

SPEC CPU2017 Command Lines

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The SPEC CPU2017 Benchmark Suite, comprising of 43 benchmarks, focuses on characterizing the compute-intensive performance (CPU, memory hierarchy, and compilers) of the system under test. More information about the benchmark suite is available on SPEC’s website [link]. The benchmarks need to be executed using SPEC’s ‘runcpu’ utility for generating reportable results. However, to run the individual benchmark-input pairs using command line:

1. You need to copy the benchmark’s executable (from the / [benchmark] /exe/ directory) and input files (from the / [benchmark] /data/ [size] /input/ directory) into the working directory.
2. The executables’ names in the command lines below need to be modified to match executables’ names from your local / [benchmark] /exe/ directory.

The following command lines for each of the SPEC CPU2017 benchmarks were obtained using the ‘specinvoke -n’ command in the appropriate / [benchmark] /run/ [size] / directories. We used these commands to generate and report the SPEC CPU2017 characterization results in:

1. A. Limaye, and T. Adegbiya, “A Workload Characterization of the SPEC CPU2017 Benchmark Suite,” in *Proc. 2018 International Symposium on Performance Analysis of Systems and Software (ISPASS)*, April 2018, pp. 149-158. [link].

Integer Benchmarks		Floating Point Benchmarks	
Rate	Speed	Rate	Speed
500.perlbench_r	600.perlbench_s	503.bwaves_r	603.bwaves_s
502.gcc_r	602.gcc_s	507.cactuBSSN_r	607.cactuBSSN_s
505.mcf_r	606.mcf_s	503.namd_r	
520.omnetpp_r	620.omnetpp_s	510.parest_r	
523.xalancmbk_r	623.xalancmbk_s	511.povray_r	
525.x264_r	625.x264_s	519.lbm_r	619.lbm_s
531.deepsjeng_r	631.deepsjeng_s	521.wrf_r	621.wrf_s
541.leela_r	641.leela_s	526.blender_r	
548.exchange2_r	648.exchange2_s	527.cam4_r	627.cam4_s
557.xz_r	657.xz_s		628.pop2_s
		538.imagick_r	638.imagick_s
		544.nab_r	644.nab_s
		549.fotonik3d_r	649.fotonik3d_s
		554.roms_r	654.roms_s

SPEC CPU2017 Integer Benchmarks

500.perlbench_r / 600.perlbench_s

Test Inputs

```
1 ./perlbench -I. -I./lib makerand.pl > makerand.out 2>> makerand.err
2 ./perlbench -I. -I./lib test.pl > test.out 2>> test.err
```

Train Inputs

```
1 ./perlbench -I./lib diffmail.pl 2 550 15 24 23 100 > diffmail.2.550.15.24.23.100.out
  2>> diffmail.2.550.15.24.23.100.err
2 ./perlbench -I./lib perfect.pl b 3 > perfect.b.3.out 2>> perfect.b.3.err
3 ./perlbench -I. -I./lib scrabbl.pl < scrabbl.in > scrabbl.out 2>> scrabbl.err
4 ./perlbench -I./lib splitmail.pl 535 13 25 24 1091 1 > splitmail.535.13.25.24.1091.1.
  out 2>> splitmail.535.13.25.24.1091.1.err
5 ./perlbench -I. -I./lib suns.pl > suns.out 2>> suns.err
```

Reference Inputs

```
1 ./perlbench -I./lib checkspam.pl 2500 5 25 11 150 1 1 1 1 > checkspam
  .2500.5.25.11.150.1.1.1.1.out 2>> checkspam.2500.5.25.11.150.1.1.1.1.err
2 ./perlbench -I./lib diffmail.pl 4 800 10 17 19 300 > diffmail.4.800.10.17.19.300.out
  2>> diffmail.4.800.10.17.19.300.err
3 ./perlbench -I./lib splitmail.pl 6400 12 26 16 100 0 > splitmail.6400.12.26.16.100.0.
  out 2>> splitmail.6400.12.26.16.100.0.err
```

