Dell Inc.
PowerEdge MX840c (Intel Xeon Gold 5220, 2.20GHz)

SPEC CPU®2017 Floating Point Rate Result

SPECrate®2017_fp_base = 365
SPECrate®2017_fp_peak = 372

CPU2017 License: 55
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

Test Date: Apr-2019
Hardware Availability: Apr-2019
Software Availability: May-2019

Copies

<table>
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<th>Program</th>
<th>Value</th>
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<tr>
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<tr>
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<tr>
<td>508.namd_r</td>
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</table>

--- SPECrate®2017_fp_base (365) ---
--- SPECrate®2017_fp_peak (372) ---

**Hardware**

- **CPU Name:** Intel Xeon Gold 5220
- **Max MHz:** 3900
- **Nominal:** 2200
- **Enabled:** 72 cores, 4 chips
- **Orderable:** 2,4 chips
- **Cache L1:** 32 KB I + 32 KB D on chip per core
- **L2:** 1 MB I+D on chip per core
- **L3:** 24.75 MB I+D on chip per chip
- **Other:** None
- **Memory:** 768 GB (24 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 19.0.4.227 of Intel C/C++ Compiler Build 20190416 for Linux;
  Fortran: Version 19.0.4.227 of Intel Fortran Compiler Build 20190416 for Linux
- **Parallel:** No
- **Firmware:** Version 2.2.9 released May-2019
- **File System:** ext4
- **System State:** Run level 3 (multi-user)
- **Base Pointers:** 64-bit
- **Peak Pointers:** 64-bit
- **Other:** None
- **Power Management:** --
SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2019 Standard Performance Evaluation Corporation

Dell Inc.

PowerEdge MX840c (Intel Xeon Gold 5220, 2.20GHz)

SPECrate®2017_fp_base = 365
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Results Table

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<td>529</td>
<td>216</td>
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</tbody>
</table>

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:/home/cpu2017/je5.0.1-32:/home/cpu2017/je5.0.1-64"

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.
Prior to runcpu invocation

(Continued on next page)
SPEC CPU®2017 Floating Point Rate Result

Dell Inc.

PowerEdge MX840c (Intel Xeon Gold 5220, 2.20GHz)  

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</table>

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

General Notes (Continued)

Filesystem page cache synced and cleared with:
sync; echo 3>       /proc/sys/vm/drop_caches
runcpu command invoked through numacll i.e.:
umactl --interleave=all runcpu <etc>

Platform Notes

BIOS settings:  
ADDDC setting disabled  
Sub NUMA Cluster enabled  
Virtualization Technology disabled  
DCU Streamer Prefetcher disabled  
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 disabled  
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 9bcde8f2999c33d61f64985e45859ea9  
running on intel-sut Tue Sep 10 00:57:51 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 5220 CPU @ 2.20GHz
  4 "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 : 18
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
physical 2: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27
physical 3: 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

(Continued on next page)
## Dell Inc.

**PowerEdge MX840c (Intel Xeon Gold 5220, 2.20GHz)**

### SPEC CPU 2017 Floating Point Rate Result

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</table>

### Platform Notes (Continued)

- **Byte Order:** Little Endian
- **CPU(s):** 72
- **On-line CPU(s) list:** 0-71
- **Thread(s) per core:** 1
- **Core(s) per socket:** 18
- **Socket(s):** 4
- **NUMA node(s):** 4
- **Vendor ID:** GenuineIntel
- **CPU family:** 6
- **Model:** 85
- **Model name:** Intel(R) Xeon(R) Gold 5220 CPU @ 2.20GHz
- **Stepping:** 6
- **CPU MHz:** 1978.163
- **BogoMIPS:** 4400.00
- **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 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 aes xsave avx f16c rdrand lahf_lm abm 3nowprefetch cpuid_fault epb cat_l3 cdp_l3 invpcid_single intel_pinn ssbd mba ibrs ibpb ibrs_enhanced tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erts invpcid rtm cmq mxp rdt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occult_llc cqm_mbb_total cqm_mbb_local dtherm ida arat pln pts pku ospke avx512_vnni flush_l1d arch_capabilities

### Platform Notes (Continued)

/proc/cpuinfo cache data
cache size : 25344 KB

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:** 191915 MB
- **node 0 free:** 191313 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:** 193532 MB
- **node 1 free:** 192785 MB

(Continued on next page)
SPEC CPU®2017 Floating Point Rate Result

Dell Inc.

PowerEdge MX840c (Intel Xeon Gold 5220, 2.20GHz)

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CPU2017 License: 55
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

Platform Notes (Continued)

node 2 cpus: 2 6 10 14 18 22 26 30 34 38 42 46 50 54 58 62 66 70
node 2 size: 193511 MB
node 2 free: 192935 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: 193531 MB
node 3 free: 193025 MB
node distances:
node 0 1 2 3
0: 10 21 31 21
1: 21 10 21 31
2: 31 21 10 21
3: 21 31 21 10

From /proc/meminfo
MemTotal: 791029992 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

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 4.15.0-45-generic #48-Ubuntu SMP Tue Jan 29 16:28:13 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 3 Sep 9 16:58

SPEC is set to: /home/cpu2017

Filesystem Type Size Used Avail Use% Mounted on

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Dell Inc.  
PowerEdge MX840c (Intel Xeon Gold 5220, 2.20GHz)  

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**Platform Notes (Continued)**

```
/dev/sda2    ext4  439G   31G  386G  8% /
```

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. 2.2.9 05/08/2019
Memory:
16x 00AD00B300AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933, configured at 2666
8x 00AD063200AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933, configured at 2666
24x Not Specified Not Specified

(End of data from sysinfo program)

```
Compiler Version Notes

C
| 519.lbm_r(base, peak) 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 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

C++
| 508.namd_r(base, peak) 510.parest_r(base, peak)
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

C++, C
| 511.povray_r(base, peak) 526.blender_r(base, peak)
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
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Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

C++, C, Fortran
| 507.cactuBSSN_r(base, peak)
(Continued on next page)
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Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

Fortran | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)
        | 554.roms_r(base, peak)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

Fortran, C | 521.wrf_r(base, peak) 527.cam4_r(base, peak)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 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

(Continued on next page)
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**Base Compiler Invocation (Continued)**

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

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

**Base Portability Flags**

503. bwaves_r: -DSPEC_LP64
507. cactusBSSN_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:
```bash
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4
```

C++ benchmarks:
```bash
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4
```

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

(Continued on next page)
Dell Inc. PowerEdge MX840c (Intel Xeon Gold 5220, 2.20GHz)

SPECrate®2017_fp_base = 365
SPECrate®2017_fp_peak = 372

Base Optimization Flags (Continued)

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

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

(Continued on next page)
Peak Optimization Flags (Continued)

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

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

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

(Continued on next page)
### Dell Inc.

**PowerEdge MX840c (Intel Xeon Gold 5220, 2.20GHz)**

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#### SPECrate®2017_fp_base = 365

#### SPECrate®2017_fp_peak = 372

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## Peak Optimization Flags (Continued)

**Benchmarks using Fortran, C, and C++ (continued):**

- `-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: