SPEC CPU®2017 Integer Rate Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

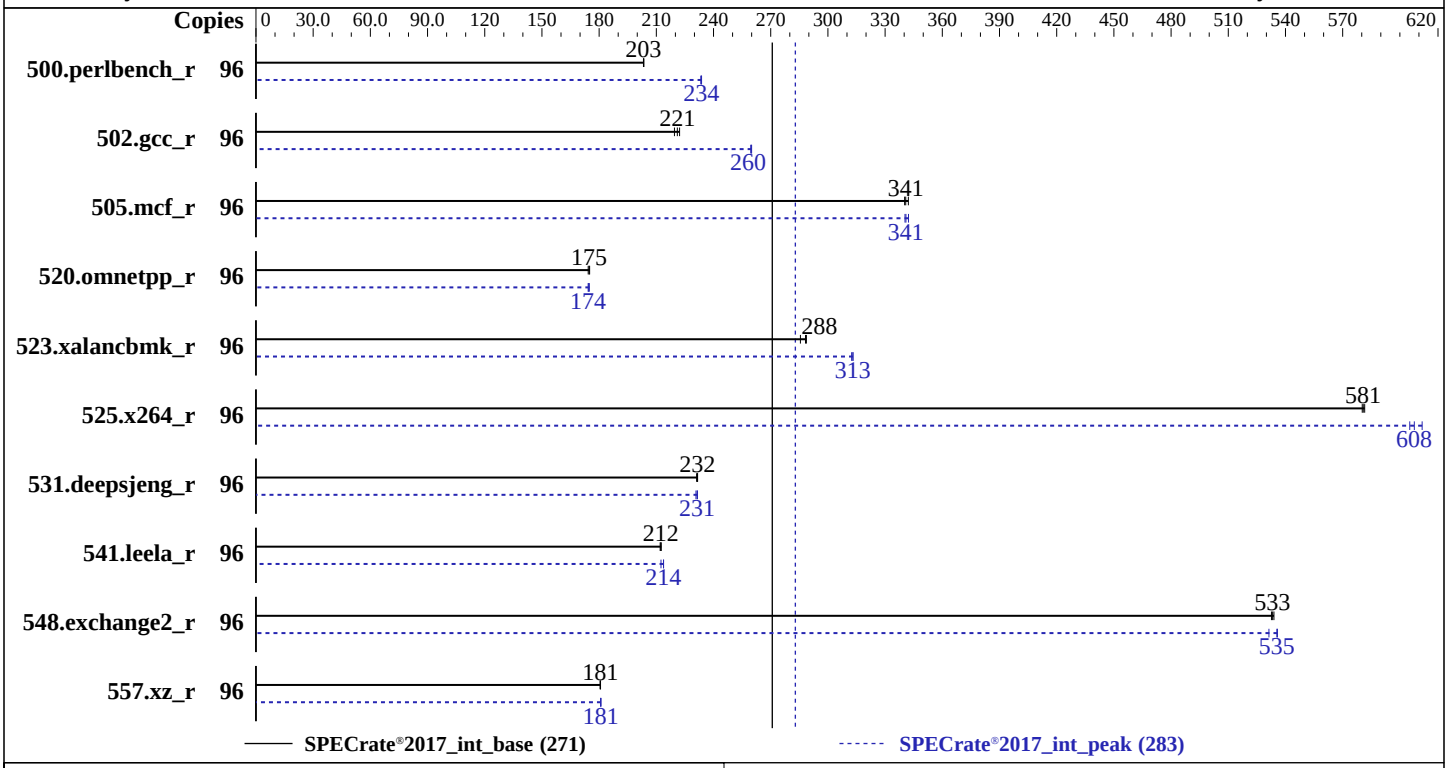
ProLiant DL360 Gen10
(2.20 GHz, Intel Xeon Gold 5220R)

SPECrate®2017_int_base = 271

SPECrate®2017_int_peak = 283

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

Test Date: Feb-2020
Hardware Availability: Apr-2020
Software Availability: Jun-2019



Hardware

CPU Name:	Intel Xeon Gold 5220R
Max MHz:	4000
Nominal:	2200
Enabled:	48 cores, 2 chips, 2 threads/core
Orderable:	1, 2 chip(s)
Cache L1:	32 KB I + 32 KB D on chip per core
L2:	1 MB I+D on chip per core
L3:	35.75 MB I+D on chip per chip
Other:	None
Memory:	384 GB (24 x 16 GB 2Rx8 PC4-2933Y-R, running at 2666)
Storage:	1 x 400 GB SAS SSD, RAID 0
Other:	None

