SPEC CPU®2017 Integer Rate Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

$SPECrate^{®}2017_int_base = $ 198

ProLiant DL320 Gen11
(3.60 GHz, Intel Xeon Gold 6544Y)

$SPECrate^{®}2017_int_peak = $ Not Run

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

Test Date: Oct-2024
Hardware Availability: Dec-2023
Software Availability: Mar-2024

Copies	Result
500.perlbench_r 32	148
502.gcc_r 32	168
505.mcf_r 32	329
520.omnetpp_r 32	130
523.xalancbmk_r 32	278
525.x264_r 32	413
531.deepsjeng_r 32	144
541.leela_r 32	135
548.exchange2_r 32	430
557.xz_r 32	90.2

—— **SPECrate®2017_int_base (198)**

Hardware

CPU Name: Intel Xeon Gold 6544Y
 Max MHz: 4100
 Nominal: 3600
Enabled: 16 cores, 1 chip, 2 threads/core
Orderable: 1 chip
Cache L1: 32 KB I + 48 KB D on chip per core
 L2: 2 MB I+D on chip per core
 L3: 45 MB I+D on chip per chip
 Other: None
Memory: 512 GB (8 x 64 GB 2Rx8 PC5-5600B-R, running at 5200)
Storage: 1 x 480 GB SATA SSD
Other: CPU Cooling: Air

Software

OS: SUSE Linux Enterprise Server 15 SP5
 Kernel 5.14.21-150500.53-default
Compiler: C/C++: Version 2024.1 of Intel oneAPI DPC++/C++ Compiler for Linux;
 Fortran: Version 2024.1 of Intel Fortran Compiler for Linux;
Parallel: No
Firmware: HPE BIOS Version v2.32 09/09/2024 released Sep-2024
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: Not Applicable
Other: None
Power Management: BIOS set to prefer performance at the cost of additional power usage

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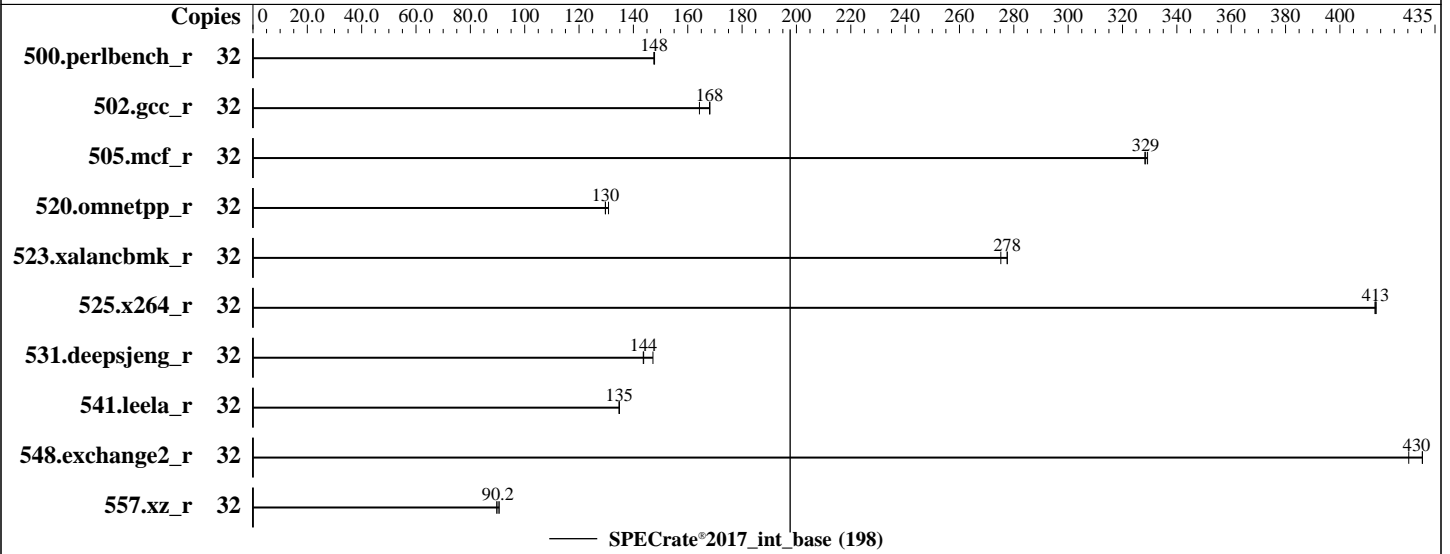SPECrate®2017_int_peak = Not Run

