# SPEC CPU® 2017 Integer Rate Result

## Lenovo Global Technology

ThinkSystem SR860 V3  
(2.40 GHz, Intel Xeon Gold 6448H)

### CPU2017 License: 9017  
Test Sponsor: Lenovo Global Technology  
Tested by: Lenovo Global Technology  
Test Date: Aug-2023  
Hardware Availability: Jun-2023  
Software Availability: Dec-2022

### Copies

<table>
<thead>
<tr>
<th>SPECrate®2017_int_base = 1230</th>
</tr>
</thead>
</table>
| SPECrate®2017_int_peak = Not Run

### Hardware

| CPU Name: Intel Xeon Gold 6448H  
Max MHz: 4100  
Nominal: 2400  
Enabled: 128 cores, 4 chips, 2 threads/core  
Orderable: 24 chips  
Cache L1: 32 KB I + 48 KB D on chip per core  
L2: 2 MB I+D on chip per core  
L3: 60 MB I+D on chip per chip  
Other: None  
Memory: 1 TB (32 x 32 GB 2Rx8 PC5-4800B-R)  
Storage: 1 x 480 GB SATA SSD  
Other: None |

### Software

| OS: SUSE Linux Enterprise Server 15 SP4 (x86_64)  
Kernel 5.14.21-150400.22-default  
Compiler: C/C++: Version 2023.0 of Intel oneAPI DPC++/C++ Compiler for Linux;  
Fortran: Version 2023.0 of Intel Fortran Compiler for Linux;  
Parallel: No  
Firmware: Lenovo BIOS Version RSE105E 1.10 released May-2023  
File System: xfs  
System State: Run level 3 (multi-user)  
Base Pointers: 64-bit  
Peak Pointers: Not Applicable  
Other: None  
Power Management: BIOS and OS set to prefer performance at the cost of additional power usage |

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### SPECrate®2017_int_base = 1230

| SPECrate®2017_int_peak = Not Run |

<table>
<thead>
<tr>
<th>500.perlbench_r</th>
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<tbody>
<tr>
<td>502.gcc_r</td>
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<td>505.mcf_r</td>
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<tr>
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<td>523.xalancbmk_r</td>
</tr>
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</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>
</tbody>
</table>

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Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<td>500.perlbench_r</td>
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<tr>
<td>502.gcc_r</td>
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<td>985</td>
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<td>256</td>
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<td>782</td>
<td>429</td>
<td>784</td>
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<tr>
<td>523.xalancbmk_r</td>
<td>256</td>
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<td>525.x264_r</td>
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<td>2420</td>
<td>185</td>
<td>2430</td>
<td>185</td>
<td>2420</td>
</tr>
<tr>
<td>531.deepsjeng_r</td>
<td>256</td>
<td>333</td>
<td>881</td>
<td>333</td>
<td>880</td>
<td>333</td>
<td>880</td>
</tr>
<tr>
<td>541.leela_r</td>
<td>256</td>
<td>511</td>
<td>830</td>
<td>511</td>
<td>830</td>
<td>511</td>
<td>830</td>
</tr>
<tr>
<td>548.exchange2_r</td>
<td>256</td>
<td>263</td>
<td>2550</td>
<td>261</td>
<td>2570</td>
<td>265</td>
<td>2530</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>256</td>
<td>487</td>
<td>568</td>
<td>486</td>
<td>569</td>
<td>488</td>
<td>566</td>
</tr>
</tbody>
</table>

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

Compiler Notes

SPEC has ruled that the compiler used for this result was performing a compilation that specifically improves the performance of the 523.xalancbmk_r / 623.xalancbmk_s benchmarks using a priori knowledge of the SPEC code and dataset to perform a transformation that has narrow applicability.

In order to encourage optimizations that have wide applicability (see rule 1.4 https://www.spec.org/cpu2017/Docs/runrules.html#rule_1.4), SPEC will no longer publish results using this optimization.

This result is left in the SPEC results database for historical reference.

