SPEC CPU®2017 Integer Rate Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)
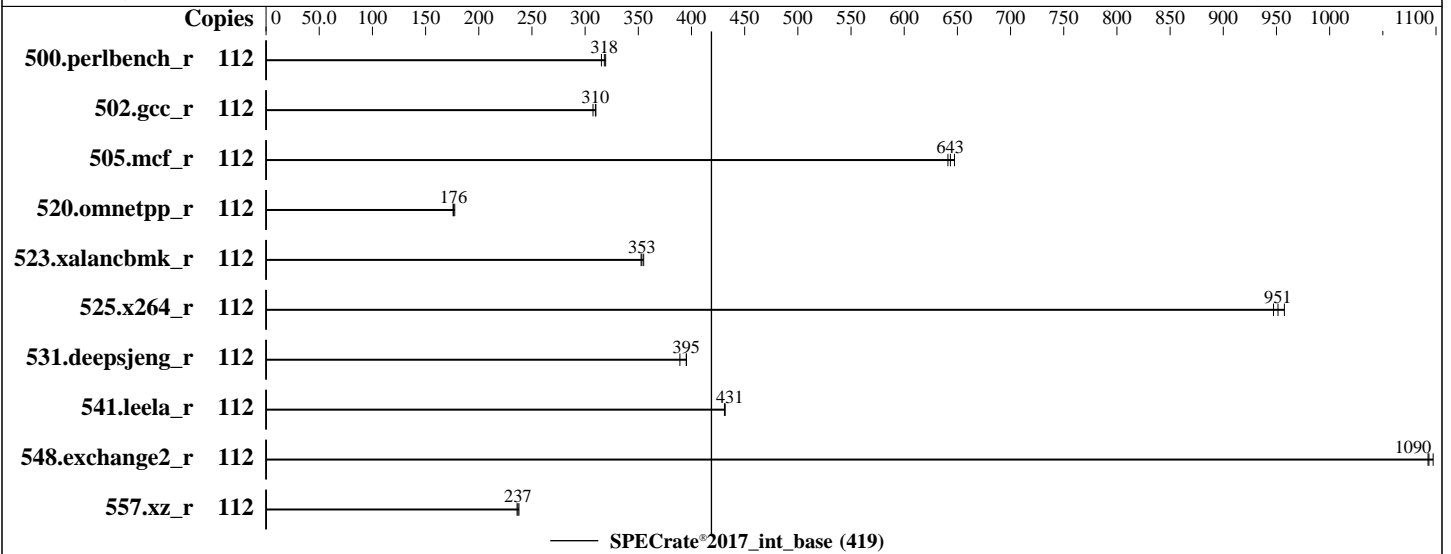
ProLiant XL225n Gen10 Plus
(2.75 GHz, AMD EPYC 7453)

$SPECrate^{®}2017\_int\_base =$ 419

$SPECrate^{®}2017\_int\_peak =$ Not Run

CPU2017 License: 3	**Test Date:** Jun-2022
Test Sponsor: HPE	**Hardware Availability:** Feb-2022
Tested by: HPE	**Software Availability:** Dec-2021

Copies

Benchmark	Copies	Result
500.perlbench_r	112	318
502.gcc_r	112	310
505.mcf_r	112	643
520.omnetpp_r	112	176
523.xalancbmk_r	112	353
525.x264_r	112	951
531.deepsjeng_r	112	395
541.leela_r	112	431
548.exchange2_r	112	1090
557.xz_r	112	237

SPECrate®2017_int_base (419)

Hardware

CPU Name: AMD EPYC 7453
 Max MHz: 3450
 Nominal: 2750
Enabled: 56 cores, 2 chips, 2 threads/core
Orderable: 1, 2 chip(s)
Cache L1: 32 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, 16 MB shared / 7 cores
 Other: None
Memory: 2 TB (16 x 128 GB 4Rx4 PC4-3200AA-L)
Storage: 1 x 960 GB SATA SSD, RAID 0
Other: None

Software

OS: Ubuntu 20.04.1 LTS (x86_64)
 Kernel 5.4.0-42-generic
Compiler: C/C++/Fortran: Version 3.2.0 of AOCC
Parallel: No
Firmware: HPE BIOS Version A46 v2.56 (02/10/2022) released Feb-2022
File System: ext4
System State: Run level 5 (multi-user)
Base Pointers: 64-bit
Peak Pointers: Not Applicable
Other: jemalloc: jemalloc memory allocator library v5.1.0
Power Management: BIOS and OS set to prefer performance at the cost of additional power usage

