## SPEC CPU®2017 Integer Rate Result

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL320 Gen11  
(3.90 GHz, Intel Xeon Gold 6534)

<table>
<thead>
<tr>
<th>Software</th>
<th>Hardware</th>
</tr>
</thead>
</table>
| OS: SUSE Linux Enterprise Server 15 SP5  
Kernel 5.14.21-150500.53-default | CPU Name: Intel Xeon Gold 6534  
Max MHz: 4200  
Nominal: 3900 |
| Compiler: C/C++: Version 2023.2.3 of Intel oneAPI DPC++/C++  
Compiler for Linux: Fortran: Version 2023.2.3 of Intel Fortran  
Compiler for Linux:  
Firmware: HPE BIOS Version v2.12 12/13/2023 released Dec-2023 | Orderable: 1 chip  
L1: 32 KB I + 48 KB D on chip per core  
L2: 2 MB I+D on chip per core  
L3: 22.5 MB I+D on chip per chip |
| File System: xfs  
System State: Run level 3 (multi-user) | Memory: 256 GB (8 x 32 GB 2Rx8 PC5-5600B-R, running at 4800)  
Storage: 1 x 480 GB SATA SSD |
| Other: jemalloc memory allocator V5.0.1  
Power Management: BIOS and OS set to prefer performance at the cost of additional power usage | Other: None

**SPECrate®2017_int_base = 100**  
**SPECrate®2017_int_peak = 103**

<table>
<thead>
<tr>
<th>Copies</th>
</tr>
</thead>
<tbody>
<tr>
<td>500.perlbench_r</td>
</tr>
<tr>
<td>502.gcc_r</td>
</tr>
<tr>
<td>505.mcf_r</td>
</tr>
<tr>
<td>520.omnetpp_r</td>
</tr>
<tr>
<td>523.xalancbmk_r</td>
</tr>
<tr>
<td>525.x264_r</td>
</tr>
<tr>
<td>531.deepsjeng_r</td>
</tr>
<tr>
<td>541.leela_r</td>
</tr>
<tr>
<td>548.exchange2_r</td>
</tr>
<tr>
<td>557.xz_r</td>
</tr>
<tr>
<td>SPECrate®2017_int_base (100)</td>
</tr>
<tr>
<td>SPECrate®2017_int_peak (103)</td>
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</table>

**CPU2017 License:** 3  
**Test Sponsor:** HPE  
**Test Date:** Feb-2024  
**Test Sponsor:** HPE  
**Hardware Availability:** Feb-2024  
**Tested by:** HPE  
**Software Availability:** Dec-2023  

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Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
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<th>Seconds</th>
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<th>Seconds</th>
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<tbody>
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<td>334</td>
<td>81.1</td>
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<tr>
<td>502.gcc_r</td>
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<td>541.leela_r</td>
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<td>44.9</td>
<td>386</td>
<td>44.8</td>
<td>380</td>
<td>45.5</td>
</tr>
</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"
Transparent Huge Pages enabled by default
Prior to runcpu invocation:
Filesystme 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>
tuned-adm profile was set to throughput-performance using "tuned-adm profile throughput-performance"

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"
MALLOC_CONF = "retain:true"

General Notes

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM
memory using Red Hat Enterprise Linux 8.4
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.

(Continued on next page)
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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

The system ROM used for this result contains Intel microcode version 0x21000200 for
the Intel Xeon Gold 6534.

BIOS Configuration:
Workload Profile set to General Throughput Compute.
Enhanced Processor Performance Profile set to Aggressive.
Thermal Configuration set to Maximum Cooling.
Memory Patrol Scrubbing set to Disabled.
Sub-NUMA Clustering (SNC) set to Enable SNC2(2-clusters).
Workload Profile set to Custom.
Minimum Processor Idle Power Package C-State set to Package C6 (non-retention) State.

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost Tue Feb 20 17:02:38 2024

SUT (System Under Test) info as seen by some common utilities.