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"

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "*/home/cpu2017-1.1.9-ic2023.0/lib/intel64:/home/cpu2017-1.1.9-ic2023.0/lib/ia32:/home/cpu2017-1.1.9-ic2023.0/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

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

runcpu command invoked through numactl i.e.:

numactl --interleave=all runcpu <etc>

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.

Platform Notes

BIOS configuration:

Choose Operating Mode set to Maximum Performance and then set it to Custom Mode

C1 Enhanced Mode set to Enabled

DCU Streamer Prefetcher set to Disabled

SNC set to SNC4

UPI Link Disable set to Disabled 1 Link

LLC Prefetch set to Disabled

Sysinfo program /home/cpu2017-1.1.9-ic2023.0/bin/sysinfo

Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197

running on localhost Thu Aug 24 11:41:35 2023

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

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9. /proc/meminfo
10. who -r
11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)
12. Services, from systemctl list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline
14. cpupower frequency-info
15. sysctl
16. /sys/kernel/mm/transparent_hugepage
17. /sys/kernel/mm/transparent_hugepage/never
18. OS release
19. Disk information
20. /sys/devices/virtual/dmi/id
21. dmidecode
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Platform Notes (Continued)

1. `uname -a`
   Linux localhost 5.14.21-150400.22-default #1 SMP PREEMPT_DYNAMIC Wed May 11 06:57:18 UTC 2022 (49db222)
   x86_64 x86_64 x86_64 GNU/Linux

2. `w`
   11:41:35 up 1:01, 1 user, load average: 23.23, 157.26, 211.56
   USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
   root     tty1     -                10:41   14.00s  1.06s  0.02s -bash

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) 4126588
   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) 4126588
   virtual memory  (kbytes, -v) unlimited
   file locks      (-x) unlimited

5. `sysinfo process ancestry`
   /usr/lib/systemd/systemd --switched-root --system --deserialize 30
   login -- root
   -bash
   -bash
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=256 -c
   ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=128 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base -o all intrate
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=256 --configfile
   ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=128 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base -o all intrate
   $SPEC/tmp/CPU2017.099/templogs/preenv.intrate.099.0.log --lognum 099.0 --from_runcpu 2
   specperl $SPEC/bin/sysinfo
   $SPEC = /home/cpu2017-1.1.9-ic2023.0

6. `/proc/cpuinfo`
   model name : Intel(R) Xeon(R) Gold 6448H
   vendor_id : GenuineIntel
   cpu family : 6
   model : 143
   stepping : 8
   microcode : 0x2b0001b0
   bugs : spectre_v1 spectre_v2 spec_store_bypass swapsps
   cpu cores : 32

(Continued on next page)
Platform Notes (Continued)

siblings : 64
4 physical ids (chips)
256 processors (hardware threads)
physical id 0: core ids 0-31
physical id 1: core ids 0-31
physical id 2: core ids 0-31
physical id 3: core ids 0-31
physical id 0: apic ids 0-63
physical id 1: apic ids 128-191
physical id 2: apic ids 256-319
physical id 3: apic ids 384-447
Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for virtualized systems. Use the above data carefully.

7. lscpu

From lscpu from util-linux 2.37.2:
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):                          256
On-line CPU(s) list:             0-255
Vendor ID:                       GenuineIntel
Model name:                      Intel(R) Xeon(R) Gold 6448H
CPU family:                      6
Model:                           143
Thread(s) per core:              2
Core(s) per socket:              32
Socket(s):                       4
Stepping:                        8
BogoMIPS:                        4800.00
Flags:                           fpu vme de pse tsc msr pae mca cmov pat pse36
                                clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb
                                rdtps cs cnu apic pse37 clckaco mm directed_page_fault mmextend mmx2
                                constant_time_ALIGNMENT_mm_default mmop mmop2 mmop3 mmop4
                                l1d cache:                       6 MiB (128 instances)
                                l1i cache:                       4 MiB (128 instances)
                                l2 cache:                        256 MiB (128 instances)
                                l3 cache:                        240 MiB (4 instances)
                                NUMA node(s):                    8
                                NUMA node0 CPU(s):              0-15,128-143
                                NUMA node1 CPU(s):              16-31,144-159
                                NUMA node2 CPU(s):              32-47,160-175
                                NUMA node3 CPU(s):              48-63,176-191
                                Virtualization:                  VT-x
                                VT-x
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Platform Notes (Continued)