CPU2017 License: 3
Test Sponsor: HPE
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Test Date: Oct-2024
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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	32	345	148	345	148	**345**	**148**							
502.gcc_r	32	269	168	276	164	**270**	**168**							
505.mcf_r	32	157	329	158	328	**157**	**329**							
520.omnetpp_r	32	**324**	**130**	324	130	321	131							
523.xalancbmk_r	32	122	278	**122**	**278**	123	275							
525.x264_r	32	**136**	**413**	136	413	136	413							
531.deepsjeng_r	32	**255**	**144**	255	144	249	147							
541.leela_r	32	**393**	**135**	393	135	393	135							
548.exchange2_r	32	**195**	**430**	197	425	195	430							
557.xz_r	32	381	90.6	**383**	**90.2**	385	89.7							

SPECrate®2017_int_base = 198

SPECrate®2017_int_peak = Not Run

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

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.
```

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Test Sponsor: HPE	**Hardware Availability:** Dec-2023
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Platform Notes

```
BIOS Configuration:
Workload Profile set to General Throughput Compute
Enhanced Processor Performance Profile set to Aggressive
Thermal Configuration set to Maximum Cooling
Sub-NUMA Clustering set to Enable SNC2(2-clusters)
Memory Patrol Scrubbing set to Disabled
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 Oct 15 11:39:39 2024

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

 ------------------------------------------------------------
 Table of contents
 ------------------------------------------------------------
  1. uname -a
  2. w
  3. Username
  4. ulimit -a
  5. sysinfo process ancestry
  6. /proc/cpuinfo
  7. lscpu
  8. numactl --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. sysctl
 16. /sys/kernel/mm/transparent_hugepage
 17. /sys/kernel/mm/transparent_hugepage/khugepaged
 18. OS release
 19. Disk information
 20. /sys/devices/virtual/dmi/id
 21. dmidecode
 22. 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
   11:39:39 up 8 min,  1 user,  load average: 0.00, 0.00, 0.00
   USER     TTY      FROM            LOGIN@   IDLE   JCPU   PCPU WHAT
   root     pts/0    172.17.1.114    11:35   11.00s  0.75s  0.00s -bash

 ------------------------------------------------------------
 3. Username
   From environment variable $USER:  root

 ------------------------------------------------------------
 4. ulimit -a
   core file size          (blocks, -c) unlimited
```

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Platform Notes (Continued)

```
   data seg size          (kbytes, -d) unlimited
   scheduling priority          (-e) 0
   file size              (blocks, -f) unlimited
   pending signals              (-i) 2062850
   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) 2062850
   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@pts/0
 -bash
 -bash
 runcpu --nobuild --action validate --define default-platform-flags --define numcopies=32 -c
   ic2024.1-lin-sapphirerapids-rate-20240308.cfg --define smt-on --define cores=16 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base -n 3 -o all intrate
 runcpu --nobuild --action validate --define default-platform-flags --define numcopies=32 --configfile
   ic2024.1-lin-sapphirerapids-rate-20240308.cfg --define smt-on --define cores=16 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base --iterations 3 --output_format all
   --nopower --runmode rate --tune base --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

    ------------------------------------------------------------
6. /proc/cpuinfo
   model name         : INTEL(R) XEON(R) GOLD 6544Y
   vendor_id          : GenuineIntel
   cpu family         : 6
   model              : 207
   stepping           : 2
   microcode          : 0x21000283
   bugs               : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrs_pbrsb
   cpu cores          : 16
   siblings           : 32
   1 physical ids (chips)
   32 processors (hardware threads)
   physical id 0: core ids 0-15
   physical id 0: apicids 0-31
  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 2.37.4:
  Architecture:              x86_64
  CPU op-mode(s):            32-bit, 64-bit
  Address sizes:             46 bits physical, 57 bits virtual
  Byte Order:                Little Endian
```

(Continued on next page)

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

Platform Notes (Continued)

```
CPU(s):                    32
On-line CPU(s) list:       0-31
Vendor ID:                 GenuineIntel
Model name:                INTEL(R) XEON(R) GOLD 6544Y
CPU family:                6
Model:                     207
Thread(s) per core:        2
Core(s) per socket:        16
Socket(s):                 1
Stepping:                  2
BogoMIPS:                  7200.00
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 tsc_known_freq 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 cat_l2 cdp_l3
                           invpcid_single cdp_l2 ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow
                           vnmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 hle avx2 smep
                           bmi2 erms invpcid rtm cqm rdt_a avx512f avx512dq rdseed adx smap
                           avx512ifma clflushopt clwb intel_pt avx512cd sha_ni avx512bw avx512vl
                           xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total
                           cqm_mbm_local avx_vnni avx512_bf16 wbnoinvd dtherm ida arat pln pts hfi
                           avx512vbmi umip pku ospke waitpkg avx512_vbmi2 gfni vaes vpclmulqdq
                           avx512_vnni avx512_bitalg tme avx512_vpopcntdq la57 rdpid bus_lock_detect
                           cldemote movdiri movdir64b enqcmd fsrm md_clear serialize tsxldtrk pconfig
                           arch_lbr avx512_fp16 amx_tile flush_l1d arch_capabilities
Virtualization:            VT-x
L1d cache:                 768 KiB (16 instances)
L1i cache:                 512 KiB (16 instances)
L2 cache:                  32 MiB (16 instances)
L3 cache:                  45 MiB (1 instance)
NUMA node(s):              2
NUMA node0 CPU(s):         0-7,16-23
NUMA node1 CPU(s):         8-15,24-31
Vulnerability Itlb multihit:    Not affected
Vulnerability L1tf:             Not affected
Vulnerability Mds:              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/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2:       Mitigation; Enhanced IBRS, IBPB conditional, RSB filling, PBRSB-eIBRS SW
                                sequence
Vulnerability Srbds:            Not affected
Vulnerability Tsx async abort:  Not affected