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3. Username
4. ulimit -a
5. sysinfo process ancestry
6. /proc/cpuinfo
7. lscpu
8. numaclt --hardware
9. /proc/meminfo
10. who -r
11. Systemd service manager version: systemd 249 (249.16+suse.171.gdad0071f15)
12. Services, from systemctl list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline
14. cpupower frequency-info
15. tuned-adm active
16. sysctl
17. /sys/kernel/mm/transparent_hugepage
18. /sys/kernel/mm/transparent_hugepage/khugepaged
19. OS release
20. Disk information
21. /sys/devices/virtual/dmi/id
22. dmidecode
23. BIOS

1. uname -a
   Linux localhost 5.14.21-150500.53-default #1 SMP PREEMPT_DYNAMIC Wed May 10 07:56:26 UTC 2023 (b630043)
   x86_64 x86_64 x86_64 GNU/Linux

2. w
   17:02:38 up 2 min,  0 users,  load average: 0.00, 0.00, 0.00

(Continued on next page)
Platform Notes (Continued)

3. Username
   From environment variable $USER: root

4. ulimit -a
   core file size  (blocks, -c) unlimited
   data seg size   (kbytes, -d) unlimited
   scheduling priority  (-e) 0
   file size       (blocks, -f) unlimited
   pending signals (-l) 1030693
   max locked memory (kbytes, -l) 64
   max memory size  (kbytes, -m) unlimited
   open files      (-n) 1024
   pipe size       (512 bytes, -p) 8
   POSIX message queues (bytes, -q) 819200
   real-time priority (-r) 0
   stack size      (kbytes, -s) unlimited
   cpu time        (seconds, -t) unlimited
   max user processes (-u) 1030693
   virtual memory  (kbytes, -v) unlimited
   file locks      (-x) unlimited

5. sysinfo process ancestry
   /usr/lib/systemd/systemd --switched-root --system --deserialize 29
   sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups
   sshd: root@notty
   bash -c cd $SPEC/ && $SPEC/intrate.sh
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=16 -c
   ic2023.2.3-in-sapphirerapids-rate-20231121.cfg --define smt-on --define cores=8 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base,peak --output_format all intrate
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=16 --configfile
   ic2023.2.3-in-sapphirerapids-rate-20231121.cfg --define smt-on --define cores=8 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base,peak --output_format all --nopower
   --runmode rate --tune base:peak --size refrate intrate --nopreenv --note-preenv --logfile
   $SPEC/tmp/CPU2017.001/templogs/preenv.intrate.001.0.log --lognum 001.0 --from_runcpu 2
   specperl $SPEC/bin/sysinfo
   $SPEC = /home/cpu2017
   $SPEC = /home/cpu2017

6. /proc/cpuinfo
   model name      : INTEL(R) XEON(R) GOLD 6534
   vendor_id       : GenuineIntel
   cpu family      : 6
   model           : 207
   stepping        : 2
   microcode       : 0x210000200
   bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrs_pbrsb
   cpu cores       : 8
   siblings        : 16
   1 physical ids  (chips)
   16 processors   (hardware threads)
   physical id 0: core ids 0-7
   physical id 0: apicids 0-15
   Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for
   virtualized systems. Use the above data carefully.

(Continued on next page)
7. lscpu

From lscpu from util-linux 2.37.4:

Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Address sizes: 46 bits physical, 57 bits virtual
Byte Order: Little Endian
CPU(s): 16
On-line CPU(s) list: 0-15
Vendor ID: GenuineIntel
Model name: INTEL(R) XEON(R) GOLD 6534
CPU family: 6
Model: 207
Thread(s) per core: 2
Core(s) per socket: 8
Socket(s): 1
Stepping: 2
BogoMIPS: 7800.00
Flags:

Virtualization: VT-x
L1d cache: 384 KiB (8 instances)
L1i cache: 256 KiB (8 instances)
L2 cache: 16 MiB (8 instances)
L3 cache: 22.5 MiB (1 instance)
NUMA node(s): 2
NUMA node0 CPU(s): 0-3,8-11
NUMA node1 CPU(s): 4-7,12-15
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Md: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Mmio stale data: Not affected
Vulnerability Retbleed: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swaps barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling, PBRSB-eIBRS SW sequence
Vulnerability Srbd: Not affected
Vulnerability Tzr async abort: Not affected

From lscpu --cache:

