908474596855333
-0.1690903553467179
-0.1690483845287476
-0.169006630340714
-0.1690233536742349
-0.1690912414950933
-0.16908618459853578
-0.1690401551753759
-0.16900291923549599
-0.16903287494401295
-0.16909558331068023
-0.16908055117112683
-0.16903390308611693
-0.16900274590717324
-0.169044593002153
-0.16909854774648347
-0.169074996973905
-0.16902883385611475
-0.16900287426059443
-0.1690534499390132
-0.16909778695823155
-0.16906885423546958

-0.16902288517126238
-0.16900341116390946
-0.1690632320282464
-0.16909793327529532
-0.16906372791447294
-0.16901758963649074
-0.16900762655228374
-0.16907413362658358
-0.1690966701275339
-0.16905715253829579
-0.16901176533640827
-0.1690131654189057
-0.16908223578131068
-0.16909188428377536
-0.1690491567288394
-0.1690084483624549
-0.1690205713597522
-0.16908716660203624
-0.16908658831402987
-0.16904412116919318
-0.1690074067381597
-0.1690293205067914
-0.1690918027627932
-0.16908292959391336
-0.16903991544245178
-0.1690052254059413
-0.16903656773671472
-0.1690941031888828
-0.16907846621158512
-0.16903274720857253
-0.16900284987914624
-0.1690462807512239
-0.16909717678662617
-0.16907293588676073
-0.1690262858527701
        306005706 function calls in 85.806 seconds

   Ordered by: cumulative time

   ncalls tottime percall cumtime percall filename:lineno(function)
        1   0.000   0.000   85.806   85.806 {built-in method builtins.exec}
        1   0.000   0.000   85.806   85.806 nbody_2.py:1(<module>)
        1   0.392   0.392   85.806   85.806 nbody_2.py:140(nbody)
  2000000   15.514   0.000   85.407   0.000 nbody_2.py:73(advance)
 20000000   23.903   0.000   64.072   0.000 nbody_2.py:58(update_vs)
120000000   17.342   0.000   40.169   0.000 nbody_2.py:49(compute_b)

```
120000000   22.827    0.000   22.827    0.000 nbody_2.py:54(compute_mag)
 10000000    2.948    0.000    2.948    0.000 nbody_2.py:67(update_rs)
 20002000    2.148    0.000    2.148    0.000 nbody_2.py:45(compute_deltas)
 14001401    0.726    0.000    0.726    0.000 {method 'keys' of 'dict' objects}
      100    0.004    0.000    0.004    0.000 {built-in method builtins.print}
      200    0.002    0.000    0.003    0.000 nbody_2.py:99(report_energy)
     2000    0.001    0.000    0.001    0.000 nbody_2.py:95(compute_energy)
        1    0.000    0.000    0.000    0.000 {method 'disable' of '_lsprof.Profiler' objects}
        1    0.000    0.000    0.000    0.000 nbody_2.py:123(offset_momentum)


-0.16907516382852453
-0.16908926275527025
-0.16905240492391002
-0.1690147440452959
-0.16902307738081185
-0.16907985939167214
-0.16908378513403755
-0.16904612370294733
-0.16901416322876098
-0.16902778605967123
-0.169083712569635
-0.16908078067627746
-0.16904474158017657
-0.16901196403207625
-0.16903317301080778
-0.16908783999484964
-0.16908019793585233
-0.16904027123722776
-0.1690066675984445
-0.16903859940008567
-0.1690927820263384
-0.16907709741616772
-0.16903181574742296
-0.1690036557874183
-0.16904872400309232
-0.16909656666616485
-0.16907120739397202
-0.16902491372612072
-0.16900540285626364
-0.1690615084418863
-0.1690973295232972
-0.1690644502691296
-0.16901977601922624
-0.16900878373305267
-0.1690694299609174
```

```
-0.16909369812506422
-0.16905776550852438
-0.16901607122932974
-0.16901202092860937
-0.16907695909884388
-0.16909176966913952
-0.16905402040532275
-0.16901235909922738
-0.16901736033369558
-0.1690847459685495
-0.16909035534673394
-0.16904838452876864
-0.16900663034073488
-0.1690233536742402
-0.16909124149511087
-0.16908618459857175
-0.16904015517542392
-0.1690029192355396
-0.16903287494402677
-0.16909558331071223
-0.1690805511711755
-0.16903390308616925
-0.16900274590720665
-0.16904459300214983
-0.16909854774651034
-0.16907499697396128
-0.16902883385617812
-0.16900287426062074
-0.16905344993899082
-0.16909778695825453
-0.1690688542355141
-0.1690228851713111
-0.1690034111639199
-0.16906323202822052
-0.16909793327533054
-0.16906372791453023
-0.16901758963653796
-0.16900762655228221
-0.16907413362655085
-0.16909667012757365
-0.16905715253835674
-0.16901176533645315
-0.16901316541888314
-0.16908223578127982
-0.16909188428381666
-0.1690491567288939
```