502.gcc_r / 602.gcc_s

Test Input

```
1 ./gcc t1.c -O3 -finline-limit=50000 -o t1.opts-O3_-finline-limit_50000.s > t1.opts-O3_-
  finline-limit_50000.out 2>> t1.opts-O3_-finline-limit_50000.err
```

Train Inputs

```
1 ./gcc 200.c -O3 -finline-limit=50000 -o 200.opts-O3_-finline-limit_50000.s > 200.opts-
  O3_-finline-limit_50000.out 2>> 200.opts-O3_-finline-limit_50000.err
2 ./gcc scilab.c -O3 -finline-limit=50000 -o scilab.opts-O3_-finline-limit_50000.s >
  scilab.opts-O3_-finline-limit_50000.out 2>> scilab.opts-O3_-finline-limit_50000.err
3 ./gcc train01.c -O3 -finline-limit=50000 -o train01.opts-O3_-finline-limit_50000.s >
  train01.opts-O3_-finline-limit_50000.out 2>> train01.opts-O3_-finline-limit_50000.
  err
```

Reference Inputs (502.gcc_r)

- 1 ./gcc gcc-pp.c -O3 -finline-limit=0 -fif-conversion -fif-conversion2 -o gcc-pp.opts-03_-finline-limit_0_-fif-conversion_-fif-conversion2.s > gcc-pp.opts-03_-finline-limit_0_-fif-conversion_-fif-conversion2.out 2>> gcc-pp.opts-03_-finline-limit_0_-fif-conversion_-fif-conversion2.err
 - 2 ./gcc gcc-pp.c -O2 -finline-limit=36000 -fpic -o gcc-pp.opts-02_-finline-limit_36000_-fpic.s > gcc-pp.opts-02_-finline-limit_36000_-fpic.out 2>> gcc-pp.opts-02_-finline-limit_36000_-fpic.err
 - 3 ./gcc gcc-smaller.c -O3 -fipa-pta -o gcc-smaller.opts-03_-fipa-pta.s > gcc-smaller.opts-03_-fipa-pta.out 2>> gcc-smaller.opts-03_-fipa-pta.err
 - 4 ./gcc ref32.c -O5 -o ref32.opts-05.s > ref32.opts-05.out 2>> ref32.opts-05.err
 - 5 ./gcc ref32.c -O3 -fselective-scheduling -fselective-scheduling2 -o ref32.opts-03_-fselective-scheduling_-fselective-scheduling2.s > ref32.opts-03_-fselective-scheduling_-fselective-scheduling2.out 2>> ref32.opts-03_-fselective-scheduling_-fselective-scheduling2.err
-

Reference Inputs (602.gcc_s)

- 1 ./gcc gcc-pp.c -O5 -fipa-pta -o gcc-pp.opts-05_-fipa-pta.s > gcc-pp.opts-05_-fipa-pta.out 2>> gcc-pp.opts-05_-fipa-pta.err
 - 2 ./gcc gcc-pp.c -O5 -finline-limit=1000 -fselective-scheduling -fselective-scheduling2 -o gcc-pp.opts-05_-finline-limit_1000_-fselective-scheduling_-fselective-scheduling2.s > gcc-pp.opts-05_-finline-limit_1000_-fselective-scheduling_-fselective-scheduling2.out 2>> gcc-pp.opts-05_-finline-limit_1000_-fselective-scheduling_-fselective-scheduling2.err
 - 3 ./gcc gcc-pp.c -O5 -finline-limit=24000 -fgcse -fgcse-las -fgcse-lm -fgcse-sm -o gcc-pp.opts-05_-finline-limit_24000_-fgcse_-fgcse-las_-fgcse-lm_-fgcse-sm.s > gcc-pp.opts-05_-finline-limit_24000_-fgcse_-fgcse-las_-fgcse-lm_-fgcse-sm.out 2>> gcc-pp.opts-05_-finline-limit_24000_-fgcse_-fgcse-las_-fgcse-lm_-fgcse-sm.err
-

505.mcf_r / 605.mcf_s

Test, Train, and Reference Inputs

- 1 ./mcf_r inp.in > inp.out 2>> inp.err
-

520.omnetpp_r / 620.omnetpp_s

Test, Train, and Reference Inputs

- 1 ./omnetpp -c General -r 0 > omnetpp.General-0.out 2>> omnetpp.General-0.err
-

