# SPEC® CPU2017 Integer Speed Result

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL325 Gen10  
(3.10 GHz, AMD EPYC 7371)

<table>
<thead>
<tr>
<th>SPECspeed2017_int_base</th>
<th>8.15</th>
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<tbody>
<tr>
<td>SPECspeed2017_int_peak</td>
<td>8.34</td>
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<td>3</td>
<td>Feb-2019</td>
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<tr>
<th>Threads (8.34)</th>
<th>SPECspeed2017_int_base (8.15)</th>
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<tbody>
<tr>
<td>600.perlbench_s 16</td>
<td>4.14</td>
<td>8.81</td>
</tr>
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<td>4.54</td>
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<tr>
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<td>5.13</td>
<td>11.4</td>
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<td>620.omnetpp_s 16</td>
<td></td>
<td>11.9</td>
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<tr>
<td>623.xalancbmk_s 32</td>
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<tr>
<td>625.x264_s 16</td>
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<td>9.43</td>
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<tr>
<td>631.deepsjeng_s 32</td>
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<tr>
<td>648.exchange2_s 16</td>
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<td>4.10</td>
</tr>
<tr>
<td>657.xz_s 16</td>
<td></td>
<td>14.6</td>
</tr>
</tbody>
</table>

## Hardware

- **CPU Name**: AMD EPYC 7371  
- **Max MHz.**: 3800  
- **Nominal**: 3100  
- **Enabled**: 16 cores, 1 chip  
- **Orderable**: 1 chip  
- **Cache L1**: 64 KB I + 32 KB D on chip per core  
- **L2**: 512 KB I+D on chip per core  
- **L3**: 64 MB I+D on chip per chip, 8 MB shared / 2 cores  
- **Other**: None  
- **Memory**: 512 GB (8 x 64 GB 4Rx4 PC4-2666V-L)  
- **Storage**: 1 x 400 GB SAS SSD RAID 0  
- **Other**: None

## Software

- **OS**: SUSE linux Enterprise Server 12 (x86_64) SP3  
- **Compiler**: C/C++: Version 1.2.1 of AOCC  
- **Fortran**: Version 4.8.2 of GCC  
- **Parallel**: Yes  
- **Firmware**: HPE BIOS Version A41 10/02/2018 released Oct-2018  
- **File System**: btrfs  
- **System State**: Run level 3 (multi-user)  
- **Base Pointers**: 64-bit  
- **Peak Pointers**: 32/64-bit  
- **Other**: jemalloc memory allocator library V5.1.0
Hewlett Packard Enterprise
(Test Sponsor: HPE)
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CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Results Table

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<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<td>4.14</td>
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<tr>
<td>620.omnetpp_s</td>
<td>16</td>
<td>318</td>
<td>5.13</td>
<td>316</td>
<td>5.16</td>
<td>339</td>
<td>4.81</td>
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<td>5.13</td>
<td>316</td>
<td>5.16</td>
<td>339</td>
<td>4.81</td>
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<td>16</td>
<td>161</td>
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<td>657.xz_s</td>
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<td>19.3</td>
<td>321</td>
<td>19.3</td>
<td>16</td>
<td>320</td>
<td>19.3</td>
<td>320</td>
<td>19.3</td>
<td>320</td>
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</tr>
</tbody>
</table>

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

Compiler Notes

The AMD64 AOCC Compiler Suite is available at http://developer.amd.com/amd-aocc/

The AOCC Gold Linker plugin was installed and used for the link stage.

The AOCC Fortran Plugin version 1.2.0 was used to leverage AOCC optimizers with gfortran. It is available here: http://developer.amd.com/amd-aocc/

jemalloc uses environment variable MALLOC_CONF with values narenas and lg_chunk:
- narenas: sets the maximum number of arenas to use for automatic multiplexing of threads and arenas.
- lg_chunk: set the virtual memory chunk size (log base 2). For example, lg_chunk:21 sets the default chunk size to 2^21 = 2MiB.

