# SPEC CPU® 2017 Floating Point Rate Result

## Dell Inc.

**PowerEdge C6520 (Intel Xeon Platinum 8368Q, 2.60 GHz)**

<table>
<thead>
<tr>
<th>SPECrate®2017_fp_base</th>
<th>426</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECrate®2017_fp_peak</td>
<td>452</td>
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</table>

**CPU2017 License:** 55  
**Test Sponsor:** Dell Inc.  
**Tested by:** Dell Inc.  
**Test Date:** Apr-2021  
**Hardware Availability:** Apr-2021  
**Software Availability:** Dec-2020

### Hardware

**Cpu Name:** Intel Xeon Platinum 8368Q  
**Max MHz:** 3700  
**Nominal:** 2600  
**Enabled:** 76 cores, 2 chips, 2 threads/core  
**Orderable:** 1,2 chips  
**Cache L1:** 32 KB I + 48 KB D on chip per core  
**L2:** 1.25 MB I+D on chip per core  
**L3:** 57 MB I+D on chip per chip  
**Other:** None  
**Memory:** 1 TB (16 x 64 GB 2Rx4 PC4-3200AA-R)  
**Storage:** 125 GB on tmpfs  
**Other:** None

### Software

**OS:** Red Hat Enterprise Linux 8.2 (Ootpa)  
4.18.0-193.el8.x86_64  
**Compiler:** C/C++: Version 2021.1 of Intel oneAPI DPC++/C++ Compiler Build 20201113 for Linux; Fortran: Version 2021.1 of Intel Fortran Compiler Classic Build 20201112 for Linux;  
**Parallel:** No  
**Firmware:** Version 1.1.2 released Apr-2021  
**File System:** tmpfs  
**System State:** Run level 3 (multi-user)  
**Base Pointers:** 64-bit  
**Peak Pointers:** 64-bit  
**Other:** jemalloc memory allocator V5.0.1  
**Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage.

### Copies

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Standard Performance Evaluation Corporation (info@spec.org)  
https://www.spec.org/
SPEC CPU®2017 Floating Point Rate Result

Dell Inc.
PowerEdge C6520 (Intel Xeon Platinum 8368Q, 2.60 GHz)

CPU2017 License: 55
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Results Table

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SPECrate®2017_fp_base = 426
SPECrate®2017_fp_peak = 452

Submit Notes

The numactl mechanism was used to bind copies to processors. The config file option 'submit' was used to generate numactl commands to bind each copy to a specific processor. For details, please see the config file.

Operating System Notes

Stack size set to unlimited using "ulimit -s unlimited"

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/mnt/ramdisk/cpu2017-1.1.7-ic2021.1/lib/intel64:/mnt/ramdisk/cpu2017-1.1.7-ic2021.1/je5.0.1-64"
MALLOCONF = "retain:true"

General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Red Hat Enterprise Linux 8.1

(Continued on next page)
General Notes (Continued)

Transparent Huge Pages enabled by default
Prior to runcpu invocation
Filesystem page cache synced and cleared with:
sync; echo 3> /proc/sys/vm/drop_caches
runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>
jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown) is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5753 (Spectre variant 1) is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5715 (Spectre variant 2) is mitigated in the system as tested and documented.

Benchmark run from a 125 GB ramdisk created with the cmd: "mount -t tmpfs -o size=125G tmpfs /mnt/ramdisk"

Platform Notes

BIOS Settings:
  Sub NUMA Cluster: 2-Way Clustering
  Virtualization Technology: Disabled
  System Profile: Custom
  CPU Power Management: Maximum Performance
  C1E: Disabled
  C States: Autonomous
  Memory Patrol Scrub: Disabled
  Energy Efficiency Policy: Performance
  CPU Interconnect Bus Link
  Power Management: Disabled

Sysinfo program /mnt/ramdisk/cpu2017-1.1.7-ic2021.1/bin/sysinfo
Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c
running on localhost.localdomain Thu Apr 29 01:26:34 2021

SUT (System Under Test) info as seen by some common utilities.
For more information on this section, see
  https://www.spec.org/cpu2017/Docs/config.html#sysinfo

From /proc/cpuinfo
  model name: Intel(R) Xeon(R) Platinum 8368Q CPU @ 2.60GHz

(Continued on next page)
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</tbody>
</table>

Platform Notes (Continued)