523.xalancbmk_r / 623.xalancbmk

Test Input

```
1 ./xalancbmk -v test.xml xalanc.xsl > test-test.out 2>> test-test.err
```

Train Input

```
1 ./xalancbmk -v allbooks.xml xalanc.xsl > train-allbooks.out 2>> train-allbooks.err
```

Reference Input

```
1 ./xalancbmk -v t5.xml xalanc.xsl > ref-t5.out 2>> ref-t5.err
```

525.x264_r / 625.x264_s

Test Input

```
1 ./x264 --dumpyuv 50 --frames 156 -o BuckBunny_New.264 BuckBunny.yuv 1280x720 > run_000-156_x264.out 2>> run_000-156_x264.err
```

Train Input

```
1 ./x264 --dumpyuv 50 --frames 142 -o BuckBunny_New.264 BuckBunny.yuv 1280x720 > run_000-142_x264.out 2>> run_000-142_x264.err
```

Reference Inputs

```
1 ./x264 --pass 1 --stats x264_stats.log --bitrate 1000 --frames 1000 -o BuckBunny_New.264 BuckBunny.yuv 1280x720 > run_000-1000_x264_pass1.out 2>> run_000-1000_x264_pass1.err
2 ./x264 --pass 2 --stats x264_stats.log --bitrate 1000 --dumpyuv 200 --frames 1000 -o BuckBunny_New.264 BuckBunny.yuv 1280x720 > run_000-1000_x264_pass2.out 2>> run_000-1000_x264_pass2.err
3 ./x264 --seek 500 --dumpyuv 200 --frames 1250 -o BuckBunny_New.264 BuckBunny.yuv 1280x720 > run_0500-1250_x264.out 2>> run_0500-1250_x264.err
```

531.deepsjeng_r / 631.deepsjeng_s

Test Input

```
1 ./deepsjeng test.txt > test.out 2>> test.err
```

Train Input

```
1 ./deepsjeng train.txt > train.out 2>> train.err
```

Reference Input

```
1 ./deepsjeng ref.txt > ref.out 2>> ref.err
```

541.leela_r / 641.leela_s

Test Input

```
1 ./leela test.sgf > test.out 2>> test.err
```

Train Input

```
1 ./leela train.sgf > train.out 2>> train.err
```

Reference Input

```
1 ./leela ref.sgf > ref.out 2>> ref.err
```

548.exchange2_r / 648.exchange2_s

Test Input

```
1 ./exchange2 0 > exchange2.txt 2>> exchange2.err
```

Train Input

```
1 ./exchange2 1 > exchange2.txt 2>> exchange2.err
```

Reference Input

```
1 ./exchange2 6 > exchange2.txt 2>> exchange2.err
```

557.xz_r / 657.xz_s

Test Inputs

```
1 ./xz cpu2006docs.tar.xz 4 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fac155
  3d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 1548636 1555348
  0 > cpu2006docs.tar-4-0.out 2>> cpu2006docs.tar-4-0.err
2 ./xz cpu2006docs.tar.xz 4 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fac155
  3d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 1462248 -1 1 >
  cpu2006docs.tar-4-1.out 2>> cpu2006docs.tar-4-1.err
```

```

3 ./xz cpu2006docs.tar.xz 4 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fac155
  3d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 1428548 -1 2 >
  cpu2006docs.tar-4-2.out 2>> cpu2006docs.tar-4-2.err
4 ./xz cpu2006docs.tar.xz 4 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fac155
  3d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 1034828 -1 3e >
  cpu2006docs.tar-4-3e.out 2>> cpu2006docs.tar-4-3e.err
5 ./xz cpu2006docs.tar.xz 4 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fac155
  3d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 1061968 -1 4 >
  cpu2006docs.tar-4-4.out 2>> cpu2006docs.tar-4-4.err
6 ./xz cpu2006docs.tar.xz 4 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fac155
  3d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 1034588 -1 4e >
  cpu2006docs.tar-4-4e.out 2>> cpu2006docs.tar-4-4e.err
7 ./xz cpu2006docs.tar.xz 1 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fac155
  3d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 650156 -1 0 >
  cpu2006docs.tar-1-0.out 2>> cpu2006docs.tar-1-0.err
8 ./xz cpu2006docs.tar.xz 1 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fac155
  3d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 639996 -1 1 >
  cpu2006docs.tar-1-1.out 2>> cpu2006docs.tar-1-1.err
9 ./xz cpu2006docs.tar.xz 1 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fac155
  3d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 637616 -1 2 >
  cpu2006docs.tar-1-2.out 2>> cpu2006docs.tar-1-2.err
10 ./xz cpu2006docs.tar.xz 1 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fac155
  3d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 628996 -1 3e >
  cpu2006docs.tar-1-3e.out 2>> cpu2006docs.tar-1-3e.err
11 ./xz cpu2006docs.tar.xz 1 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fac155
  3d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 631912 -1 4 >
  cpu2006docs.tar-1-4.out 2>> cpu2006docs.tar-1-4.err
12 ./xz cpu2006docs.tar.xz 1 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fac155
  3d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 629064 -1 4e >
  cpu2006docs.tar-1-4e.out 2>> cpu2006docs.tar-1-4e.err