Operating System Notes

'ulimit -s unlimited' was used to set environment stack size
'ulimit -l 2097152' was used to set environment locked pages in memory limit

runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>

Set dirty_ratio=8 to limit dirty cache to 8% of memory
Set swappiness=1 to swap only if necessary
Set zone_reclaim_mode=1 to free local node memory and avoid remote memory
sync then drop_caches=3 to reset caches before invoking runcpu

(Continued on next page)
Operating System Notes (Continued)

dirty_ratio, swappiness, zone_reclaim_mode and drop_caches were all set using privileged echo (e.g. echo 1 > /proc/sys/vm/swappiness).

Transparent huge pages were enabled for this run (OS default)

General Notes

Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-31"
OMP_PROC_BIND = "true"
OMP_STACKSIZE = "192M"
OMP_WAIT_POLICY = "active"

Binaries were compiled on a system with 2x AMD EPYC 7601 CPU + 512GB Memory using RHEL 7.4

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.
jemalloc: configured and built with GCC v4.8.2 in RHEL v7.2 under default conditions.

Platform Notes

BIOS Configuration
AMD SMT Option set to Disabled
Thermal Configuration set to Maximum Cooling
Performance Determinism set to Power Deterministic
Workload Power and Utilization Monitoring set to Disabled
Minimum Processor Idle Power core C-State set to C6 State
Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
running on linux-qlr8 Thu Feb  7 14:37:19 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 : AMD EPYC 7371 16-Core Processor
  1 "physical id"s (chips)
  16 "processors"

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

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 : 16
- siblings : 16
- physical 0: cores 0 1 8 9 16 17 24 25 32 33 40 41 48 49 56 57

From lscpu:
- Architecture: x86_64
- CPU op-mode(s): 32-bit, 64-bit
- Byte Order: Little Endian
- CPU(s): 16
- On-line CPU(s) list: 0-15
- Thread(s) per core: 1
- Core(s) per socket: 16
- Socket(s): 1
- NUMA node(s): 4
- Vendor ID: AuthenticAMD
- CPU family: 23
- Model: 1
- Model name: AMD EPYC 7371 16-Core Processor
- Stepping: 2
- CPU MHz: 3100.000
- CPU max MHz: 3100.0000
- CPU min MHz: 2500.0000
- BogoMIPS: 6188.22
- Virtualization: AMD-V
- L1d cache: 32K
- L1i cache: 64K
- L2 cache: 512K
- L3 cache: 8192K
- NUMA node0 CPU(s): 0-3
- NUMA node1 CPU(s): 4-7
- NUMA node2 CPU(s): 8-11
- NUMA node3 CPU(s): 12-15
- Flags: fpu vme de pse tsc msr pae mca cmov pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb rdtscp lm constant_tsc rep_good nopl nonstop_tsc extd_apicid amdipherals eagerfpu pni pclmulqdq mdiv deprecated_bdsrock msr_dtes64 msr_tsc msr_mivs msr_aarch64.fsrm msr_aarch64.usrm msr_aarch64.usc0 msr_aarch64.usc1 msr_aarch64.usc3 msr_aarch64.usc7\n\n/proc/cpuinfo cache data
- cache size : 512 KB

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**Hewlett Packard Enterprise**

**(Test Sponsor: HPE)**

**ProLiant DL325 Gen10**

**(3.10 GHz, AMD EPYC 7371)**

**CPU2017 License:** 3

**Test Date:** Feb-2019

**Test Sponsor:** HPE

**Hardware Availability:** Apr-2019

**Tested by:** HPE

**Software Availability:** Jul-2018
## Platform Notes (Continued)

Warning: a numactl 'node' might or might not correspond to a physical chip.

```plaintext
From numactl --hardware

available: 4 nodes (0-3)
node 0 cpus: 0 1 2 3
node 0 size: 128841 MB
node 0 free: 128663 MB
node 1 cpus: 4 5 6 7
node 1 size: 129022 MB
node 1 free: 128871 MB
node 2 cpus: 8 9 10 11
node 2 size: 129022 MB
node 2 free: 128916 MB
node 3 cpus: 12 13 14 15
node 3 size: 129022 MB
node 3 free: 128850 MB
node distances:
   node   0   1   2   3
0: 10 16 16 16
1: 16 10 16 16
2: 16 16 10 16
3: 16 16 16 10
```

From /proc/meminfo
```
MemTotal:       528291400 kB
HugePages_Total:       0
Hugepagesize:       2048 kB
```

```plaintext
/usr/bin/lsb_release -d
SUSE Linux Enterprise Server 12 SP3
```