<table>
<thead>
<tr>
<th>NAME</th>
<th>ONE-SIZE</th>
<th>ALL-SIZE</th>
<th>WAYS</th>
<th>TYPE</th>
<th>LEVEL</th>
<th>SETS</th>
<th>PHY-LINE</th>
<th>COHERENCY-SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1d</td>
<td>48K</td>
<td>384K</td>
<td>12</td>
<td>Data</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
</tr>
</tbody>
</table>

(Continued on next page)
Platform Notes (Continued)

8. numactl --hardware
   NOTE: a numactl 'node' might or might not correspond to a physical chip.
   available: 2 nodes (0-1)
   node 0 cpus: 0-3,8-11
   node 0 size: 128681 MB
   node 0 free: 128165 MB
   node 1 cpus: 4-7,12-15
   node 1 size: 129014 MB
   node 1 free: 128337 MB
   node distances:
   node   0   1
   0:  10  20
   1:  20  10

9. /proc/meminfo
   MemTotal:       263880840 kB

10. who -r
    run-level 3 Feb 20 17:00

11. Systemd service manager version: systemd 249 (249.16+suse.171.gdad0071f15)
    Default Target Status
    multi-user running

12. Services, from systemctl list-unit-files
    STATE UNIT FILES
    enabled apparmor auditd cron getty@ irqbalance issue-generator kbdsettings lvm2-monitor postfix
    purge-kernels rollback sshd systemd-psstore wicked wickedd-auto4 wickedd-dhcp4
    wickedd-dhcp6 wickedd-nanny
    enabled-runtime systemd-remount-fs
    disabled blk-availability boot-sysctl ca-certificates chrony-wait chrony démochrony debug-shell
    grub2-once haveged haveged-switch-root hwloc-dump-hwdata issue-add-ash-keys kexec-load kam
    kvm_stat lurnmask multipathd rpmconfigcheck serial-getty@ systemd-boot-check-no-failures
    systemd-network-generator systemd-sysext systemd-time-wait-sync systemd-timesyncd
    target-iscsi targetc1l targetclld tuned
    indirect wickedd

13. Linux kernel boot-time arguments, from /proc/cmdline
    BOOT_IMAGE=/boot/vmlinuz-5.14.21-150500.53-default
    root=UUID=c791a00c-0ac0-437c-a123-380d9ca9a82f
    splash=silent
    resume=/dev/disk/by-uuid/2045128c-8306-498f-ba9c-cef6051d72af
    mitigations=auto
    quiet
    security=apparmor

14. cpupower frequency-info
    analyzing CPU 0:
      Unable to determine current policy

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

- **boost state support:**
  - Supported: yes
  - Active: yes

15. **tuned-adm active**
   - Current active profile: throughput-performance

16. **sysctl**
   - `kernel.numa_balancing`: 1
   - `kernel.randomize_va_space`: 2
   - `vm.compoaction_proactive`: 20
   - `vm.dirty_background_bytes`: 0
   - `vm.dirty_background_ratio`: 10
   - `vm.dirty_bytes`: 0
   - `vm.dirty_expire_centisecs`: 3000
   - `vm.dirty_ratio`: 20
   - `vm.dirty_writeback_centisecs`: 500
   - `vm.dirtytime_expire_seconds`: 43200
   - `vm.exfrag_threshold`: 500
   - `vm.min_unmapped_ratio`: 1
   - `vm.nr_hugepages`: 0
   - `vm.nr_hugepages_mempolicy`: 0
   - `vm.nr_overcommit_hugepages`: 0
   - `vm.swappiness`: 10
   - `vm.watermark_boost_factor`: 15000
   - `vm.watermark_scale_factor`: 10
   - `vm.zone_reclaim_mode`: 0

17. **/sys/kernel/mm/transparent_hugepage**
   - `defrag`: always defer defer+madvice [madvice] never
   - `enabled`: [always] madvice never
   - `hpage_pmd_size`: 2097152
   - `shmem_enabled`: always within_size advise [never] deny force

18. **/sys/kernel/mm/transparent_hugepage/klugepaged**
   - `alloc_sleep_millisecs`: 60000
   - `defrag`: 1
   - `max_ptes`: 511
   - `max_ptes_shared`: 256
   - `max_ptes_swap`: 64
   - `pages_to_scan`: 4096
   - `scan_sleep_millisecs`: 10000