```

Train Inputs

```

1 ./xz input.combined.xz 40 a841f68f38572a49d86226b7ff5baeb31bd19dc637a922a972b2e6d1257a8
  90f6a544ecab967c313e370478c74f760eb229d4eef8a8d2836d233d3e9dd1430bf 6356684 -1 8 >
  input.combined-40-8.out 2>> input.combined-40-8.err
2 ./xz IMG_2560.cr2.xz 40 ec03e53b02deae89b6650f1de4bed76a012366fb3d4bdc791e8633d1a5964
  e03004523752ab008eff0d9e693689c53056533a05fc4b277f0086544c6c3cbbbf6 40822692
  40824404 4 > IMG_2560.cr2-40-4.out 2>> IMG_2560.cr2-40-4.err

```

Reference Inputs (557.xz_r)

```

1 ./xz cld.tar.xz 160 19cf30ae51eddcbefda78dd06014b4b96281456e078ca7c13e1c0c9e6a8df3
  efb4ad6b0456697718cede6bd5454852652806a657bb56e07d61128434b474 59796407 61004416 6
  > cld.tar-160-6.out 2>> cld.tar-160-6.err
2 ./xz cpu2006docs.tar.xz 250 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fa
  c1553d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 23047774
  23513385 6e > cpu2006docs.tar-250-6e.out 2>> cpu2006docs.tar-250-6e.err

```

```
3 ./xz input.combined.xz 250 a841f68f38572a49d86226b7ff5baeb31bd19dc637a922a972b2e6d12
57a890f6a544ecab967c313e370478c74f760eb229d4eef8a8d2836d233d3e9dd1430bf 40401484
41217675 7 > input.combined-250-7.out 2>> input.combined-250-7.err
```

Reference Inputs (657.xz_s)

```
1 ./xz cpu2006docs.tar.xz 6643 055ce243071129412e9dd0b3b69a21654033a9b723d874b2015c774fa
c1553d9713be561ca86f74e4f16f22e664fc17a79f30caa5ad2c04fbc447549c2810fae 1036078272
1111795472 4 > cpu2006docs.tar-6643-4.out 2>> cpu2006docs.tar-6643-4.err
2 ./xz cld.tar.xz 1400 19cf30ae51eddcbefda78dd06014b4b96281456e078ca7c13e1c0c9e6aeea8dff3
efb4ad6b0456697718cedebd5454852652806a657bb56e07d61128434b474 536995164 539938872
8 > cld.tar-1400-8.out 2>> cld.tar-1400-8.err
```

999.specrand_ir / 998.specrand_is

Test Input

```
1 ./specrand 324342 24239 > rand.24239.out 2>> rand.24239.err
```

Train Input

```
1 ./specrand 1 11 > rand.11.out 2>> rand.11.err
```

Reference Input

```
1 ./specrand 1255432124 234923 > rand.234923.out 2>> rand.234923.err
```

