SPEC CPU2017 Command Lines

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The SPEC CPU2017 Benchmark Suite, comprising of 43 benchmarks, focuses on characterizing a system's compute-intensive performance (CPU, memory hierarchy, and compilers). More information about the benchmark suite is available on SPEC's website [link]. Detailed workload characterization of the SPEC CPU2107 Benchmark Suite can be found at:

1. A. Limaye, and T. Adegbija, "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].

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 the appropriate input files (from the `/[benchmark]/data/[size]/input/` directory) into the working directory.

2. The executables' names in the command lines listed below need to be modified to match executables' names from your local `/[banchmark]/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. The links to each benchmark are in the table below:

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	605.mcf_s	508.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-O3_
    -finline-limit_0_-fif-conversion_-fif-conversion2.s > gcc-pp.opts-O3_-finline-
    limit_0_-fif-conversion_-fif-conversion2.out 2>> gcc-pp.opts-O3_-finline-limit_0_-
    fif-conversion_-fif-conversion2.err
2 ./gcc gcc-pp.c -O2 -finline-limit=36000 -fpic -o gcc-pp.opts-O2_-finline-limit_36000_-
    fpic.s > gcc-pp.opts-O2_-finline-limit_36000_-fpic.out 2>> gcc-pp.opts-O2_-finline-
    limit_36000_-fpic.err
3 ./gcc gcc-smaller.c -O3 -fipa-pta -o gcc-smaller.opts-O3_-fipa-pta.s > gcc-smaller.opts
    -O3_-fipa-pta.out 2>> gcc-smaller.opts-O3_-fipa-pta.err
4 ./gcc ref32.c -O5 -o ref32.opts-O5.s > ref32.opts-O5.out 2>> ref32.opts-O5.err
5 ./gcc ref32.c -O3 -fselective-scheduling -fselective-scheduling2 -o ref32.opts-O3_-
    fselective-scheduling_-fselective-scheduling2.s > ref32.opts-O3_-fselective-
    scheduling_-fselective-scheduling2.out 2>> ref32.opts-O3_-fselective-scheduling_-
    fselective-scheduling2.err
```

Reference Inputs (602.gcc_s)

```
1 ./gcc gcc-pp.c -O5 -fipa-pta -o gcc-pp.opts-O5_-fipa-pta.s > gcc-pp.opts-O5_-fipa-pta.
    out 2>> gcc-pp.opts-O5_-fipa-pta.err
2 ./gcc gcc-pp.c -O5 -finline-limit=1000 -fselective-scheduling -fselective-scheduling2 -
    o gcc-pp.opts-O5_-finline-limit_1000_-fselective-scheduling_-fselective-scheduling2
    .s > gcc-pp.opts-O5_-finline-limit_1000_-fselective-scheduling_-fselective-
    scheduling2.out 2>> gcc-pp.opts-O5_-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-O5_-finline-limit_24000_-fgcse_-fgcse-las_-fgcse-lm_-fgcse-sm.s > gcc-pp.opts
    -O5_-finline-limit_24000_-fgcse_-fgcse-las_-fgcse-lm_-fgcse-sm.out 2>> gcc-pp.opts-
    O5_-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_s

Test Input

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

Train Input

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

Reference Input

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

525.x264_r / 625.x264_s

Test Input

```
./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

```
./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

```
./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
./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
./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

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

Train Input

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

Reference Input

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

541.leela_r / 641.leela_s

Test Input

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

Train Input

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

Reference Input

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

548.exchange2_r / 648.exchange2_s

Test Input

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

Train Input

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

Reference Input

```
./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 19cf30ae51eddcbefda78dd06014b4b96281456e078ca7c13e1c0c9e6aaea8dff3
    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 19cf30ae51eddcbefda78dd06014b4b96281456e078ca7c13e1c0c9e6aaea8dff3
    efb4ad6b0456697718cede6bd5454852652806a657bb56e07d61128434b474 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

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

Reference Inputs

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

603.bwaves_s

Test, Train, and Reference Inputs

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

507.cactuBSSN_r / 607.cactuBSSN_s

Test Input

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

Train Input

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

Reference Input

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

508.namd_r

Test Input

```
./namd --input apoa1.input --iterations 1 --output apoa1.test.output > namd.out 2>>
    namd.err
```

Train Input

```
./namd --input apoa1.input --iterations 7 --output apoa1.train.output > namd.out 2>>
    namd.err
```

Reference Input

```
./namd --input apoa1.input --output apoa1.ref.output --iterations 65 > namd.out 2>>
    namd.err
```

510.parest_r

Test Input

```
./parest test.prm > test.out 2>> test.err
```

Train Input

```
./parest train.prm > train.out 2>> train.err
```

Reference Input

```
./parest ref.prm > ref.out 2>> ref.err
```

511.povray_r

Test Input

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

Train Input

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

Reference Input

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

519.lbm_r

Test Input

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

Train Input

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

Reference Input

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

619.lbm_s

Test Input

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

Train Input

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

Reference Input

```
./lbm 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

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

526.blender_r

Test Input

```
./blender 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 Input

```
./blender 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 Input

```
./blender 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

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

628.pop2_s

Test, Train, and Reference Inputs

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

538.imagick_r / 638.imagick_s

Test Input

```
./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

```
./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)

```
./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)

```
./imagick -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

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

Train Inputs

```
./nab aminos 391519156 1000 > aminos.out 2>> aminos.err
./nab gcn4dna 1850041461 300 > gcn4dna.out 2>> gcn4dna.err
```

Reference Input (544.nab_r)

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

Reference Input (644.nab_s)

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

549.fotonik3d_r / 649.fotonik3d_s

Test, Train, and Reference Inputs

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

554.roms_r / 654.roms_s

Test Input

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

Train Input

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

Reference Input (554.roms_r)

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

Reference Input (654.roms_s)

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

997.specrand_fr / 996.specrand_fs

Test Input

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

Train Input

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

Reference Input

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