2 "physical id"s (chips)
152 "processors"
cores, siblings (Caution: counting these is hw and system dependent. The following excerpts from /proc/cpuinfo might not be reliable. Use with caution.)
cpu cores : 38
siblings : 76
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 152
On-line CPU(s) list: 0-151
Thread(s) per core: 2
Core(s) per socket: 38
Socket(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 106
Model name: Intel(R) Xeon(R) Platinum 8368Q CPU @ 2.60GHz
Stepping: 6
CPU MHz: 3300.000
BogoMIPS: 5200.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 58368K
NUMA node0 CPU(s): 0-37,76-113
NUMA node1 CPU(s): 38-75,114-151
Flags: fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfmperf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 invpcid_single sbbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm rdt_a avx512f avx512dq rdseed adx smap avx512ifma clflushopt clwb intel_pt avx512cd sha_ni avx512bw avx512vl xsaveopt xsaves xsavec xgetbv1 xsaves cqm_llc cqm_occp_llc cqm_mbb_total cqm_mbb_loca wboinvd dtcmtm ida arat pln pts avx512vmbi umip pku ospke avx512_vmbi2 g仲 q avx512_vnmi avx512_vbta1g tme avx512_vpopcntdq

(Continued on next page)
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Hardware Availability: Apr-2021
Software Availability: Dec-2020

Platform Notes (Continued)

```
la57 rdpld md_clear pconfig flush_l1d arch_capabilities

(cache size : 58368 KB)
```

From numactl --hardware  WARNING: a numactl 'node' might or might not correspond to a physical chip.

available: 2 nodes (0-1)

node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36 37 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94
95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113
node 0 size: 515473 MB
node 0 free: 472950 MB
node 1 cpus: 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62
63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147
148 149 150 151
node 1 size: 516047 MB
node 1 free: 487448 MB
node distances:
node 0: 10 20
node 1: 20 10
```

From /proc/meminfo

```
MemTotal: 1056278004 kB
HugePages_Total: 0
Hugepagesize: 2048 kB
```

/sbin/tuned-adm active

```
Current active profile: throughput-performance
```

From /etc/*release* /etc/*version*

```
os-release:
NAME="Red Hat Enterprise Linux"
VERSION="8.2 (Ootpa)"
ID="rhel"
ID_LIKE="fedora"
VERSION_ID="8.2"
PLATFORM_ID="platform:el8"
PRETTY_NAME="Red Hat Enterprise Linux 8.2 (Ootpa)"
ANSI_COLOR="0;31"
redhat-release: Red Hat Enterprise Linux release 8.2 (Ootpa)
system-release: Red Hat Enterprise Linux release 8.2 (Ootpa)
system-release-cpe: cpe:/o:redhat:enterprise_linux:8.2:ga
```

uname -a:

(Continued on next page)
## Platform Notes (Continued)

Linux localhost.localdomain 4.18.0-193.el8.x86_64 #1 SMP Fri Mar 27 14:35:58 UTC 2020
x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

- **CVE-2018-12207 (iTLB Multihit):** Not affected
- **CVE-2018-3620 (L1 Terminal Fault):** Not affected
- **Microarchitectural Data Sampling:** Not affected
- **CVE-2017-5754 (Meltdown):** Not affected
- **CVE-2018-3639 (Speculative Store Bypass):** Mitigation: Speculative Store Bypass disabled via prctl and seccomp
- **CVE-2017-5753 (spectre variant 1):** Mitigation: usercopy/swapsgs barriers and __user pointer sanitization
- **CVE-2017-5715 (spectre variant 2):** Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
- **CVE-2020-0543 (Special Register Buffer Data Sampling):** No status reported
- **CVE-2019-11135 (TSX Asynchronous Abort):** Not affected

run-level 3 Apr 28 20:03

SPEC is set to: /mnt/ramdisk/cpu2017-1.1.7-ic2021.1

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<th>Avail</th>
<th>Use%</th>
<th>Mounted on</th>
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<td>tmpfs</td>
<td>125G</td>
<td>63G</td>
<td>63G</td>
<td>51%</td>
<td>/mnt/ramdisk</td>
</tr>
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</table>

From /sys/devices/virtual/dmi/id

- **Vendor:** Dell Inc.
- **Product:** PowerEdge C6520
- **Product Family:** PowerEdge
- **Serial:** SDPT078

Additional information from dmidecode follows. WARNING: Use caution when you interpret this section. The 'dmidecode' program reads system data which is "intended to allow hardware to be accurately determined", but the intent may not be met, as there are frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.

Memory:
16x 00AD063200AD HMAA8GR7AJR4N-XN 64 GB 2 rank 3200

BIOS:
- **BIOS Vendor:** Dell Inc.
- **BIOS Version:** 1.1.2
- **BIOS Date:** 04/09/2021
- **BIOS Revision:** 1.1

(End of data from sysinfo program)
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Compiler Version Notes

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| C               | 519.lbm_r(base, peak) 538.imagick_r(base, peak) 544.nab_r(base, peak) |
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| Version 2021.1 Build 20201113 |
| Copyright (C) 1985-2020 Intel Corporation. All rights reserved. |
==============================================================================
| C++             | 508.namd_r(base, peak) 510.parest_r(base, peak) |
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| Version 2021.1 Build 20201113 |
| Copyright (C) 1985-2020 Intel Corporation. All rights reserved. |
==============================================================================
| C++, C          | 511.povray_r(peak) |
==============================================================================
| Intel(R) C++ Intel(R) 64 Compiler Classic for applications running on |
| Intel(R) 64, Version 2021.1 Build 20201112_000000 |
| Copyright (C) 1985-2020 Intel Corporation. All rights reserved. |
| Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R) |
| 64, Version 2021.1 Build 20201112_000000 |
| Copyright (C) 1985-2020 Intel Corporation. All rights reserved. |
==============================================================================
| C++, C          | 511.povray_r(base) 526.blender_r(base, peak) |
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Compiler Version Notes (Continued)

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C++, C | 511.povray_r(base) 526.blender_r(base, peak)

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C++, C, Fortran | 507.cactuBSSN_r(base, peak)

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Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
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Fortran | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak) 554.roms_r(base, peak)

Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
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Fortran, C | 521.wrf_r(peak)

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Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
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(Continued on next page)
## Compiler Version Notes (Continued)