Standard Performance Evaluation Corporation (info@spec.org)

https://www.spec.org/

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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	112	558	319	565	315	**561**	**318**							
502.gcc_r	112	511	310	516	307	**512**	**310**							
505.mcf_r	112	280	647	**281**	**643**	282	641							
520.omnetpp_r	112	828	177	**833**	**176**	836	176							
523.xalancbmk_r	112	**335**	**353**	333	355	335	353							
525.x264_r	112	205	957	207	947	**206**	**951**							
531.deepsjeng_r	112	325	395	**325**	**395**	330	389							
541.leela_r	112	430	432	**430**	**431**	430	431							
548.exchange2_r	112	267	1100	**268**	**1090**	269	1090							
557.xz_r	112	**511**	**237**	509	238	513	236							
SPECrate®2017_int_base =	**419**													
SPECrate®2017_int_peak =	**Not Run**													

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/
```

Submit Notes

```
The config file option 'submit' was used.
'numactl' was used to bind copies to the cores.
See the configuration file for details.
```

Operating System Notes

```
'ulimit -s unlimited' was used to set environment stack size limit
'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>

To limit dirty cache to 8% of memory, 'sysctl -w vm.dirty_ratio=8' run as root.
To limit swap usage to minimum necessary, 'sysctl -w vm.swappiness=1' run as root.
To free node-local memory and avoid remote memory usage,
'sysctl -w vm.zone_reclaim_mode=1' run as root.
To clear filesystem caches, 'sync; sysctl -w vm.drop_caches=3' run as root.
To disable address space layout randomization (ASLR) to reduce run-to-run
variability, 'sysctl -w kernel.randomize_va_space=0' run as root.
```

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Operating System Notes (Continued)

```
To enable Transparent Hugepages (THP) only on request for base runs,
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled' run as root.
To enable THP for all allocations for peak runs,
'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and
'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
     "/home/cpu2017/amd_rate_aocc320_milanx_A_lib/lib;/home/cpu2017/amd_rate_
     aocc320_milanx_A_lib/lib32:"
MALLOC_CONF = "retain:true"
```

General Notes

```
Binaries were compiled on a system with 2x AMD EPYC 7742 CPU + 1TiB Memory using OpenSUSE 15.2

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 7.4 (No options specified)
jemalloc 5.1.0 is available here:
https://github.com/jemalloc/jemalloc/releases/download/5.1.0/jemalloc-5.1.0.tar.bz2
```

Platform Notes

```
BIOS Configuration:
 Workload Profile set to General Throughput Compute
 Determinism Control set to Manual
  Performance Determinism set to Power Deterministic
 Last-Level Cache (LLC) as NUMA Node set to Enabled
 NUMA memory domains per socket set to Four memory domains per socket
 Data Fabric C-State Enable set to Force Enabled
 Thermal Configuration set to Maximum Cooling
 Workload Profile set to Custom
```

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Platform Notes (Continued)

```
  Infinity Fabric Power Management set to Disabled
   Infinity Fabric Performance State set to P0
 L2 HW Prefetcher set to Disabled


The system date and time as discovered by sysinfo is incorrect as the time was not updated
prior to the run. The test_date field shows an accurate date for the result.

 Sysinfo program /home/cpu2017/bin/sysinfo
 Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
 running on ubuntu Wed Apr  1 13:28:22 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 : AMD EPYC 7453 28-Core Processor
      2  "physical id"s (chips)
      112 "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 : 28
      siblings  : 56
      physical 0: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 14 16 17 18 19 20 21 22 24 25 26 27
      28 29 30
      physical 1: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 14 16 17 18 19 20 21 22 24 25 26 27
      28 29 30

 From lscpu from util-linux 2.34:
      Architecture:             x86_64
      CPU op-mode(s):           32-bit, 64-bit
      Byte Order:               Little Endian
      Address sizes:            48 bits physical, 48 bits virtual
      CPU(s):                   112
      On-line CPU(s) list:      0-111
      Thread(s) per core:       2
      Core(s) per socket:       28
      Socket(s):                2
      NUMA node(s):             8
      Vendor ID:                AuthenticAMD
      CPU family:               25
      Model:                    1
      Model name:               AMD EPYC 7453 28-Core Processor
      Stepping:                 1
      CPU MHz:                  3198.444
      BogoMIPS:                 5489.97
```

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Platform Notes (Continued)

