## SPEC® CPU2017 Floating Point Rate Result

**CPU2017 License:** 55  
**Test Sponsor:** Dell Inc.  
**Tested by:** Dell Inc.  
**Test Date:** Mar-2019  
**Hardware Availability:** Apr-2019  
**Software Availability:** Mar-2019

### Hardware

- **CPU Name:** Intel Xeon Gold 5220S  
- **Max MHz.:** 3900  
- **Nominal:** 2700  
- **Enabled:** 36 cores, 2 chips, 2 threads/core  
- **Orderable:** 1.2 chips  
- **Cache L1:** 32 KB I + 32 KB D on chip per core  
- **Cache L2:** 1 MB I+D on chip per core  
- **Cache L3:** 24.75 MB I+D on chip per chip  
- **Other:** None  
- **Memory:** 384 GB (12 x 32 GB 2Rx4 PC4-2933Y-R, running at 2666)  
- **Storage:** 1 x 480 GB SATA SSD  
- **Other:** None

### Software

- **OS:** Ubuntu 18.04.2 LTS  
- **Compiler:** C/C++: Version 19.0.1.144 of Intel C/C++ Compiler Build 20181018 for Linux; Fortran: Version 19.0.1.144 of Intel Fortran Compiler Build 20181018 for Linux  
- **Parallel:** No  
- **Firmware:** Version 2.1.6 released Mar-2019  
- **File System:** ext4  
- **System State:** Run level 5 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** None

### Test Data

- **Dell Inc. PowerEdge FC740 (Intel Xeon Gold 5220S, 2.70GHz)**  
- **SPECrate2017_fp_peak = 196**  
- **SPECrate2017_fp_base = 192**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>SPECrate2017_fp_base</th>
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<td>507.caCTuBSSN_r</td>
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SPEC CPU2017 Floating Point Rate Result

Copyright 2017-2019 Standard Performance Evaluation Corporation

Dell Inc. PowerEdge FC740 (Intel Xeon Gold 5220S, 2.70GHz)

SPECrate2017_fp_base = 192
SPECrate2017_fp_peak = 196

Results Table

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<td>86.0</td>
</tr>
</tbody>
</table>

SPECrater2017_fp_base = 192
SPECrater2017_fp_peak = 196

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

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"

General Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2017/lib/ia32:/home/cpu2017/lib/intel64"

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.5
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.
Transparent Huge Pages enabled by default
Prior to runcpu invocation

(Continued on next page)
General Notes (Continued)

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>
```

Platform Notes

BIOS settings:
- ADDDC setting disabled
- Sub NUMA Cluster enabled
- Virtualization Technology disabled
- DCU Streamer Prefetcher enabled
- System Profile set to Custom
- CPU Performance set to Maximum Performance
- C States set to Autonomous
- C1E disabled
- Uncore Frequency set to Dynamic
- Energy Efficiency Policy set to Performance
- Memory Patrol Scrub disabled
- Logical Processor enabled
- CPU Interconnect Bus Link Power Management disabled
- PCI ASPM L1 Link Power Management disabled
- Sysinfo program /home/cpu2017/bin/sysinfo
- Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f6d4985e45859ea9
- running on intel-sut Tue May 7 05:26:57 2019

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) Gold 5220S CPU @ 2.70GHz
  2 "physical id"s (chips)
  72 "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 : 18
siblings : 36
physical 0: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27
physical 1: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27
```

From lscpu:
```
Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:            Little Endian
CPU(s):                72
```
SPEC CPU2017 Floating Point Rate Result

Dell Inc.

PowerEdge FC740 (Intel Xeon Gold 5220S, 2.70GHz)

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On-line CPU(s) list: 0-71
Thread(s) per core: 2
Core(s) per socket: 18
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 5220S CPU @ 2.70GHz
Stepping: 7
CPU MHz: 3099.927
BogoMIPS: 5400.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 25344K
NUMA node0 CPU(s): 0,4,8,12,16,20,24,28,32,36,40,44,48,52,56,60,64,68
NUMA node1 CPU(s): 1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61,65,69
NUMA node2 CPU(s): 2,6,10,14,18,22,26,30,34,38,42,46,50,54,58,62,66,70
NUMA node3 CPU(s): 3,7,11,15,19,23,27,31,35,39,43,47,51,55,59,63,67,71
Flags: fpu vme de pse tsc msr pae mce cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp lm constant_tsc arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfmperf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt abm smt cmov sterc stibp tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 3dnowprefetch invpcid_single ssbd mba ibrs ibpb stibp ibrs_hidden tpr_shadow vvmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 3dnowprefetch invpcid_single ssbd mba ibrs ibpb stibp ibrs_hidden tpr_shadow vvmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 3dnowprefetch invpcid_single ssbd mba ibrs ibpb stibp ibrs_hidden tpr_shadow vvmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 3dnowprefetch invpcid_single ssbd mba ibrs ibpb stibp ibrs_hidden tpr_shadow vvmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 3dnowprefetch invpcid_single ssbd mba ibrs ibpb stibp ibrs_hidden tpr_shadow vvmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 3dnowprefetch invpcid_single ssbd mba ibrs ibpb stibp ibrs_hidden tpr_shadow vvmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 3dnowprefetch invpcid_single ssbd mba ibrs ibpb stibp ibrs_hidden tpr_shadow vvmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2