From lscpu --cache:
    NAME ONE-SIZE ALL-SIZE WAYS TYPE        LEVEL  SETS PHY-LINE COHERENCY-SIZE
    L1d      48K     768K  12 Data            1    64      1          64
    L1i      32K     512K   8 Instruction     1    64      1          64
    L2        2M      32M  16 Unified         2  2048      1          64
    L3       45M      45M  15 Unified         3 49152      1          64

    -----------------------------------------------------------
8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
  available: 2 nodes (0-1)
```

(Continued on next page)

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Platform Notes (Continued)

```
  node 0 cpus: 0-7,16-23
  node 0 size: 257703 MB
  node 0 free: 257045 MB
  node 1 cpus: 8-15,24-31
  node 1 size: 258031 MB
  node 1 free: 257130 MB
  node distances:
  node   0   1
    0:  10  20
    1:  20  10

------------------------------------------------------------
9. /proc/meminfo
   MemTotal:       528113184 kB


------------------------------------------------------------
10. who -r
  run-level 3 Oct 15 11:31


------------------------------------------------------------
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-pstore wicked wickedd-auto4 wickedd-dhcp4
                     wickedd-dhcp6 wickedd-nanny
   enabled-runtime   systemd-remount-fs
   disabled          blk-availability boot-sysctl ca-certificates chrony-wait chronyd console-getty debug-shell
                     grub2-once haveged haveged-switch-root hwloc-dump-hwdata issue-add-ssh-keys kexec-load ksm
                     kvm_stat lunmask multipathd rpmconfigcheck serial-getty@ systemd-boot-check-no-failures
                     systemd-network-generator systemd-sysext systemd-time-wait-sync systemd-timesyncd
                     target-isns targetcli targetclid
   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
    boost state support:
      Supported: yes
      Active: yes


------------------------------------------------------------
15. sysctl
  kernel.numa_balancing            1
  kernel.randomize_va_space        2
```

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Platform Notes (Continued)

```
   vm.compaction_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.extfrag_threshold               500
   vm.min_unmapped_ratio                1
   vm.nr_hugepages                      0
   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 defer+madvise [madvise] never
   enabled         [always] madvise never
   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 SP5


   ---------------------------------------------------------------
19. Disk information
SPEC is set to: /home/cpu2017
   Filesystem      Type  Size  Used Avail Use% Mounted on
   /dev/sda4       xfs   155G   26G  129G  17% /home


   ---------------------------------------------------------------
20. /sys/devices/virtual/dmi/id
   Vendor:        HPE
   Product:       ProLiant DL320 Gen11
   Product Family: ProLiant
   Serial:        CNX2210H28


   ---------------------------------------------------------------
21. 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:
```

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Platform Notes (Continued)

```
     8x Hynix HMCG94AGBRA184N 64 GB 2 rank 5600, configured at 5200


    ------------------------------------------------------------
    22. BIOS
    (This section combines info from /sys/devices and dmidecode.)
       BIOS Vendor:       HPE
       BIOS Version:      2.32
       BIOS Date:         09/09/2024
       BIOS Revision:     2.32
       Firmware Revision: 1.62
```

Compiler Version Notes

```
==============================================================================
C      | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base) 525.x264_r(base) 557.xz_r(base)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2024.1.0 Build 20240308
Copyright (C) 1985-2024 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------


==============================================================================
C++    | 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base) 541.leela_r(base)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2024.1.0 Build 20240308
Copyright (C) 1985-2024 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------


==============================================================================
Fortran | 548.exchange2_r(base)
------------------------------------------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2024.1.0 Build 20240308
Copyright (C) 1985-2024 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`

(Continued on next page)

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Base Portability Flags (Continued)

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/opt/intel/oneapi/compiler/2024.1/lib -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/opt/intel/oneapi/compiler/2024.1/lib -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/opt/intel/oneapi/compiler/2024.1/lib -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-EMR-rev1.0.html
  http://www.spec.org/cpu2017/flags/Intel-ic2024-official-linux64.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/Intel-ic2024-official-linux64.xml

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 2024-10-15 02:09:39-0400.
Report generated on 2024-11-20 11:02:23 by CPU2017 PDF formatter v6716.
Originally published on 2024-11-19.