From /etc/*release* /etc/*version*
```
SuSE-release:
   SUSE Linux Enterprise Server 12 (x86_64)
   VERSION = 12
   PATCHLEVEL = 3
# This file is deprecated and will be removed in a future service pack or release.
# Please check /etc/os-release for details about this release.
```

```plaintext
os-release:
   NAME="SLES"
   VERSION="12-SP3"
   VERSION_ID="12.3"
   PRETTY_NAME="SUSE Linux Enterprise Server 12 SP3"
   ID="sles"
   ANSI_COLOR="0;32"
   CPE_NAME="cpe:/o:suse:sles:12:sp3"

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SPEC CPU2017 Integer Speed Result

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SPECspeed2017_int_base = 8.15
SPECspeed2017_int_peak = 8.34

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Platform Notes (Continued)

uname -a:
    Linux linux-qlr8 4.4.132-94.33-default #1 SMP Tue May 29 20:09:56 UTC 2018 (76aae3b)
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: Full AMD retpoline + IBPB

run-level 3 Feb 7 14:36

SPEC is set to: /home/cpu2017
Filesystem Type Size Used Avail Use% Mounted on
/dev/sda4 xfs 331G 4.4G 326G 2% /home

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 HPE A41 10/02/2018
Memory:
    8x UNKNOWN NOT AVAILABLE
    8x UNKNOWN NOT AVAILABLE 64 GB 4 rank 2666

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
CXXC 623.xalancbmk_s(peak)
==============================================================================
AOCC.LLVM.1.2.1.B29.2018_05_14 clang version 6.0.0 (CLANG:
b6b3d31d6df08fb7da935a28842b39b7b3c2c55b) (llvm/cpu/llvm
18855c80ed252fc4ba4ac41e2086627ef2bd0d04) (based on LLVM
AOCC.LLVM.1.2.1.B29.2018_05_14)
Target: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.2.1/AOCC-1.2.1-Compiler/bin
==============================================================================
CC  600.perlbench_s(base) 602.gcc_s(base, peak) 605.mcf_s(base, peak)
    625.x264_s(base) 657.xz_s(base, peak)
==============================================================================
AOCC.LLVM.1.2.1.B29.2018_05_14 clang version 6.0.0 (CLANG:

(Continued on next page)
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SPECspeed2017_int_base = 8.15
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Compiler Version Notes (Continued)

b6b3d31d6df08fb7da935a28842b39b7b3c2c55b) (llvm/cpu/llvm
18855c80ed252fc4ba4ac41e2086627ef2bddd04) (based on LLVM
AOCC.LLVM.1.2.1.B29.2018_05_14)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.2.1/AOCC-1.2.1-Compiler/bin

==============================================================================
CXXC 620.omnetpp_s(base, peak) 623.xalancbmk_s(base) 631.deepsjeng_s(base, peak) 641.leela_s(base)
==============================================================================
AOCC.LLVM.1.2.1.B29.2018_05_14 clang version 6.0.0 (CLANG:
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Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.2.1/AOCC-1.2.1-Compiler/bin

==============================================================================
CC 600.perlbench_s(peak) 625.x264_s(peak)
==============================================================================
AOCC.LLVM.1.2.1.B29.2018_05_14 clang version 6.0.0 (CLANG:
b6b3d31d6df08fb7da935a28842b39b7b3c2c55b) (llvm/cpu/llvm
18855c80ed252fc4ba4ac41e2086627ef2bddd04) (based on LLVM
AOCC.LLVM.1.2.1.B29.2018_05_14)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.2.1/AOCC-1.2.1-Compiler/bin

==============================================================================
CXXC 641.leela_s(peak)
==============================================================================