19. **OS release**
   - From `/etc/*-release /etc/*-version`
   - os-release SUSE Linux Enterprise Server 15 SP5

20. **Disk information**
   - SPEC is set to: `/home/cpu2017`
   - Files system Type Size Used Avail Used% Mounted on
     - `/dev/sda4 xfs 155G 141G 14G 92% /home`

21. **/sys/devices/virtual/dmi/id**
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Platform Notes (Continued)

Vendor: HPE
Product: ProLiant DL320 Gen11
Product Family: ProLiant
Serial: CNX2210HZ8

22. dmidecode
Additional information from dmidecode 3.4 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:
8x Hynix HMCG88AGBRA193N 32 GB 2 rank 5600, configured at 4800

23. BIOS
(This section combines info from /sys/devices and dmidecode.)
BIOS Vendor: HPE
BIOS Version: 2.12
BIOS Date: 12/13/2023
BIOS Revision: 2.12
Firmware Revision: 1.55

Compiler Version Notes

| C       | 502.gcc_r(peak) |
|------------------------|
| Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2023.2.3 Build x |
| Copyright (C) 1985-2023 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) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x |
| Copyright (C) 1985-2023 Intel Corporation. All rights reserved. |

| C++     | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base, peak) 531.deepsjeng_r(base, peak) 541.leela_r(base, peak) |
|------------------------|
| Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2023.2.3 Build x |
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Software Availability: Dec-2023

Compiler Version Notes (Continued)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

-----------------------------------------------------------------------------------------------
Fortran | 548.exchange2_r(base, peak)
---------------------------------------------------------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
icx
C++ benchmarks:
icpx
Fortran benchmarks:
ifx

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:
-w -std=c11 -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-lqkmalloc

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Base Optimization Flags (Continued)

C++ benchmarks:
-w -std=c++14 -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-lqkmalloc

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-lqkmalloc

Peak Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifx

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: -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
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL320 Gen11
(3.90 GHz, Intel Xeon Gold 6534)

SPEC CPU®2017 Integer Rate Result
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Tested by: HPE

Peak Optimization Flags

C benchmarks:

500.perlbench_r: -w -std=c11 -m64 -Wl,-z,muldefs
-ffile-byte-code
-ffile-byte-code=pass 1
-ffile-byte-code=pass 2
-xCORE-AVX512 -ffast-math -mfpmath=sse
-flto -Ofast -L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-lqkmalloc

502.gcc_r: -m32
-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/ia32_lin
-std=gnu89 -Wl,-z,muldefs -ffile-byte-code
-ffile-byte-code=pass 1
-ffile-byte-code=pass 2
-xCORE-AVX512 -ffast-math -mfpmath=sse
-flto -Ofast -L/usr/local/jemalloc32-5.0.1/lib -ljemalloc

505.mcf_r: basepeak = yes

525.x264_r: -w -std=c11 -m64 -Wl,-z,muldefs -xsapphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-ffunroll-loops=pass 1
-xCORE-AVX512 -ffast-math -mfpmath=sse
-flto -Ofast -L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-lqkmalloc

557.xz_r: basepeak = yes

C++ benchmarks:

520.omnetpp_r: basepeak = yes

523.xalancbmk_r: basepeak = yes

531.deepsjeng_r: basepeak = yes

541.leela_r: basepeak = yes

Fortran benchmarks:

548.exchange2_r: basepeak = yes

SPECrater®2017_int_base = 100
SPECrater®2017_int_peak = 103
### SPEC CPU®2017 Integer Rate Result

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL320 Gen11  
(3.90 GHz, Intel Xeon Gold 6534)

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**CPU2017 License:** 3  
**Test Date:** Feb-2024  
**Test Sponsor:** HPE  
**Hardware Availability:** Feb-2024  
**Tested by:** HPE  
**Software Availability:** Dec-2023

The flags files that were used to format this result can be browsed at:

- [http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-EMR-rev1.0.html](http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-EMR-rev1.0.html)

You can also download the XML flags sources by saving the following links:

- [http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-EMR-rev1.0.xml](http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-EMR-rev1.0.xml)

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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

Tested with SPEC CPU®2017 v1.1.9 on 2024-02-20 06:32:38-0500.  
Originally published on 2024-03-15.