NUMA node4 CPU(s): 64-79,192-207
NUMA node5 CPU(s): 80-95,208-223
NUMA node6 CPU(s): 96-111,224-239
NUMA node7 CPU(s): 112-127,240-255
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling
Vulnerability Srbds: Not affected
Vulnerability Tax 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>6M</td>
<td>12</td>
<td>Data</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L1i</td>
<td>32K</td>
<td>4M</td>
<td>8</td>
<td>Instruction</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L2</td>
<td>2M</td>
<td>256M</td>
<td>16</td>
<td>Unified</td>
<td>2</td>
<td>2048</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L3</td>
<td>60M</td>
<td>240M</td>
<td>15</td>
<td>Unified</td>
<td>3</td>
<td>65536</td>
<td>1</td>
<td>64</td>
</tr>
</tbody>
</table>

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8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.

node 0 cpus: 0-15,128-143
node 0 size: 1298677 MB
node 0 free: 1265993 MB
node 1 cpus: 16-31,144-159
node 1 size: 129015 MB
node 1 free: 127907 MB
node 2 cpus: 32-47,160-175
node 2 size: 129015 MB
node 2 free: 127923 MB
node 3 cpus: 48-63,176-191
node 3 size: 129015 MB
node 3 free: 127922 MB
node 4 cpus: 64-79,192-207
node 4 size: 129015 MB
node 4 free: 127926 MB
node 5 cpus: 80-95,208-223
node 5 size: 129015 MB
node 5 free: 127924 MB
node 6 cpus: 96-111,224-239
node 6 size: 128981 MB
node 6 free: 127729 MB
node 7 cpus: 112-127,240-255
node 7 size: 128932 MB
node 7 free: 127729 MB
node distances:

0: 10 12 21 21 31 31 21 21
1: 12 10 21 21 31 31 21 21
2: 21 21 10 12 21 21 31 31
3: 21 21 12 10 21 21 31 31
4: 21 21 21 31 31 21 21 21
5: 21 21 21 21 31 31 21 21
6: 21 21 21 21 21 31 31 21
7: 21 21 21 21 21 21 21 12 (Continued on next page)
Platform Notes (Continued)

9. /proc/meminfo
   MemTotal: 1056431124 kB

10. who -r
    run-level 3 Aug 24 10:40

11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)
    Default Target  Status
    multi-user  running

12. Services, from systemctl list-unit-files
    STATE UNIT FILES
    enabled YaST2-Firstboot YaST2-Second-Stage apparmor auditd cron getty@ havedeg irqbalance
    issue-generator kbsettings klog lvm2-monitor nscd postfix purge-kernels rollback rsyslog
    smartd sshd(Systemd-Remount-Fs)wicked wickedd-auto4 wickedd-dhcp4 wickedd-dhcp6 wickedd-nanny
    enabled-runtime systemd-remount-fs
    disabled autofs autostart-initscripts blk-availability boot-sysctl ca-certificates chrony-wait
    chronyD console-getty cups cups-browsed debug-shell ebtables exchange-bmc-os-info
    firewalld gpm grub2-once havedeg-switch-root ipmi ipmievq issue-add-ssh-keys keexec-load
    lnumask man-db-create multipathd nfs nfs-blkmap rdisc rpcbind rpmconfigcheck rsyncd
    serial-getty@ smartd_generate_opts snmpd snmptrapd systemd-boot-check-no-failures
    systemd-network-generator systemd-sysext systemd-time-wait-sync systemd-timesyncd
    indirect wicked