Software

OS:	SUSE Linux Enterprise Server 15 SP1 (x86_64) Kernel 4.12.14-195-default
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:	HPE BIOS Version U32 v2.22 (11/13/2019) released Apr-2020
File System:	btrfs
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:	BIOS set to prefer performance at the cost of additional power usage

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Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	96	**752**	**203**	752	203	751	203	96	654	234	**654**	**234**	655	233
502.gcc_r	96	**615**	**221**	612	222	619	220	96	524	260	523	260	**523**	**260**
505.mcf_r	96	453	342	**455**	**341**	456	340	96	453	342	456	340	**455**	**341**
520.omnetpp_r	96	723	174	720	175	**721**	**175**	96	723	174	**723**	**174**	720	175
523.xalancbmk_r	96	355	286	**352**	**288**	351	289	96	324	313	**324**	**313**	324	312
525.x264_r	96	**289**	**581**	289	582	290	580	96	278	605	**277**	**608**	275	612
531.deepsjeng_r	96	476	231	**475**	**232**	475	232	96	**476**	**231**	475	232	477	231
541.leela_r	96	750	212	748	213	**749**	**212**	96	**744**	**214**	744	214	748	212
548.exchange2_r	96	471	534	472	533	**472**	**533**	96	**470**	**535**	469	536	473	531
557.xz_r	96	574	181	574	181	**574**	**181**	96	573	181	573	181	**573**	**181**

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SPECrate®2017_int_peak = 283

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"
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
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
     "/home/cpu2017/lib/intel64:/home/cpu2017/lib/ia32:/home/cpu2017/je5.0.1-
     32"
```

General Notes

```
 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)
```

(Continued on next page)

General Notes (Continued)

```
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, a general purpose malloc implementation
 built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5
 sources available from jemalloc.net or https://github.com/jemalloc/jemalloc/releases
```

Platform Notes

```
BIOS Configuration:
 Thermal Configuration set to Maximum Cooling
 Memory Patrol Scrubbing set to Disabled
 LLC Prefetch set to Enabled
 LLC Dead Line Allocation set to Disabled
 Enhanced Processor Performance set to Enabled
 Workload Profile set to General Throughput Compute
 Workload Profile set to Custom
  Energy/Performance Bias set to Balanced Performance

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edb1e6e46a485a0011
running on linux-z3xp Wed Feb 26 06:50:33 2020

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 5220R CPU @ 2.20GHz
      2  "physical id"s (chips)
      96 "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 : 24
      siblings  : 48
      physical 0: cores 0 1 2 3 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29
      physical 1: cores 0 1 2 3 4 8 9 10 11 12 13 16 17 18 19 20 21 25 26 27 28 29

From lscpu:
     Architecture:        x86_64
     CPU op-mode(s):      32-bit, 64-bit
     Byte Order:          Little Endian
     Address sizes:       46 bits physical, 48 bits virtual
     CPU(s):              96
```

(Continued on next page)

Platform Notes (Continued)

```
      On-line CPU(s) list: 0-95
      Thread(s) per core:  2
      Core(s) per socket:  24
      Socket(s):           2
      NUMA node(s):        4
      Vendor ID:           GenuineIntel
      CPU family:          6
      Model:               85
      Model name:          Intel(R) Xeon(R) Gold 5220R CPU @ 2.20GHz
      Stepping:            7
      CPU MHz:             2200.000
      BogoMIPS:            4400.00
      Virtualization:      VT-x
      L1d cache:           32K
      L1i cache:           32K
      L2 cache:            1024K
      L3 cache:            36608K
      NUMA node0 CPU(s):   0-11,48-59
      NUMA node1 CPU(s):   12-23,60-71
      NUMA node2 CPU(s):   24-35,72-83
      NUMA node3 CPU(s):   36-47,84-95
      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 cdp_l3
      invpcid_single intel_ppin ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi
      flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm
      cqm mpx rdt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd
      avx512bw avx512vl xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total
      cqm_mbm_local dtherm ida arat pln pts pku ospke avx512_vnni md_clear flush_l1d
      arch_capabilities

