SPEC CPU®2017 Floating Point Rate Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL385 Gen10 Plus v2
(3.05 GHz, AMD EPYC 7373X)

$SPECrate®2017\_fp\_base = 392$
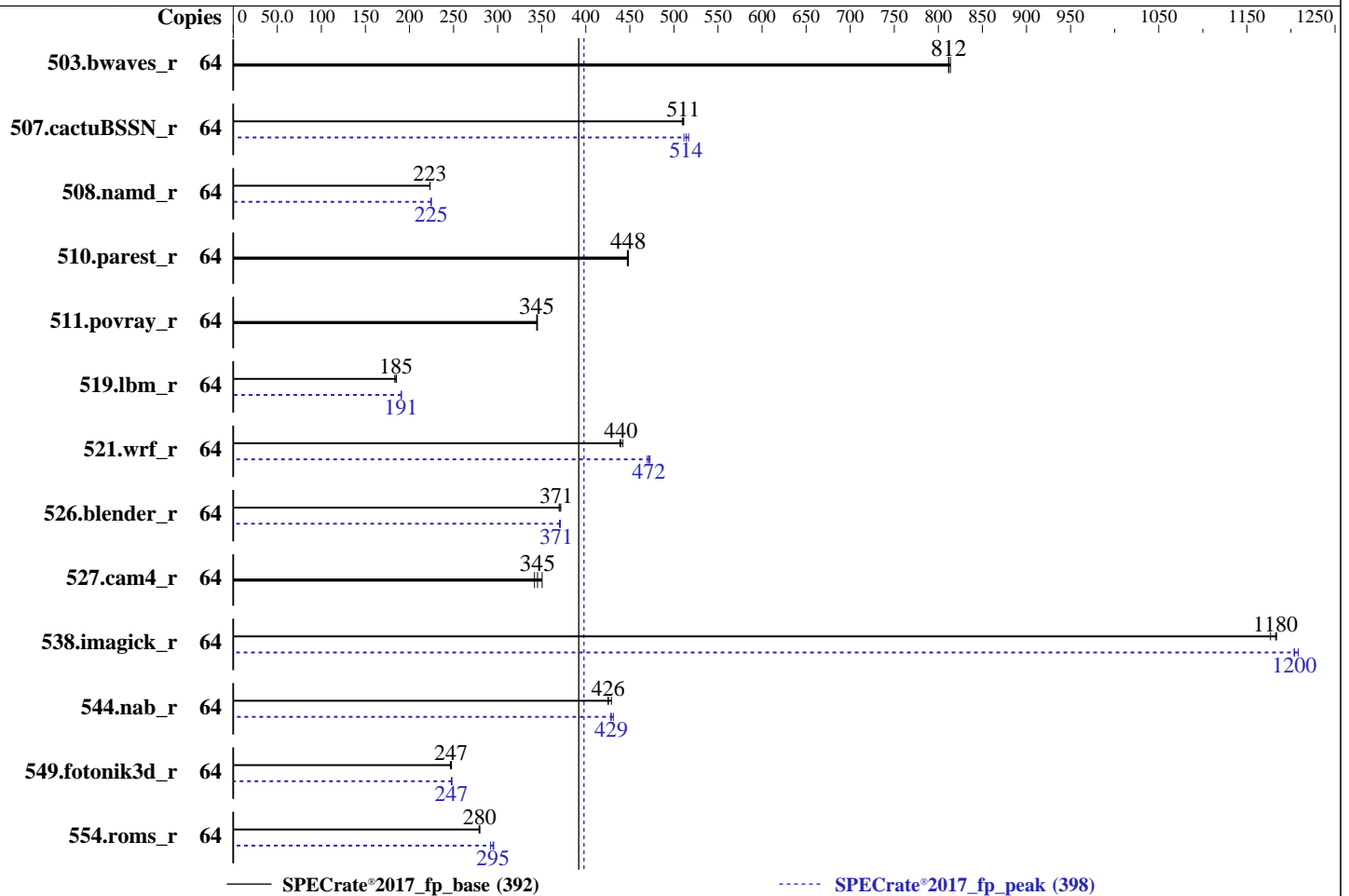
$SPECrate®2017\_fp\_peak = 398$