AOCC.LLVM.1.2.1.B29.2018_05_14 clang version 6.0.0 (CLANG:
b6b3d31d6df08fb7da935a28842b39b7b3c2c55b) (llvm/cpu/llvm
18855c80ed252fc4ba4ac41e2086627ef2bddd04) (based on LLVM
AOCC.LLVM.1.2.1.B29.2018_05_14)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.2.1/AOCC-1.2.1-Compiler/bin

==============================================================================
FC 648.exchange2_s(base, peak)
(Continued on next page)
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### Compiler Version Notes (Continued)

GNU Fortran (GCC) 4.8.2  
Copyright (C) 2013 Free Software Foundation, Inc.  
GNU Fortran comes with NO WARRANTY, to the extent permitted by law.  
You may redistribute copies of GNU Fortran  
under the terms of the GNU General Public License.  
For more information about these matters, see the file named COPYING

### Base Compiler Invocation

C benchmarks:
- clang

C++ benchmarks:
- clang++

Fortran benchmarks:
- clang gfortran

### Base Portability Flags

- 600.perlbench_s: -DSPEC_LINUX_X64 -DSPEC_LP64
- 602.gcc_s: -DSPEC_LP64
- 605.mcf_s: -DSPEC_LP64
- 620.omnetpp_s: -DSPEC_LP64
- 623.xalancbmk_s: -DSPEC_LINUX -DSPEC_LP64
- 625.x264_s: -DSPEC_LP64
- 631.deepsjeng_s: -DSPEC_LP64
- 641.leela_s: -DSPEC_LP64
- 648.exchange2_s: -DSPEC_LP64
- 657.xz_s: -DSPEC_LP64

### Base Optimization Flags

C benchmarks:
- -flto -fuse-ld=lld -Wl,-mllvm -Wl,-function-specialize -O3  
- -ffast-math -march=znver1 -fstruct-layout=3
- -mllvm -unroll-threshold=50 -fremap-arrays -mno-avx2
- -mllvm -inline-threshold=1000 -flv-function-specialization
- -mllvm -enable-gvn-hoist -mllvm -function-specialize -z muldefs

(Continued on next page)
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### Base Optimization Flags (Continued)

C benchmarks (continued):
- lamdlibm -DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -ljemalloc

C++ benchmarks:
- Wl,-mllvm -Wl,--use-vzeroupper=false -flto -fuse-ld=lld
- Wl,-mllvm -Wl,-function-specialize -O3 -march=znver1 -ffast-math
- mllvm -unroll-threshold=100 -flv-function-specialization
- mllvm -enable-partial-unswitch -fremap-arrays
- mllvm -inline-threshold=1000 -z muldefs -lamdlibm -DSPEC_OPENMP
- fopenmp -fopenmp=libomp -lomp -ljemalloc

Fortran benchmarks:
- Wl,-mllvm -Wl,-inline-recursion=4 -Wl,-mllvm -Wl,-lsr-in-nested-loop
- Wl,-mllvm -Wl,-enable-iv-split -Wl,-mllvm -Wl,-merge-constant
- Wl,-mllvm -Wl,-unroll-aggressive -Wl,-mllvm -Wl,-unroll-threshold=150
- flto -fuse-ld=lld -Wl,-mllvm -Wl,-function-specialize -O3
- funroll-loops -ffast-math -z muldefs -lamdlibm -fplugin=dragonegg.so
- specs= integrated-as.specs
- fplugin-arg-dragonegg-llvm-option=-disable-indvar-simplify
- fplugin-arg-dragonegg-llvm-option=-unroll-aggressive
- fplugin-arg-dragonegg-llvm-option=-unroll-threshold:150 -DSPEC_OPENMP
- fopenmp -fopenmp=libomp -lomp -ljemalloc -lgfortran

### Base Other Flags

C benchmarks:
- Wno-return-type -DUSE_OPENMP

C++ benchmarks:
- Wno-return-type -DUSE_OPENMP

Fortran benchmarks:
- DUSE_OPENMP  -Wno-return-type

### Peak Compiler Invocation

C benchmarks:
- clang

C++ benchmarks:
- clang++

(Continued on next page)
SPEC CPU2017 Integer Speed Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL325 Gen10
(3.10 GHz, AMD EPYC 7371)

<table>
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CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Test Date: Feb-2019
Hardware Availability: Apr-2019
Software Availability: Jul-2018

Peak Compiler Invocation (Continued)

Fortran benchmarks:
clang gfortran

Peak Portability Flags

600.perlbench_s: -DSPEC_LINUX_X64 -DSPEC_LP64
602.gcc_s: -DSPEC_LP64