-0.16900844836248805
-0.16902057135971402
-0.16908716660201437
-0.1690865883140791
-0.16904412116926257
-0.1690074067382012
-0.16902932050675912
-0.1690918027627956
-0.16908292959398183
-0.16903991544253186
-0.1690052254059898
-0.1690365677366612
-0.1690941031888847
-0.16907846621165054
-0.16903274720865358
-0.16900284987917302
-0.16904628075114922
-0.16909717678663738
-0.16907293588683348

         326003906 function calls in 90.107 seconds

   Ordered by: cumulative time

   ncalls tottime percall cumtime percall filename:lineno(function)
        1   0.000   0.000   90.107   90.107 {built-in method builtins.exec}
        1   0.000   0.000   90.107   90.107 nbody_3.py:1(<module>)
        1   0.404   0.404   90.107   90.107 nbody_3.py:95(nbody)
  2000000   18.118   0.000   89.697   0.000 nbody_3.py:34(advance)
 20000000   23.665   0.000   64.542   0.000 nbody_3.py:19(update_vs)
120000000   17.439   0.000   40.877   0.000 nbody_3.py:10(compute_b)
120000000   23.438   0.000   23.438   0.000 nbody_3.py:15(compute_mag)
 10000000   3.002   0.000   3.002   0.000 nbody_3.py:28(update_rs)
 20001000   2.235   0.000   2.235   0.000 nbody_3.py:6(compute_deltas)
 20001000   1.004   0.000   1.004   0.000 {method 'append' of 'list' objects}
 14000701   0.795   0.000   0.795   0.000 {method 'keys' of 'dict' objects}
      100   0.004   0.000   0.004   0.000 {built-in method builtins.print}
      100   0.001   0.000   0.002   0.000 nbody_3.py:57(report_energy)
     1000   0.000   0.000   0.000   0.000 nbody_3.py:53(compute_energy)
        1   0.000   0.000   0.000   0.000 {method 'disable' of '_lsprof.Profiler' objects}
        1   0.000   0.000   0.000   0.000 nbody_3.py:78(offset_momentum)

-0.16908926275527025
-0.16905240492390494
-0.1690147440452967
-0.16902307738080996

-0.16907985939167475
-0.16908378513403594
-0.16904612370294356
-0.169014163228756556
-0.169027786059668
-0.16908371256962812
-0.16908078067626844
-0.16904474158016541
-0.16901196403206928
-0.16903317301080156
-0.1690878399948368
-0.16908019793584073
-0.16904027123721807
-0.16900666759843433
-0.16903859940008237
-0.1690927820263301
-0.16907709741615898
-0.1690318157474176
-0.16900365578741586
-0.16904872400309137
-0.16909656666615996
-0.16907120739396314
-0.16902491372611023
-0.16900540285625235
-0.16906150844187284
-0.16909732952327508
-0.16906445026910183
-0.16901977601920565
-0.16900878373304162
-0.169069429960914
-0.16909369812504424
-0.1690577655084966
-0.16901607122930815
-0.16901202092860457
-0.16907695909884457
-0.16909176966912898
-0.16905402040530781
-0.16901235909922357
-0.16901736033371176
-0.16908474596855333
-0.1690903553467179
-0.1690483845287476
-0.169006630340714
-0.1690233536742349
-0.1690912414950933
-0.16908618459853578

-0.16904401551753759
-0.16900291923549599
-0.16903287494401295
-0.16909558331068023
-0.16908055117112683
-0.16903390308611693
-0.16900274590717324
-0.169044593002153
-0.16909854774648347
-0.169074996973905
-0.16902883385611475
-0.16900287426059443
-0.16905344499390132
-0.16909778695823155
-0.16906885423546958
-0.16902288517126238
-0.16900341116390946
-0.1690632320282464
-0.16909793327529532
-0.16906372791447294
-0.16901758963649074
-0.16900762655228374
-0.16907413362658358
-0.1690966701275339
-0.16905715253829579
-0.16901176533640827
-0.1690131654189057
-0.16908223578131068
-0.16909188428377536
-0.1690491567288394
-0.1690084483624549
-0.1690205713597522
-0.16908716660203624
-0.16908658831402987
-0.16904412116919318
-0.1690074067381597
-0.1690293205067914
-0.1690918027627932
-0.16908292959391336
-0.16903991544245178
-0.1690052254059413
-0.16903656773671472
-0.1690941031888828
-0.16907846621158512
-0.16903274720857253
-0.16900284987914624

-0.16904628075122239
-0.16909717678662617
-0.16907293588676073
-0.1690262858527701
        292004306 function calls in 81.169 seconds