CPU2017 License: 3

Test Sponsor: HPE

Tested by: HPE

Test Date: Feb-2022

Hardware Availability: Mar-2022

Software Availability: Jan-2022

Copies

Benchmark	Copies	base	peak
503.bwaves_r	64	812	
507.cactuBSSN_r	64	511	514
508.namd_r	64	223	225
510.parest_r	64	448	
511.povray_r	64	345	
519.lbm_r	64	185	191
521.wrf_r	64	440	472
526.blender_r	64	371	371
527.cam4_r	64	345	
538.imagick_r	64	1180	1200
544.nab_r	64	426	429
549.fotonik3d_r	64	247	247
554.roms_r	64	280	295

—— SPECrate®2017_fp_base (392)   ------ SPECrate®2017_fp_peak (398)

Hardware

CPU Name: AMD EPYC 7373X

Max MHz: 3800

Nominal: 3050

Enabled: 32 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: 768 MB I+D on chip per chip,
96 MB shared / 2 cores

Other: None

Memory: 2 TB (16 x 128 GB 4Rx4 PC4-3200AA-L)

Storage: 1 x 400 GB SAS SSD

Other: None

Software

OS: Ubuntu 20.04.3 LTS (x86_64)
Kernel 5.13.0-28-generic

Compiler: C/C++/Fortran: Version 3.2.0 of AOCC

Parallel: No

Firmware: HPE BIOS Version A42 v2.56 02/10/2022 released Feb-2022

File System: ext4

System State: Run level 5 (multi-user)

Base Pointers: 64-bit

Peak Pointers: 64-bit

Other: jemalloc: jemalloc memory allocator library v5.1.0

Power Management: BIOS set to prefer performance at the cost of additional power usage

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Results Table

Benchmark	Copies	Base Seconds	Base Ratio	Base Seconds	Base Ratio	Base Seconds	Base Ratio	Copies	Peak Seconds	Peak Ratio	Peak Seconds	Peak Ratio	Peak Seconds	Peak Ratio
503.bwaves_r	64	**_791_**	**_812_**	791	812	789	814	64	**_791_**	**_812_**	791	812	789	814
507.cactuBSSN_r	64	159	509	**_159_**	**_511_**	159	511	64	158	511	**_158_**	**_514_**	157	517
508.namd_r	64	272	223	273	223	**_272_**	**_223_**	64	271	224	**_271_**	**_225_**	271	225
510.parest_r	64	374	447	**_374_**	**_448_**	373	448	64	374	447	**_374_**	**_448_**	373	448
511.povray_r	64	**_434_**	**_345_**	434	344	433	345	64	**_434_**	**_345_**	434	344	433	345
519.lbm_r	64	368	183	**_365_**	**_185_**	364	185	64	**_354_**	**_191_**	353	191	354	190
521.wrf_r	64	324	442	327	439	**_326_**	**_440_**	64	303	473	305	470	**_304_**	**_472_**
526.blender_r	64	**_263_**	**_371_**	264	370	262	372	64	**_263_**	**_371_**	263	370	263	371
527.cam4_r	64	327	342	319	350	**_324_**	**_345_**	64	327	342	319	350	**_324_**	**_345_**
538.imagick_r	64	134	1180	**_135_**	**_1180_**	135	1180	64	132	1200	132	1210	**_132_**	**_1200_**
544.nab_r	64	251	429	253	425	**_253_**	**_426_**	64	251	429	**_251_**	**_429_**	250	431
549.fotonik3d_r	64	1007	248	1012	246	**_1009_**	**_247_**	64	**_1008_**	**_247_**	1005	248	1008	247
554.roms_r	64	364	280	365	279	**_364_**	**_280_**	64	348	292	**_345_**	**_295_**	344	296
SPECrate®2017_fp_base =		**392**												
SPECrate®2017_fp_peak =		**398**												

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.