  /proc/cpuinfo cache data
     cache size : 36608 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 1 2 3 4 5 6 7 8 9 10 11 48 49 50 51 52 53 54 55 56 57 58 59
    node 0 size: 96357 MB
    node 0 free: 95942 MB
    node 1 cpus: 12 13 14 15 16 17 18 19 20 21 22 23 60 61 62 63 64 65 66 67 68 69 70 71
    node 1 size: 96763 MB
    node 1 free: 94566 MB
    node 2 cpus: 24 25 26 27 28 29 30 31 32 33 34 35 72 73 74 75 76 77 78 79 80 81 82 83
```

(Continued on next page)

Platform Notes (Continued)

```
   node 2 size: 96733 MB
   node 2 free: 96454 MB
   node 3 cpus: 36 37 38 39 40 41 42 43 44 45 46 47 84 85 86 87 88 89 90 91 92 93 94 95
   node 3 size: 96761 MB
   node 3 free: 96499 MB
   node distances:
   node   0   1   2   3
     0:  10  21  31  31
     1:  21  10  31  31
     2:  31  31  10  21
     3:  31  31  21  10

 From /proc/meminfo
    MemTotal:       395895848 kB
    HugePages_Total:       0
    Hugepagesize:       2048 kB

 From /etc/*release* /etc/*version*
    os-release:
       NAME="SLES"
       VERSION="15-SP1"
       VERSION_ID="15.1"
       PRETTY_NAME="SUSE Linux Enterprise Server 15 SP1"
       ID="sles"
       ID_LIKE="suse"
       ANSI_COLOR="0;32"
       CPE_NAME="cpe:/o:suse:sles:15:sp1"

 uname -a:
    Linux linux-z3xp 4.12.14-195-default #1 SMP Tue May 7 10:55:11 UTC 2019 (8fba516)
    x86_64 x86_64 x86_64 GNU/Linux

 Kernel self-reported vulnerability status:

 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: __user pointer sanitization
 CVE-2017-5715 (Spectre variant 2):        Mitigation: Enhanced IBRS, IBPB: conditional,
                                           RSB filling

 run-level 3 Feb 26 06:48

 SPEC is set to: /home/cpu2017
    Filesystem     Type   Size  Used Avail Use% Mounted on
```

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Platform Notes (Continued)

```
    /dev/sda2      btrfs  371G  100G  270G  27% /home

 From /sys/devices/virtual/dmi/id
     BIOS:    HPE U32 11/13/2019
     Vendor:  HPE
     Product: ProLiant DL360 Gen10
     Product Family: ProLiant
     Serial:  MXQ94204PV

 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:
     24x UNKNOWN NOT AVAILABLE 16 GB 2 rank 2933

 (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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------------------------------------------------------------------------------

==============================================================================
```

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Compiler Version Notes (Continued)

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

==============================================================================
C++     | 523.xalancbmk_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++     | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base)
        | 531.deepsjeng_r(base, peak) 541.leela_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++     | 523.xalancbmk_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++     | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base)
        | 531.deepsjeng_r(base, peak) 541.leela_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.
------------------------------------------------------------------------------

==============================================================================
Fortran | 548.exchange2_r(base, peak)
------------------------------------------------------------------------------
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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Compiler Version Notes (Continued)

```
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`

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`

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Base Optimization Flags (Continued)

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

Peak Compiler Invocation

C benchmarks (except as noted below):
icc -m64 -std=c11

502.gcc_r: icc -m32 -std=c11 -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/ia32_lin

C++ benchmarks (except as noted below):
icpc -m64

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

Fortran benchmarks:
ifort -m64

Peak Portability Flags

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -D_FILE_OFFSET_BITS=64
505.mcf_r: -DSPEC_LP64
520.omnetpp_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:

500.perlbench_r: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=4

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Peak Optimization Flags (Continued)

500.perlbench_r (continued):
-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 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

505.mcf_r: -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

525.x264_r: -Wl,-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: -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

523.xalancbmk_r: -Wl,-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:
-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

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.2-CLX-revB.html
http://www.spec.org/cpu2017/flags/Intel-ic19.0u1-official-linux64.2019-07-09.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.2-CLX-revB.xml
http://www.spec.org/cpu2017/flags/Intel-ic19.0u1-official-linux64.2019-07-09.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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