```
    Virtualization:                 AMD-V
    L1d cache:                      1.8 MiB
    L1i cache:                      1.8 MiB
    L2 cache:                       28 MiB
    L3 cache:                       128 MiB
    NUMA node0 CPU(s):              0-6,56-62
    NUMA node1 CPU(s):              7-13,63-69
    NUMA node2 CPU(s):              14-20,70-76
    NUMA node3 CPU(s):              21-27,77-83
    NUMA node4 CPU(s):              28-34,84-90
    NUMA node5 CPU(s):              35-41,91-97
    NUMA node6 CPU(s):              42-48,98-104
    NUMA node7 CPU(s):              49-55,105-111
    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; Full AMD retpoline, IBPB conditional,
    IBRS_FW, STIBP always-on, RSB filling
    Vulnerability Srbds:            Not affected
    Vulnerability Tsx async abort:  Not affected
    Flags:                          fpu vme de pse tsc msr pae mce cx8 apic sep mtrr
    pge 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 cpuid extd_apicid
    aperfmperf pni pclmulqdq monitor ssse3 fma cx16 pcid sse4_1 sse4_2 movbe popcnt aes
    xsave avx f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a
    misalignsse 3dnowprefetch osvw ibs skinit wdt tce topoext perfctr_core perfctr_nb
    bpext perfctr_llc mwaitx cpb cat_l3 cdp_l3 invpcid_single hw_pstate ssbd mba ibrs
    ibpb stibp vmmcall fsgsbase bmi1 avx2 smep bmi2 invpcid cqm rdt_a rdseed adx smap
    clflushopt clwb sha_ni xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc
    cqm_mbm_total cqm_mbm_local clzero irperf xsaveerptr wbnoinvd arat npt lbrv svm_lock
    nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter pfthreshold
    v_vmsave_vmload vgif umip pku ospke vaes vpclmulqdq rdpid overflow_recov succor smca

 From lscpu --cache:
    NAME ONE-SIZE ALL-SIZE WAYS TYPE          LEVEL
    L1d        32K     1.8M   8 Data             1
    L1i        32K     1.8M   8 Instruction      1
    L2        512K      28M   8 Unified          2
    L3         16M     128M  16 Unified          3

 /proc/cpuinfo cache data
    cache size : 512 KB
```

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Platform Notes (Continued)

```
 From numactl --hardware
 WARNING: a numactl 'node' might or might not correspond to a physical chip.
   available: 8 nodes (0-7)
   node 0 cpus: 0 1 2 3 4 5 6 56 57 58 59 60 61 62
   node 0 size: 257771 MB
   node 0 free: 256457 MB
   node 1 cpus: 7 8 9 10 11 12 13 63 64 65 66 67 68 69
   node 1 size: 258044 MB
   node 1 free: 257734 MB
   node 2 cpus: 14 15 16 17 18 19 20 70 71 72 73 74 75 76
   node 2 size: 258044 MB
   node 2 free: 257774 MB
   node 3 cpus: 21 22 23 24 25 26 27 77 78 79 80 81 82 83
   node 3 size: 258032 MB
   node 3 free: 257759 MB
   node 4 cpus: 28 29 30 31 32 33 34 84 85 86 87 88 89 90
   node 4 size: 258044 MB
   node 4 free: 257816 MB
   node 5 cpus: 35 36 37 38 39 40 41 91 92 93 94 95 96 97
   node 5 size: 258044 MB
   node 5 free: 257831 MB
   node 6 cpus: 42 43 44 45 46 47 48 98 99 100 101 102 103 104
   node 6 size: 258044 MB
   node 6 free: 257785 MB
   node 7 cpus: 49 50 51 52 53 54 55 105 106 107 108 109 110 111
   node 7 size: 258043 MB
   node 7 free: 257829 MB
   node distances:
   node   0   1   2   3   4   5   6   7
     0:  10  12  12  12  32  32  32  32
     1:  12  10  12  12  32  32  32  32
     2:  12  12  10  12  32  32  32  32
     3:  12  12  12  10  32  32  32  32
     4:  32  32  32  32  10  12  12  12
     5:  32  32  32  32  12  10  12  12
     6:  32  32  32  32  12  12  10  12
     7:  32  32  32  32  12  12  12  10

 From /proc/meminfo
    MemTotal:       2113606104 kB
    HugePages_Total:        0
    Hugepagesize:        2048 kB

 /sbin/tuned-adm active
     Current active profile: throughput-performance
```

(Continued on next page)

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Platform Notes (Continued)