```plaintext
Fortran, C      | 521.wrf_r(base) 527.cam4_r(base, peak)
=================================================================================
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
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=================================================================================
Fortran, C      | 521.wrf_r(peak)
=================================================================================
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
64, Version 2021.1 Build 20201112_000000
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=================================================================================
Fortran, C      | 521.wrf_r(base) 527.cam4_r(base, peak)
=================================================================================
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
Intel(R) 64, Version 2021.1 Build 20201112_000000
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```

## Base Compiler Invocation

C benchmarks:
- icx

C++ benchmarks:
- icpx

Fortran benchmarks:
- ifort
**SPEC CPU®2017 Floating Point Rate Result**

Dell Inc.  
PowerEdge C6520 (Intel Xeon Platinum 8368Q, 2.60 GHz)  

<table>
<thead>
<tr>
<th>CPU2017 License: 55</th>
<th>SPECrate®2017_fp_base = 426</th>
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<tbody>
<tr>
<td>Test Sponsor: Dell Inc.</td>
<td>SPECrate®2017_fp_peak = 452</td>
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**Base Compiler Invocation (Continued)**

- Benchmarks using both Fortran and C:  
  `ifort icx`

- Benchmarks using both C and C++:  
  `icpx icx`

- Benchmarks using Fortran, C, and C++:  
  `icpx icx ifort`

**Base Portability Flags**

- 503.bwaves_r: `-DSPEC_LP64`
- 507.cactuBSSN_r: `-DSPEC_LP64`
- 508.namd_r: `-DSPEC_LP64`
- 510.parest_r: `-DSPEC_LP64`
- 511.povray_r: `-DSPEC_LP64`
- 519.lbm_r: `-DSPEC_LP64`
- 521.wrf_r: `-DSPEC_LP64 `-DSPEC_CASE_FLAG `-convert big_endian`
- 526.blender_r: `-DSPEC_LP64 `-DSPEC_LINUX `-funsigned-char`
- 527.cam4_r: `-DSPEC_LP64 `-DSPEC_CASE_FLAG`
- 538.imagick_r: `-DSPEC_LP64`
- 544.nab_r: `-DSPEC_LP64`
- 549.fotonik3d_r: `-DSPEC_LP64`
- 554.roms_r: `-DSPEC_LP64`

**Base Optimization Flags**

- C benchmarks:  
  `-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
  -flto -mfpmath=sse -funroll-loops -gopt-mem-layout-trans=4
  -mbranches-within-32B-boundaries -ljemalloc
  -L/usr/local/jemalloc64-5.0.1/lib`

- C++ benchmarks:  
  `-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto
  -mfpmath=sse -funroll-loops -gopt-mem-layout-trans=4
  -mbranches-within-32B-boundaries -ljemalloc
  -L/usr/local/jemalloc64-5.0.1/lib`

- Fortran benchmarks:  
  `-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -03 -ipo -no-prec-div
  -gopt-prefetch -ffinite-math-only`

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Base Optimization Flags (Continued)

Fortran benchmarks (continued):
-`-qopt-multiple-gather-scatter-by-shuffles` `-qopt-mem-layout-trans=4`
-`-nostandard-realloc-lhs` `-align array32byte -auto`
-`-mbranches-within-32B-boundaries` `-ljemalloc`
-`-L/usr/local/jemalloc64-5.0.1/lib`

Benchmarks using both Fortran and C:
-`-w` `-m64` `-std=c11` `-Wl,-z,muldefs -xCORE-AVX512` `-Ofast -ffast-math`
-`-flto` `-mfpmath=sse` `-funroll-loops -qopt-mem-layout-trans=4` `-O3` `-ipo`
-`-no-prec-div` `-qopt-prefetch` `-ffinite-math-only`
-`-qopt-multiple-gather-scatter-by-shuffles`
-`-mbranches-within-32B-boundaries` `-nostandard-realloc-lhs`
-`-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`

Benchmarks using both C and C++:
-`-w` `-m64` `-std=c11` `-Wl,-z,muldefs` `-xCORE-AVX512` `-Ofast -ffast-math`
-`-flto` `-mfpmath=sse` `-funroll-loops` `-qopt-mem-layout-trans=4`
-`-mbranches-within-32B-boundaries` `-ljemalloc`
-`-L/usr/local/jemalloc64-5.0.1/lib`

Benchmarks using Fortran, C, and C++:
-`-w` `-m64` `-std=c11` `-Wl,-z,muldefs` `-xCORE-AVX512` `-Ofast -ffast-math`
-`-flto` `-mfpmath=sse` `-funroll-loops` `-qopt-mem-layout-trans=4` `-O3`
-`-no-prec-div` `-qopt-prefetch` `-ffinite-math-only`
-`-qopt-multiple-gather-scatter-by-shuffles`
-`-mbranches-within-32B-boundaries` `-nostandard-realloc-lhs`
-`-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`

Peak Compiler Invocation

C benchmarks:
- icx

C++ benchmarks:
- icpx

Fortran benchmarks:
- ifort

Benchmarks using both Fortran and C:
- 521.wrf_r: ifort icc

(Continued on next page)
Peak Compiler Invocation (Continued)

527.cam4_r: ifort icx

Benchmarks using both C and C++:
511.povray_r: icpc icc
526.blender_r: icpx icx

Benchmarks using Fortran, C, and C++:
icpx icx ifort

Peak Portability Flags
Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:
519.lbm_r: basepeak = yes
538.imagick_r: basepeak = yes

544.nab_r: -w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -flto
-Ofast -qopt-mem-layout-trans=4
-fimf-accuracy-bits=14:sqrt
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

C++ benchmarks:
508.namd_r: basepeak = yes

510.parest_r: -w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
-ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

Fortran benchmarks:
503.bwaves_r: -w -m64 -Wl,-z,muldefs -xCORE-AVX512 -03 -ipo
-no-prec-div -qopt-prefetch -ffinite-math-only

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Peak Optimization Flags (Continued)

503.bwaves_r (continued):
-qopt-multiple-gather-scatter-by-shuffles
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs
-align array32byte -auto -mbranches-within-32B-boundaries
-ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

549.fotonik3d_r: basepeak = yes
554.roms_r: Same as 503.bwaves_r

Benchmarks using both Fortran and C:
521.wrf_r: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX512 -O3
-ipo -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles
-qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
-nostandard-realloc-lhs -align array32byte -auto
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

527.cam4_r: basepeak = yes

Benchmarks using both C and C++:
511.povray_r: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX512 -O3
-ipo -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles
-qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

526.blender_r: basepeak = yes

Benchmarks using Fortran, C, and C++:
507.cactuBSSN_r: basepeak = yes

The flags files that were used to format this result can be browsed at

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.xml
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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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