SPEC CPU2017 Floating Point Benchmarks

503.bwaves_r

Test and Train Inputs

```
1 ./bwaves bwaves_1 < bwaves_1.in > bwaves_1.out 2>> bwaves_1.err
2 ./bwaves bwaves_2 < bwaves_2.in > bwaves_2.out 2>> bwaves_2.err
```

Reference Inputs

```
1 ./bwaves bwaves_1 < bwaves_1.in > bwaves_1.out 2>> bwaves_1.err
2 ./bwaves bwaves_2 < bwaves_2.in > bwaves_2.out 2>> bwaves_2.err
3 ./bwaves bwaves_3 < bwaves_3.in > bwaves_3.out 2>> bwaves_3.err
4 ./bwaves bwaves_4 < bwaves_4.in > bwaves_4.out 2>> bwaves_4.err
```

603.bwaves_s

Test, Train, and Reference Inputs

```
1 ./bwaves bwaves_1 < bwaves_1.in > bwaves_1.out 2>> bwaves_1.err
2 ./bwaves bwaves_2 < bwaves_2.in > bwaves_2.out 2>> bwaves_2.err
```

507.cactuBSSN_r / 607.cactuBSSN_s

Test Input

```
1 ./cactusBSSN spec_test.par > spec_test.out 2>> spec_test.err
```

Train Input

```
1 ./cactusBSSN spec_train.par > spec_train.out 2>> spec_train.err
```

Reference Input

```
1 ./cactusBSSN spec_ref.par > spec_ref.out 2>> spec_ref.err
```

508.namd_r

Test Input

```
1 ./namd_r --input apoal.input --iterations 1 --output apoal.test.output > namd.out 2>>
  namd.err
```

Train Input

```
1 ./namd_r --input apoal.input --iterations 7 --output apoal.train.output > namd.out 2>>
  namd.err
```

Reference Input

```
1 ./namd_r --input apoal.input --output apoal.ref.output --iterations 65 > namd.out 2>>
  namd.err
```

510.parest_r

Test Input

```
1 ./parest_r test.prm > test.out 2>> test.err
```

Train Input

```
1 ./parest_r train.prm > train.out 2>> train.err
```

Reference Input

```
1 ./parest_r ref.prm > ref.out 2>> ref.err
```

511.povray_r

Test Input

```
1 ./povray_r SPEC-benchmark-test.ini > SPEC-benchmark-test.stdout 2>> SPEC-benchmark-test
  .stderr
```

Train Input

```
1 ./povray_r SPEC-benchmark-train.ini > SPEC-benchmark-train.stdout 2>> SPEC-benchmark-
  train.stderr
```

Reference Input

```
1 ./povray_r SPEC-benchmark-ref.ini > SPEC-benchmark-ref.stdout 2>> SPEC-benchmark-ref.
  stderr
```

519.lbm_r

Test Input

```
1 ./lbm_r 20 reference.dat 0 1 100_100_130_cf_a.of > lbm.out 2>> lbm.err
```

Train Input

```
1 ./lbm_r 300 reference.dat 0 1 100_100_130_cf_b.of > lbm.out 2>> lbm.err
```

Reference Input

```
1 ./lbm_r 3000 reference.dat 0 0 100_100_130_ldc.of > lbm.out 2>> lbm.err
```

619.lbm_s

Test Inputs

```
1 ./lbm_s 20 reference.dat 0 1 200_200_260_ldc.of > lbm.out 2>> lbm.err
```

Train Inputs

```
1 ./lbm_s 300 reference.dat 0 1 200_200_260_ldc.of > lbm.out 2>> lbm.err
```

Reference Inputs

```
1 ./lbm_s 2000 reference.dat 0 0 200_200_260_ldc.of > lbm.out 2>> lbm.err
```

521.wrf_r / 621.wrf_s

Test, Train, and Reference Inputs

```
1 ./wrf > rsl.out.0000 2>> wrf.err
```

526.blender_r

Test Inputs

```
1 ./blender_r cube.blend --render-output cube_ --threads 1 -b -F RAWTGA -s 1 -e 1 -a >
  cube.1.spec.out 2>> cube.1.spec.err
```