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Operating System Notes (Continued)

```
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.

To enable Transparent Hugepages (THP) for all allocations,
'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
 Memory Interleaving Mode set to Disabled
 Memory Patrol Scrubbing set to Disabled
 Memory PStates set to Disabled
```

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Standard Performance Evaluation Corporation (info@spec.org) https://www.spec.org/

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Platform Notes (Continued)

```
 Thermal Configuration set to Maximum Cooling
 Infinity Fabric Power Management set to Disabled
   Infinity Fabric Performance State set to P0
 Workload Profile set to Custom
   L1 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.


The system ROM used for this result contains microcode version 0x 0A001227h for the
AMD EPYC 7nn3X family of processors. The reference code/AGESA version used in this
ROM is version MilanPI 1.0.0.8

 Sysinfo program /home/cpu2017/bin/sysinfo
 Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
 running on new-ProLiant-DL385-Gen10-Plus Mon Jan 10 10:34:29 2022

 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 7373X 16-Core Processor
       2  "physical id"s (chips)
       64 "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 : 16
       siblings  : 32
       physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
       physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

 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):                  64
    On-line CPU(s) list:     0-63
    Thread(s) per core:      2
    Core(s) per socket:      16
    Socket(s):               2
    NUMA node(s):            16
    Vendor ID:               AuthenticAMD
    CPU family:              25
    Model:                   1
    Model name:              AMD EPYC 7373X 16-Core Processor
```

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Platform Notes (Continued)

```
          Stepping:                       2
          Frequency boost:                enabled
          CPU MHz:                        3050.000
          CPU max MHz:                    3050.0000
          CPU min MHz:                    1500.0000
          BogoMIPS:                       6088.80
          Virtualization:                 AMD-V
          L1d cache:                      1 MiB
          L1i cache:                      1 MiB
          L2 cache:                       16 MiB
          L3 cache:                       1.5 GiB
          NUMA node0 CPU(s):              0,1,32,33
          NUMA node1 CPU(s):              2,3,34,35
          NUMA node2 CPU(s):              4,5,36,37
          NUMA node3 CPU(s):              6,7,38,39
          NUMA node4 CPU(s):              8,9,40,41
          NUMA node5 CPU(s):              10,11,42,43
          NUMA node6 CPU(s):              12,13,44,45
          NUMA node7 CPU(s):              14,15,46,47
          NUMA node8 CPU(s):              16,17,48,49
          NUMA node9 CPU(s):              18,19,50,51
          NUMA node10 CPU(s):             20,21,52,53
          NUMA node11 CPU(s):             22,23,54,55
          NUMA node12 CPU(s):             24,25,56,57
          NUMA node13 CPU(s):             26,27,58,59
          NUMA node14 CPU(s):             28,29,60,61
          NUMA node15 CPU(s):             30,31,62,63
          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
```

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Platform Notes (Continued)

```
    clflushopt clwb sha_ni xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc
    cqm_mbm_total cqm_mbm_local clzero irperf xsaveerptr rdpru wbnoinvd amd_ppin arat
    npt lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists
    pausefilter pfthreshold v_vmsave_vmload vgif v_spec_ctrl umip pku ospke vaes
    vpclmulqdq rdpid overflow_recov succor smca

  From lscpu --cache:
      NAME ONE-SIZE ALL-SIZE WAYS TYPE          LEVEL
      L1d       32K       1M    8 Data              1
      L1i       32K       1M    8 Instruction       1
      L2       512K      16M    8 Unified           2
      L3        96M     1.5G   16 Unified           3

  /proc/cpuinfo cache data
     cache size : 512 KB

  From numactl --hardware
  WARNING: a numactl 'node' might or might not correspond to a physical chip.
    available: 16 nodes (0-15)
    node 0 cpus: 0 1 32 33
    node 0 size: 128712 MB
    node 0 free: 128087 MB
    node 1 cpus: 2 3 34 35
    node 1 size: 129020 MB
    node 1 free: 128813 MB
    node 2 cpus: 4 5 36 37
    node 2 size: 129022 MB
    node 2 free: 128950 MB
    node 3 cpus: 6 7 38 39
    node 3 size: 129021 MB
    node 3 free: 128965 MB
    node 4 cpus: 8 9 40 41
    node 4 size: 129022 MB
    node 4 free: 128955 MB
    node 5 cpus: 10 11 42 43
    node 5 size: 129021 MB
    node 5 free: 128948 MB
    node 6 cpus: 12 13 44 45
    node 6 size: 129022 MB
    node 6 free: 128937 MB
    node 7 cpus: 14 15 46 47
    node 7 size: 129009 MB
    node 7 free: 128953 MB
    node 8 cpus: 16 17 48 49
    node 8 size: 129022 MB
    node 8 free: 128901 MB
    node 9 cpus: 18 19 50 51
```