13. Linux kernel boot-time arguments, from /proc/cmdline
    BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
    root=UUID=07b494b8-a782-4eba-84fa-ef5cafe789da8
    splash=silent
    mitigations=auto
    quiet
    security=apparmor

14. cpupower frequency-info
    analyzing CPU 0:
    Unable to determine current policy
    boost state support:
    Support: yes
    Active: yes

15. sysctl
    kernel.numa_balancing 1
    kernel.randomize_va_space 2
    vm.comaption_proactiveness 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.extragram threshold 500
    vm.min_unmapped_ratio 1
    vm.nr_hugepages 0

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**Platform Notes (Continued)**

```plaintext
vm.nr_hugepages_mempolicy           0
vm.nr_overcommit_hugepages          0
vm.swappiness                      60
vm.watermark_boost_factor          15000
vm.watermark_scale_factor          10
vm.zone_reclaim_mode                0

16. /sys/kernel/mm/transparent_hugepage
   defrag always defer madvise [madvise] never
   enabled [always] madvise
   hpage_pmd_size 2097152
   shmem_enabled always within_size advise [never] deny force

17. /sys/kernel/mm/transparent_hugepage/khugepaged
   alloc_sleep_millisecs 60000
   defrag 1
   max_ptes_none 511
   max_ptes_shared 256
   max_ptes_swap 64
   pages_to_scan 4096
   scan_sleep_millisecs 10000

18. OS release
   From /etc/*-release /etc/*-version
   os-release SUSE Linux Enterprise Server 15 SP4

19. Disk information
   SPEC is set to: /home/cpu2017-1.1.9-ic2023.0
   Filesystem Type  Size  Used Avail Use% Mounted on
   /dev/sda3      xfs   445G   12G  433G   3% /

20. /sys/devices/virtual/dmi/id
   Vendor: Lenovo
   Product: ThinkSystem SR860 V3
   Product Family: ThinkSystem
   Serial: None

21. dmidecode
   Additional information from dmidecode 3.2 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:
   19x Samsung M321R4GA3BB0-CQKDG 32 GB 2 rank 4800
   6x Samsung M321R4GA3BB0-CQKEG 32 GB 2 rank 4800
   4x Samsung M321R4GA3BB0-CQKMG 32 GB 2 rank 4800
   3x Samsung M321R4GA3BB0-CQKVG 32 GB 2 rank 4800

22. BIOS
   (This section combines info from /sys/devices and dmidecode.)
   BIOS Vendor: Lenovo
   BIOS Version: RSE105E-1.10
```

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

- **BIOS Date:** 05/12/2023  
- **BIOS Revision:** 1.10  
- **Firmware Revision:** 1.10

### Compiler Version Notes

<table>
<thead>
<tr>
<th>Language</th>
<th>Benchmark</th>
<th>Compiler Version Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base) 525.x264_r(base) 557.xz_r(base)</td>
<td>Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201 Copyright (C) 1985-2022 Intel Corporation. All rights reserved.</td>
</tr>
<tr>
<td>C++</td>
<td>520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base) 541.leela_r(base)</td>
<td>Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201 Copyright (C) 1985-2022 Intel Corporation. All rights reserved.</td>
</tr>
<tr>
<td>Fortran</td>
<td>548.exchange2_r(base)</td>
<td>Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201 Copyright (C) 1985-2022 Intel Corporation. All rights reserved.</td>
</tr>
</tbody>
</table>

### 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
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(2.40 GHz, Intel Xeon Gold 6448H)

SPECRate®2017_int_base = 1230
SPECRate®2017_int_peak = Not Run

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Test Date: Aug-2023
Tested by: Lenovo Global Technology
Hardware Availability: Jun-2023
Software Availability: Dec-2022

Base Portability Flags (Continued)

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/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin
-lqkmalloc

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/usr/local/intel/compiler/2023.0.0/linux/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/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin
-lqkmalloc

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Eaglestream-X.html
http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Eaglestream-X.xml
http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.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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