Train Inputs

```
1 ./blender_r sh5_reduced.blend --render-output sh5_reduced_ --threads 1 -b -F RAWTGA -s
  234 -e 234 -a > sh5_reduced.234.spec.out 2>> sh5_reduced.234.spec.err
```

Reference Inputs

```
1 ./blender_r sh3_no_char.blend --render-output sh3_no_char_ --threads 1 -b -F RAWTGA -s
  849 -e 849 -a > sh3_no_char.849.spec.out 2>> sh3_no_char.849.spec.err
```

527.cam4_r / 627.cam4_s

Test, Train, and Reference Inputs

```
1 ./cam4 > cam4.txt 2>> cam4.err
```

628.pop2_s

Test, Train, and Reference Inputs

```
1 ./pop2 > pop2.out 2>> pop2.err
```

538.imagick_r / 638.imagick_s

Test Input

```
1 ./imagick -limit disk 0 test_input.tga -shear 25 -resize 640x480 -negate -alpha Off
  test_output.tga > test_convert.out 2>> test_convert.err
```

Train Input

```
1 ./imagick -limit disk 0 train_input.tga -resize 320x240 -shear 31 -edge 140 -negate -
  flop -resize 900x900 -edge 10 train_output.tga > train_convert.out 2>>
  train_convert.err
```

Reference Input (538.imagick_r)

```
1 ./imagick -limit disk 0 refrate_input.tga -edge 41 -resample 181% -emboss 31 -
  colorspace YUV -mean-shift 19x19+15% -resize 30% refrate_output.tga >
  refrate_convert.out 2>> refrate_convert.err
```

Reference Input (638.imagick_s)

```
1 ./imagemagick -limit disk 0 refspeed_input.tga -resize 817% -rotate -2.76 -shave 540x375 -
  alpha remove -auto-level -contrast-stretch 1x1% -colorspace Lab -channel R -
  equalize +channel -colorspace sRGB -define histogram:unique-colors=false -adaptive-
  blur 0x5 -despeckle -auto-gamma -adaptive-sharpen 55 -enhance -brightness-contrast
  10x10 -resize 30% refspeed_output.tga > refspeed_convert.out 2>> refspeed_convert.
  err
```

544.nab_r / 644.nab_s

Test Input

```
1 ./nab hkrdenq 1930344093 1000 > hkrdenq.out 2>> hkrdenq.err
```

Train Input

```
1 ./nab aminos 391519156 1000 > aminos.out 2>> aminos.err
2 ./nab gc4dna 1850041461 300 > gc4dna.out 2>> gc4dna.err
```

Reference Input (544.nab_r)

```
1 ./nab 1am0 1122214447 122 > 1am0.out 2>> 1am0.err
```

Reference Input (644.nab_s)

```
1 ./nab 3j1n 20140317 220 > 3j1n.out 2>> 3j1n.err
```

549.fotonik3d_r / 649.fotonik3d_s

Test, Train, and Reference Inputs

```
1 ./fotonik3d > fotonik3d.log 2>> fotonik3d.err
```

554.roms_r / 654.roms_s

Test Input

```
1 ./roms < ocean_benchmark0.in.x > ocean_benchmark0.log 2>> ocean_benchmark0.err
```

Train Input

```
1 ./roms < ocean_benchmark1.in.x > ocean_benchmark1.log 2>> ocean_benchmark1.err
```

Reference Input (554.roms_r)

```
1 ./roms < ocean_benchmark2.in.x > ocean_benchmark2.log 2>> ocean_benchmark2.err
```

Reference Input (654.roms_s)

```
1 ./roms < ocean_benchmark3.in.x > ocean_benchmark3.log 2>> ocean_benchmark3.err
```

997.specrand_fr / 996.specrand_fs

Test Input

```
1 ./specrand 324342 24239 > rand.24239.out 2>> rand.24239.err
```

Train Input

```
1 ./specrand 1 11 > rand.11.out 2>> rand.11.err
```

Reference Input

```
1 ./specrand 1255432124 234923 > rand.234923.out 2>> rand.234923.err
```
