Dell Inc.

PowerEdge MX840c (Intel Xeon Gold 5220, 2.20GHz)

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

<table>
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<th>Copy</th>
<th>SPECrate®2017_int_base</th>
<th>SPECrate®2017_int_peak</th>
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<tr>
<td>500.perlbench_r</td>
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<td>(337)</td>
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<td>(385)</td>
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<td></td>
</tr>
<tr>
<td>557.xz_r</td>
<td>(186)</td>
<td></td>
</tr>
</tbody>
</table>

---

**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:** 32/64-bit  
- **Other:** jemalloc memory allocator V5.0.1  
- **Power Management:** --
Dell Inc. PowerEdge MX840c (Intel Xeon Gold 5220, 2.20GHz)

**SPECrate®2017_int_base = 328**

**SPECrate®2017_int_peak = 337**

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</table>

**SPECrate®2017_int_base = 328**

**SPECrate®2017_int_peak = 337**

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:

```
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>
```

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

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

**SPECrater®2017_int_base = 328**

**SPECrater®2017_int_peak = 337**

<table>
<thead>
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<th>Test Date:</th>
<th>Test Sponsor:</th>
<th>Hardware Availability:</th>
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<td>Apr-2019</td>
<td>Dell Inc.</td>
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</tr>
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<td>Tested by:</td>
<td>Dell Inc.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### General Notes (Continued)

jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

#### 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 Mon Sep 9 19:11:05 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
- Byte Order: Little Endian

(Continued on next page)
SPEC CPU®2017 Integer Rate Result
Copyright 2017-2019 Standard Performance Evaluation Corporation

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

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CPU2017 License: 55
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Tested by: Dell Inc.

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

Platform Notes (Continued)

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: 1996.533
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 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
xtrn pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt aes xsave avx f16c rdrnd
lahf_lm abm 3dnowprefetch cpuid_fault ebpx cat_l3 cdpl_l3 invpcid_single intel_ppi
ssbd mba ibrs ibpb ibrs_enhanced tpr_shadow vnumi flexpriority ept vpid
fsyncbase tsc_adjust bmi1 hle avx2 smep bmi2 erness invpcid rtl cqm mpex rdt_a avx512f
avx512dq rsseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl
xsaveopt xsaves cqm_llc cqm_occum_llc cqm_mbb_total cqm_mbb_local
dtherm ida arat pln pts pku ospke avx512_vnni flush_l1d arch_capabilities

/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: 191545 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: 193176 MB
      node 2 cpus: 2 6 10 14 18 22 26 30 34 38 42 46 50 54 58 62 66 70

(Continued on next page)
Dell Inc.

PowerEdge MX840c (Intel Xeon Gold 5220, 2.20GHz)

SPEC CPU®2017 Integer Rate Result

Copyright 2017-2019 Standard Performance Evaluation Corporation

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CPU2017 License: 55
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Test Date: Apr-2019
Hardware Availability: Apr-2019
Software Availability: May-2019

Platform Notes (Continued)

node 2 size: 193511 MB
node 2 free: 193176 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: 193276 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

/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 4.15.0-45-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
/dev/sda2 ext4 439G 31G 386G 8% /

(Continued on next page)
**Standard Performance Evaluation Corporation**

**SPEC CPU®2017 Integer Rate Result**

**Dell Inc.**

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

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

**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. 2.2.9 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 | 502.gcc_r(peak)
```

- **Intel(R) C Intel(R) 64 Compiler for applications running on IA-32, Version 19.0.4.227 Build 20190416**
- **Copyright (C) 1985-2019 Intel Corporation. All rights reserved.**