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Platform Notes (Continued)

```
   node 9 size: 129021 MB
   node 9 free: 128847 MB
   node 10 cpus: 20 21 52 53
   node 10 size: 129022 MB
   node 10 free: 128914 MB
   node 11 cpus: 22 23 54 55
   node 11 size: 128988 MB
   node 11 free: 128902 MB
   node 12 cpus: 24 25 56 57
   node 12 size: 129022 MB
   node 12 free: 128960 MB
   node 13 cpus: 26 27 58 59
   node 13 size: 129021 MB
   node 13 free: 128962 MB
   node 14 cpus: 28 29 60 61
   node 14 size: 129022 MB
   node 14 free: 128945 MB
   node 15 cpus: 30 31 62 63
   node 15 size: 129018 MB
   node 15 free: 128934 MB
   node distances:
   node   0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15
     0:  10  11  12  12  12  12  12  12  32  32  32  32  32  32  32  32
     1:  11  10  12  12  12  12  12  12  32  32  32  32  32  32  32  32
     2:  12  12  10  11  12  12  12  12  32  32  32  32  32  32  32  32
     3:  12  12  11  10  12  12  12  12  32  32  32  32  32  32  32  32
     4:  12  12  12  12  10  11  12  12  32  32  32  32  32  32  32  32
     5:  12  12  12  12  11  10  12  12  32  32  32  32  32  32  32  32
     6:  12  12  12  12  12  12  10  11  32  32  32  32  32  32  32  32
     7:  12  12  12  12  12  12  11  10  32  32  32  32  32  32  32  32
     8:  32  32  32  32  32  32  32  32  10  11  12  12  12  12  12  12
     9:  32  32  32  32  32  32  32  32  11  10  12  12  12  12  12  12
    10:  32  32  32  32  32  32  32  32  12  12  10  11  12  12  12  12
    11:  32  32  32  32  32  32  32  32  12  12  11  10  12  12  12  12
    12:  32  32  32  32  32  32  32  32  12  12  12  12  10  11  12  12
    13:  32  32  32  32  32  32  32  32  12  12  12  12  11  10  12  12
    14:  32  32  32  32  32  32  32  32  12  12  12  12  12  12  10  11
    15:  32  32  32  32  32  32  32  32  12  12  12  12  12  12  11  10

 From /proc/meminfo
    MemTotal:       2113531780 kB
    HugePages_Total:         0
    Hugepagesize:         2048 kB

 /sbin/tuned-adm active
     Current active profile: balanced
```

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Platform Notes (Continued)

```
/sys/devices/system/cpu/cpu*/cpufreq/scaling_governor has
    performance

/usr/bin/lsb_release -d
    Ubuntu 20.04.3 LTS

From /etc/*release* /etc/*version*
    debian_version: bullseye/sid
    os-release:
        NAME="Ubuntu"
        VERSION="20.04.3 LTS (Focal Fossa)"
        ID=ubuntu
        ID_LIKE=debian
        PRETTY_NAME="Ubuntu 20.04.3 LTS"
        VERSION_ID="20.04"
        HOME_URL="https://www.ubuntu.com/"
        SUPPORT_URL="https://help.ubuntu.com/"

uname -a:
    Linux new-ProLiant-DL385-Gen10-Plus 5.13.0-28-generic #31~20.04.1-Ubuntu SMP Wed Jan
    19 14:08:10 UTC 2022 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 Jan 10 10:27

SPEC is set to: /home/cpu2017
    Filesystem      Type  Size  Used Avail Use% Mounted on
    /dev/sdc2       ext4  366G   21G  327G   6% /

From /sys/devices/virtual/dmi/id
```