605.mcf_s: -DSPEC_LP64
620.omnetpp_s: -DSPEC_LP64
623.xalancbmk_s: -DSPEC_LINUX -D_FILE_OFFSET_BITS=64
625.x264_s: -DSPEC_LP64
631.deepsjeng_s: -DSPEC_LP64
641.leela_s: -DSPEC_LP64
648.exchange2_s: -DSPEC_LP64
657.xz_s: -DSPEC_LP64

Peak Optimization Flags

C benchmarks:

600.perlbench_s: -flto -fuse-ld=lld -Wl,-mllvm -Wl,-function-specialize
   -fprofile-instr-generate(pass 1)
   -fprofile-instr-use(pass 2) -Ofast -march=znver1
   -mno-sse4a -fstruct-layout=5
   -mllvm -vectorize-memory-aggressively -mno-avx2
   -mllvm -unroll-threshold=50 -fremap-arrays
   -mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
   -flv-function-specialization
   -mllvm -enable-vectorize-compare -z muldefs -lamdlibm
   -DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -ljemalloc

602.gcc_s: basepeak = yes

605.mcf_s: -flto -fuse-ld=lld -Wl,-mllvm -Wl,-function-specialize
   -Ofast -march=znver1 -mno-sse4a -fstruct-layout=5
   -mllvm -vectorize-memory-aggressively -mno-avx2
   -mllvm -unroll-threshold=50 -fremap-arrays
   -mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
   -flv-function-specialization
   -mllvm -enable-vectorize-compare -z muldefs -lamdlibm
   -DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -ljemalloc

(Continued on next page)
SPEC CPU2017 Integer Speed Result

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Peak Optimization Flags (Continued)

625.x264_s: Same as 600.perlbench_s

657.xz_s: Same as 605.mcf_s

C++ benchmarks:

620.omnetpp_s: basepeak = yes

623.xalancbmk_s: -m32 -fuse-ld=lld -Wl,-mllvm -Wl,-x86-use-vzeroupper=false -flto -Wl,-mllvm -Wl,-function-specialize -Ofast
-march=znver1 -flv-function-specialization
-mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -z muldefs -DSPEC_OPENMP
-fopenmp -fopenmp=libomp -lomp -libs-revA/32 -ljemalloc

631.deepsjeng_s: -Wl,-mllvm -Wl,-x86-use-vzeroupper=false -flto
-fuse-ld=lld -Wl,-mllvm -Wl,-function-specialize -Ofast
-march=znver1 -flv-function-specialization
-mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -z muldefs -lamdlibm -DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -ljemalloc

641.leela_s: basepeak = yes

Fortran benchmarks:
-Wl,-mllvm -Wl,-inline-recursion=4 -Wl,-mllvm -Wl,-lsr-in-nested-loop
-Wl,-mllvm -Wl,-enable-iv-split -Wl,-mllvm -Wl,-merge-constant
-Wl,-mllvm -Wl,-unroll-aggressive -Wl,-mllvm -Wl,-unroll-threshold=150
-flto -fuse-ld=lld -Wl,-mllvm -Wl,-function-specialize -O3
-funroll-loops -ffast-math -z muldefs -lamdlibm -fplugin=dragonegg.so
-specs=integrated-as.specs
-fplugin-arg-dragonegg-llvm-option=-disable-indvar-simplify
-fplugin-arg-dragonegg-llvm-option=-unroll-aggressive
-fplugin-arg-dragonegg-llvm-option=-unroll-threshold:150 -DSPEC_OPENMP
-fopenmp -fopenmp=libomp -lomp -ljemalloc -lgfortran

Peak Other Flags

C benchmarks:
- Wno-return-type -DUSE_OPENMP

C++ benchmarks (except as noted below):
- Wno-return-type -DUSE_OPENMP

(Continued on next page)
**SPEC CPU2017 Integer Speed Result**

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### Peak Other Flags (Continued)

623.xalancbmk_s: -Wno-return-type -DUSE_OPENMP  
-L/root/work/cpu2017/v105/amd1806-speed

Fortran benchmarks:  
-DUSE_OPENMP -Wno-return-type

The flags files that were used to format this result can be browsed at  
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revD.html

You can also download the XML flags sources by saving the following links:  
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revD.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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