 Ordered by: cumulative time

 ncalls tottime percall cumtime percall filename:lineno(function)
      1   0.000   0.000   81.169   81.169 {built-in method builtins.exec}
      1   0.000   0.000   81.169   81.169 nbody_4.py:1(<module>)
      1   0.356   0.356   81.169   81.169 nbody_4.py:130(nbody)
 2000000   10.106   0.000   80.808   0.000 nbody_4.py:78(advance)
 20000000   24.287   0.000   65.218   0.000 nbody_4.py:63(update_vs)
 120000000   17.448   0.000   40.931   0.000 nbody_4.py:54(compute_b)
 120000000   23.483   0.000   23.483   0.000 nbody_4.py:59(compute_mag)
 10000000   3.032   0.000   3.032   0.000 nbody_4.py:72(update_rs)
 20002000   2.452   0.000   2.452   0.000 nbody_4.py:50(compute_deltas)
    100   0.004   0.000   0.004   0.000 {built-in method builtins.print}
    200   0.001   0.000   0.002   0.000 nbody_4.py:97(report_energy)
   2000   0.001   0.000   0.001   0.000 nbody_4.py:93(compute_energy)
      1   0.000   0.000   0.000   0.000 {method 'disable' of '_lsprof.Profiler' objects}
      1   0.000   0.000   0.000   0.000 nbody_4.py:113(offset_momentum)
      1   0.000   0.000   0.000   0.000 {method 'keys' of 'dict' objects}

-0.16908926275527025
-0.16905240492391002
-0.1690147440452959
-0.16902307738081185
-0.16907985939167214
-0.16908378513403755
-0.16904612370294733
-0.16901416322876098
-0.16902778605967123
-0.169083712569635
-0.16908078067627746
-0.16904474158017657
-0.16901196403207625
-0.16903317301080778
-0.16908783999484964
-0.16908019793585233
-0.16904027123722776
-0.1690066675984445
-0.16903859940008567
-0.1690927820263384

-0.16907709741616772
-0.16903181574742296
-0.16900036557874183
-0.16904872400309232
-0.16909656666616485
-0.16907120739397202
-0.16902491372612072
-0.16900540285626364
-0.1690615084418863
-0.1690973295232972
-0.1690644502691296
-0.16901977601922624
-0.16900878373305267
-0.1690694299609174
-0.1690936981250642
-0.1690577655085243
-0.16901607122932974
-0.16901202092860937
-0.16907695909884388
-0.169091769669139527
-0.16905402040532275
-0.16901235909922738
-0.16901736033369558
-0.1690847459685495
-0.16909035534673394
-0.16904838452876864
-0.16900663034073488
-0.1690233536742402
-0.16909124149511087
-0.16908618459857175
-0.16904015517542392
-0.1690029192355396
-0.16903287494402677
-0.16909558331071223
-0.1690805511711755
-0.16903390308616925
-0.16900274590720665
-0.16904459300214983
-0.16909854774651034
-0.16907499697396128
-0.16902883385617812
-0.16900287426062074
-0.16905344993899082
-0.16909778695825453
-0.1690688542355141
-0.1690228851713111

-0.1690034111639199
-0.16906323202822052
-0.16909793327533054
-0.16906372791453023
-0.16901758963653796
-0.16900762655228221
-0.16907413362655085
-0.16909667012757365
-0.16905715253835674
-0.16901176533645315
-0.16901316541888314
-0.16908223578127982
-0.16909188428381666
-0.1690491567288939
-0.16900844836248805
-0.16902057135971402
-0.16908716660201437
-0.1690865883140791
-0.16904412116926257
-0.1690074067382012
-0.16902932050675912
-0.1690918027627956
-0.16908292959398183
-0.16903991544253186
-0.1690052254059898
-0.1690365677366612
-0.1690941031888847
-0.16907846621165054
-0.16903274720865358
-0.16900284987917302
-0.16904628075114922
-0.16909717678663738
-0.16907293588683348
-0.16902628585284388
        4000806 function calls in 19.967 seconds

   Ordered by: cumulative time

   ncalls tottime percall cumtime percall filename:lineno(function)
        1   0.000   0.000   19.967   19.967 {built-in method builtins.exec}
        1   0.000   0.000   19.967   19.967 nbody_opt.py:1(<module>)
        1   0.000   0.000   19.967   19.967 nbody_opt.py:94(nbody)
      100   19.793   0.198   19.964   0.200 nbody_opt.py:31(advance)
  4000401   0.171   0.000   0.171   0.000 {method 'keys' of 'dict' objects}
      100   0.002   0.000   0.002   0.000 {built-in method builtins.print}
      200   0.001   0.000   0.001   0.000 nbody_opt.py:61(report_energy)

```
1    0.000    0.000    0.000    0.000 {method 'disable' of '_lsprof.Profiler' objects}
1    0.000    0.000    0.000    0.000 nbody_opt.py:77(offset_momentum)
```