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Platform Notes (Continued)

```
        Vendor:          HPE
        Product:         ProLiant DL385 Gen10 Plus
        Product Family:  ProLiant
        Serial:          CN79340HC

 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
     16x UNKNOWN NOT AVAILABLE

 BIOS:
   BIOS Vendor:       HPE
   BIOS Version:      A42
   BIOS Date:         02/10/2022
   BIOS Revision:     2.56
   Firmware Revision: 2.40

 (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
C                  | 519.lbm_r(base, peak) 538.imagick_r(base, peak)
                   | 544.nab_r(base, peak)
------------------------------------------------------------------------------
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++                | 508.namd_r(base, peak) 510.parest_r(base, peak)
------------------------------------------------------------------------------
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
------------------------------------------------------------------------------


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

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Compiler Version Notes (Continued)

```
C++, C          | 511.povray_r(base, peak) 526.blender_r(base, peak)
------------------------------------------------------------------------
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
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++, C, Fortran | 507.cactuBSSN_r(base, peak)
------------------------------------------------------------------------
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
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
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         | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)
                | 554.roms_r(base, peak)
------------------------------------------------------------------------
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, C      | 521.wrf_r(base, peak) 527.cam4_r(base, peak)
```

(Continued on next page)

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ProLiant DL385 Gen10 Plus v2
(3.05 GHz, AMD EPYC 7373X)

SPECrate®2017_fp_base = 392

SPECrate®2017_fp_peak = 398

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

Test Date: Feb-2022
Hardware Availability: Mar-2022
Software Availability: Jan-2022

Compiler Version Notes (Continued)

```
--------------------------------------------------------------------------
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
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
--------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
`clang`

C++ benchmarks:
`clang++`

Fortran benchmarks:
`flang`

Benchmarks using both Fortran and C:
`flang clang`

Benchmarks using both C and C++:
`clang++ clang`

Benchmarks using Fortran, C, and C++:
`clang++ clang flang`

Base Portability Flags

503.bwaves_r: `-DSPEC_LP64`
507.cactuBSSN_r: `-DSPEC_LP64`
508.namd_r: `-DSPEC_LP64`
510.parest_r: `-DSPEC_LP64`
511.povray_r: `-DSPEC_LP64`
519.lbm_r: `-DSPEC_LP64`
521.wrf_r: `-DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64`
526.blender_r: `-funsigned-char -D__BOOL_DEFINED -DSPEC_LP64`

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Hewlett Packard Enterprise
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ProLiant DL385 Gen10 Plus v2
(3.05 GHz, AMD EPYC 7373X)

SPECrate®2017_fp_base = 392

SPECrate®2017_fp_peak = 398

CPU2017 License:	3	**Test Date:**	Feb-2022
Test Sponsor:	HPE	**Hardware Availability:**	Mar-2022
Tested by:	HPE	**Software Availability:**	Jan-2022

Base Portability Flags (Continued)

527.cam4_r: `-DSPEC_CASE_FLAG -DSPEC_LP64`
538.imagick_r: `-DSPEC_LP64`
544.nab_r: `-DSPEC_LP64`
549.fotonik3d_r: `-DSPEC_LP64`
554.roms_r: `-DSPEC_LP64`

Base Optimization Flags

C benchmarks:

```
-m64 -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
-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 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false -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 -lamdlibm -ljemalloc -lflang
```

Fortran benchmarks:

```
-m64 -Wl,-mllvm -Wl,-enable-X86-prefetching
-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 -Hz,1,0x1 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -Kieee -Mrecursive
```