```
C | 500.perlbench_r(base, peak) 502.gcc_r(base) 505.mcf_r(base, peak)
   | 525.x264_r(base, peak) 557.xz_r(base, peak)
```

- **Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416**
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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**

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

Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

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### C++

<table>
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<tbody>
<tr>
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Intel(R) C++ Intel(R) 64 Compiler for applications running on IA-32, Version 19.0.4.227 Build 20190416
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### Fortran

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<td>548.exchange2_r(base, peak)</td>
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Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416
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## SPEC CPU®2017 Integer Rate Result

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

### SPECrate®2017 int_base = 328  
### SPECrate®2017 int_peak = 337

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

### Base Compiler Invocation

C benchmarks:  
icc -m64 -std=c11  

C++ benchmarks:  
icpc -m64  

Fortran benchmarks:  
ifort -m64

### Base Portability Flags

- 500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64  
- 502.gcc_r: -DSPEC_LP64  
- 505.mcf_r: -DSPEC_LP64  
- 520.omnetpp_r: -DSPEC_LP64  
- 523.xalancbmk_r: -DSPEC_LP64 -DSPEC_LINUX  
- 525.x264_r: -DSPEC_LP64  
- 531.deepsjeng_r: -DSPEC_LP64  
- 541.leela_r: -DSPEC_LP64  
- 548.exchange2_r: -DSPEC_LP64  
- 557.xz_r: -DSPEC_LP64

### Base Optimization Flags

C benchmarks:  
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div  
-qopt-mem-layout-trans=4  
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64  
-lqkmalloc  

C++ benchmarks:  
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div  
-qopt-mem-layout-trans=4  
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64  
-lqkmalloc

Fortran benchmarks:  
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div  
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte  
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64  
-lqkmalloc
### Dell Inc.

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**Software Availability:** May-2019

### Peak Compiler Invocation

C benchmarks (except as noted below):

```bash
icc -m64 -std=c11
```


C++ benchmarks (except as noted below):

```bash
icpc -m64
```

523.xalancbmk_r:icpc -m32 -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/ia32_lin

### Peak Portability Flags

- **500.perlbench_r:** -DSPEC_LP64  
- **502.gcc_r:** -D_FILE_OFFSET_BITS=64  
- **505.mcf_r:** -DSPEC_LP64  
- **520.ommnetpp_r:** -DSPEC_LP64  
- **523.xalancbmk_r:** -D_FILE_OFFSET_BITS=64 -DSPEC_LINUX  
- **525.x264_r:** -DSPEC_LP64  
- **531.deepsjeng_r:** -DSPEC_LP64  
- **541.leela_r:** -DSPEC_LP64  
- **548.exchange2_r:** -DSPEC_LP64  
- **557.xz_r:** -DSPEC_LP64

### Peak Optimization Flags

C benchmarks:

```bash
500.perlbench_r: -Wl,-z,muldefs -prof-gen(pass l) -prof-use(pass 2) -ipo  
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=4  
-fno-strict-overflow  
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64  
-lqkmalloc
```

502.gcc_r: -Wl,-z,muldefs -prof-gen(pass l) -prof-use(pass 2) -ipo  
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=4  
-L/usr/local/jemalloc  
-Ljalaloc

505.mcf_r: -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div  
-qopt-mem-layout-trans=4

(Continued on next page)
SPEC CPU®2017 Integer Rate Result
Copyright 2017-2019 Standard Performance Evaluation Corporation

Dell Inc.
PowerEdge MX840c (Intel Xeon Gold 5220, 2.20GHz)  SPECrate®2017_int_base = 328  SPECrate®2017_int_peak = 337

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

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

Peak Optimization Flags (Continued)

505.mcf_r (continued):
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

525.x264_r: -W1, -z, muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -fno-alias
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

557.xz_r: Same as 505.mcf_r

C++ benchmarks:

520.omnetpp_r: -W1, -z, muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

523.xalancbk_r: -W1, -z, muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=4
-L/usr/local/je5.0.1-32/lib -ljemalloc

531.deepsjeng_r: Same as 520.omnetpp_r

541.leela_r: Same as 520.omnetpp_r

Fortran benchmarks:
-W1, -z, muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

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:
Dell Inc.

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