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

Available: 4 nodes (0-3)
node 0 cpus: 0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68
node 0 size: 95147 MB
node 0 free: 94631 MB
node 1 cpus: 1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69
node 1 size: 96764 MB
node 1 free: 96264 MB
node 2 cpus: 2 6 10 14 18 22 26 30 34 38 42 46 50 54 58 62 66 70
node 2 size: 96764 MB

(Continued on next page)
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Platform Notes (Continued)

node 2 free: 96037 MB
node 3 cpus: 3 7 11 15 19 23 27 31 35 39 43 47 51 55 59 63 67 71
node 3 size: 96763 MB
node 3 free: 96245 MB
node distances:
    node 0  1  2  3
    0:  10  21  11  21
    1:  21  10  21  11
    2:  11  21  10  21
    3:  21  11  21  10

From /proc/meminfo
    MemTotal:       394689832 kB
    HugePages_Total:       0
    Hugepagesize:       2048 kB

/usr/bin/lsb_release -d
    Ubuntu 18.04.2 LTS

From /etc/*release* /etc/*version*
    debian_version: buster/sid
    os-release:
        NAME="Ubuntu"
        VERSION="18.04.2 LTS (Bionic Beaver)"
        ID=ubuntu
        ID_LIKE=debian
        PRETTY_NAME="Ubuntu 18.04.2 LTS"
        VERSION_ID="18.04"
        HOME_URL="https://www.ubuntu.com/
        SUPPORT_URL="https://help.ubuntu.com/"

uname -a:
    Linux intel-sut 4.15.0-47-generic #50-Ubuntu SMP Wed Mar 13 10:44:52 UTC 2019 x86_64
    x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2017-5754 (Meltdown):          Not affected
CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB

run-level 5 May 6 20:10

SPEC is set to: /home/cpu2017
    Filesystem Type Size Used Avail Use% Mounted on
    /dev/sda2  ext4  439G  20G  398G  5% /
Dell Inc.
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Platform Notes (Continued)

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.
BIOS Dell Inc. 2.1.6 03/04/2019
Memory:
4x 00AD00B300AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933, configured at 2666
8x 00AD069D00AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933, configured at 2666
4x Not Specified Not Specified

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
CC  519.lbm_r(base) 538.imagick_r(base, peak) 544.nab_r(base, peak)
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
==============================================================================
CC   519.lbm_r(peak)
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
==============================================================================
CXXC 508.namd_r(base) 510.parest_r(base, peak)
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
==============================================================================
CXXC 508.namd_r(peak)
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
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Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

(Continued on next page)
Compiler Version Notes (Continued)

==============================================================================
CC  511.povray_r(base) 526.blender_r(base, peak)
==============================================================================
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
 Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
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==============================================================================

Expected on next page
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Software Availability: Mar-2019

Compiler Version Notes (Continued)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
icc -m64 -std=c11

C++ benchmarks:
icpc -m64

Fortran benchmarks:
ifort -m64

Benchmarks using both Fortran and C:
ifort -m64 icc -m64 -std=c11

Benchmarks using both C and C++:
icpc -m64 icc -m64 -std=c11

Benchmarks using Fortran, C, and C++:
icpc -m64 icc -m64 -std=c11 ifort -m64
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## 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:

- xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
- qopt-mem-layout-trans=4

### C++ benchmarks:

- xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
- qopt-mem-layout-trans=4

### Fortran benchmarks:

- xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
- qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
- align array32byte

### Benchmarks using both Fortran and C:

- xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
- qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
- align array32byte

### Benchmarks using both C and C++:

- xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
- qopt-mem-layout-trans=4

### Benchmarks using Fortran, C, and C++:

- xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
- qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
- align array32byte
Dell Inc. 

PowerEdge FC740 (Intel Xeon Gold 5220S, 2.70GHz) 

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---

**Peak Compiler Invocation**

C benchmarks:
`icc -m64 -std=c11`

C++ benchmarks:
`icpc -m64`

Fortran benchmarks:
`ifort -m64`

Benchmarks using both Fortran and C:
`ifort -m64 icc -m64 -std=c11`

Benchmarks using both C and C++:
`icpc -m64 icc -m64 -std=c11`

Benchmarks using Fortran, C, and C++:
`icpc -m64 icc -m64 -std=c11 ifort -m64`

---

**Peak Portability Flags**

Same as Base Portability Flags

---

**Peak Optimization Flags**

C benchmarks:

519.lbm_r: 
`-prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4`

538.imagick_r: 
`-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4`

544.nab_r: Same as 538.imagick_r

C++ benchmarks:

508.namd_r: 
`-prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4`

(Continued on next page)
SPEC CPU2017 Floating Point Rate Result

Dell Inc.
PowerEdge FC740 (Intel Xeon Gold 5220S, 2.70GHz)

SPECrate2017_fp_base = 192
SPECrate2017_fp_peak = 196

CPU2017 License: 55
Test Sponsor: Dell Inc.
Tested by: Dell Inc.
Test Date: Mar-2019
Hardware Availability: Apr-2019
Software Availability: Mar-2019

**Peak Optimization Flags (Continued)**

510.parest_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4

Fortran benchmarks:
503.bwaves_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -auto
-nostandard-realloc-lhs -align array32byte

549.fotonik3d_r: Same as 503.bwaves_r

554.roms_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

Benchmarks using both Fortran and C:
-prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

Benchmarks using both C and C++:
511.povray_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

526.blender_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4

Benchmarks using Fortran, C, and C++:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

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:
<table>
<thead>
<tr>
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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

Tested with SPEC CPU2017 v1.0.5 on 2019-05-07 01:26:56-0400.
Originally published on 2019-07-23.