```
/usr/bin/lsb_release -d
   Ubuntu 20.04.1 LTS

From /etc/*release* /etc/*version*
   debian_version: bullseye/sid
   os-release:
      NAME="Ubuntu"
      VERSION="20.04.1 LTS (Focal Fossa)"
      ID=ubuntu
      ID_LIKE=debian
      PRETTY_NAME="Ubuntu 20.04.1 LTS"
      VERSION_ID="20.04"
      HOME_URL="https://www.ubuntu.com/"
      SUPPORT_URL="https://help.ubuntu.com/"

uname -a:
   Linux ubuntu 5.4.0-42-generic #46-Ubuntu SMP Fri Jul 10 00:24:02 UTC 2020 x86_64
   x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit):                  Not affected
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: usercopy/swapgs
                                                 barriers and __user pointer
                                                 sanitization
CVE-2017-5715 (Spectre variant 2):               Mitigation: Full AMD retpoline,
                                                IBPB: conditional, IBRS_FW, STIBP:
                                                 always-on, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort):         Not affected

 run-level 5 Apr 1 13:24

SPEC is set to: /home/cpu2017
   Filesystem                  Type  Size  Used Avail Use% Mounted on
   /dev/mapper/vgubuntu-root ext4   732G   19G  676G   3% /

From /sys/devices/virtual/dmi/id
   Vendor:         HPE
   Product:        ProLiant XL225n Gen10 Plus
   Product Family: ProLiant
```

(Continued on next page)

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Platform Notes (Continued)

```
         Serial:          CN700303ZK

 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:
     16x Samsung M386AAG40AM3-CWE 128 GB 4 rank 3200

 BIOS:
   BIOS Vendor:       HPE
   BIOS Version:      A46
   BIOS Date:         02/10/2022
   BIOS Revision:     2.56
   Firmware Revision: 2.55

 (End of data from sysinfo program)
```

Compiler Version Notes

```
================================================================================
C       | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base)
        | 525.x264_r(base) 557.xz_r(base)
--------------------------------------------------------------------------------
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
--------------------------------------------------------------------------------


================================================================================
C++     | 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base)
        | 541.leela_r(base)
--------------------------------------------------------------------------------
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
--------------------------------------------------------------------------------


================================================================================
Fortran | 548.exchange2_r(base)
--------------------------------------------------------------------------------
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
```

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Compiler Version Notes (Continued)

```
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
-----------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
```
clang
```

C++ benchmarks:
```
clang++
```

Fortran benchmarks:
```
flang
```

Base Portability Flags

500.perlbench_r: `-DSPEC_LINUX_X64 -DSPEC_LP64`
502.gcc_r: `-DSPEC_LP64`
505.mcf_r: `-DSPEC_LP64`
520.omnetpp_r: `-DSPEC_LP64`
523.xalancbmk_r: `-DSPEC_LINUX -DSPEC_LP64`
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:
```
-m64 -Wl,-allow-multiple-definition -Wl,-mllvm -Wl,-enable-licm-vrp
-flto -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM
-ffast-math -fstruct-layout=5 -mllvm -unroll-threshold=50
-mllvm -inline-threshold=1000 -fremap-arrays
```

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Base Optimization Flags (Continued)

C benchmarks (continued):
```
-mllvm -function-specialize -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -enable-loop-fusion -z muldefs -lamdlibm -ljemalloc -lflang
```

C++ benchmarks:
```
-m64 -std=c++98 -flto -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM
-ffast-math -mllvm -enable-partial-unswitch
-mllvm -unroll-threshold=100 -finline-aggressive
-flv-function-specialization -mllvm -loop-unswitch-threshold=200000
-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch
-mllvm -extra-vectorizer-passes -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -convert-pow-exp-to-int=false
-mllvm -enable-loop-fusion -z muldefs -fvirtual-function-elimination
-fvisibility=hidden -lamdlibm -ljemalloc -lflang
```

Fortran benchmarks:
```
-m64 -Wl,-mllvm -Wl,-inline-recursion=4
-Wl,-mllvm -Wl,-lsr-in-nested-loop -Wl,-mllvm -Wl,-enable-iv-split
-flto -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM
-ffast-math -z muldefs -mllvm -unroll-aggressive
-mllvm -unroll-threshold=500 -lamdlibm -ljemalloc -lflang
```

Base Other Flags

C benchmarks:
```
-Wno-unused-command-line-argument
```

C++ benchmarks:
```
-Wno-unused-command-line-argument
```

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-revR.html
http://www.spec.org/cpu2017/flags/aocc320-flags-A1.html

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SPECrate®2017_int_peak = Not Run

CPU2017 License:	3	**Test Date:**	Jun-2022
Test Sponsor:	HPE	**Hardware Availability:**	Feb-2022
Tested by:	HPE	**Software Availability:**	Dec-2021

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-revR.xml
http://www.spec.org/cpu2017/flags/aocc320-flags-A1.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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