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL385 Gen10 Plus v2
(3.05 GHz, AMD EPYC 7373X)

SPECrate®2017_fp_base = 392

SPECrate®2017_fp_peak = 398

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

Test Date: Feb-2022
Hardware Availability: Mar-2022
Software Availability: Jan-2022

Base Optimization Flags (Continued)

Fortran benchmarks (continued):
```
-mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -enable-loop-fusion
-mllvm -enable-loopinterchange -mllvm -compute-interchange-order
-z muldefs -lamdlibm -ljemalloc -lflang
```

Benchmarks using both Fortran and C:
```
-m64 -Wl,-mllvm -Wl,-enable-X86-prefetching
-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
-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 -Hz,1,0x1 -Kieee -Mrecursive
-mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop
-mllvm -enable-loopinterchange -mllvm -compute-interchange-order
-z muldefs -lamdlibm -ljemalloc -lflang
```

Benchmarks using both C and C++:
```
-m64 -std=c++98 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false -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
-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 -mllvm -enable-partial-unswitch
-mllvm -unroll-threshold=100 -finline-aggressive
-mllvm -loop-unswitch-threshold=200000 -mllvm -reroll-loops
-mllvm -aggressive-loop-unswitch -mllvm -extra-vectorizer-passes
-mllvm -convert-pow-exp-to-int=false -z muldefs -lamdlibm -ljemalloc
-lflang
```

Hewlett Packard Enterprise
(Test Sponsor: HPE)

ProLiant DL385 Gen10 Plus v2
(3.05 GHz, AMD EPYC 7373X)

SPECrate®2017_fp_base = 392

SPECrate®2017_fp_peak = 398

CPU2017 License: 3	**Test Date:**	Feb-2022
Test Sponsor: HPE	**Hardware Availability:**	Mar-2022
Tested by: HPE	**Software Availability:**	Jan-2022

Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++:
```
-m64 -std=c++98 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false -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
-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 -mllvm -enable-partial-unswitch
-mllvm -unroll-threshold=100 -finline-aggressive
-mllvm -loop-unswitch-threshold=200000 -mllvm -reroll-loops
-mllvm -aggressive-loop-unswitch -mllvm -extra-vectorizer-passes
-mllvm -convert-pow-exp-to-int=false -Hz,1,0x1 -Kieee -Mrecursive
-mllvm -fuse-tile-inner-loop -funroll-loops -mllvm -lsr-in-nested-loop
-mllvm -enable-loopinterchange -mllvm -compute-interchange-order
-z muldefs -lamdlibm -ljemalloc -lflang
```

Base Other Flags

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

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

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

Benchmarks using both Fortran and C:
```
-Wno-unused-command-line-argument
```

Benchmarks using both C and C++:
```
-Wno-unused-command-line-argument
```

Benchmarks using Fortran, C, and C++:
```
-Wno-unused-command-line-argument
```

SPEC CPU®2017 Floating Point Rate Result

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(Test Sponsor: HPE)

ProLiant DL385 Gen10 Plus v2
(3.05 GHz, AMD EPYC 7373X)

SPECrate®2017_fp_base = 392

SPECrate®2017_fp_peak = 398

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

Test Date: Feb-2022
Hardware Availability: Mar-2022
Software Availability: Jan-2022

Peak Compiler Invocation

C benchmarks:
```
clang
```

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

Fortran benchmarks:
```
flang
```

Benchmarks using both Fortran and C:
```
flang clang
```

Benchmarks using both C and C++:
```
clang++ clang
```

Benchmarks using Fortran, C, and C++:
```
clang++ clang flang
```

Peak Portability Flags

```
Same as Base Portability Flags
```

Peak Optimization Flags

C benchmarks:

```
519.lbm_r: -m64 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math
-fstruct-layout=7 -mllvm -unroll-threshold=50
-fremap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -lamdlibm -ljemalloc
```

```
538.imagick_r: Same as 519.lbm_r
```

```
544.nab_r: -m64 -flto -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize -Ofast -march=znver3
-fveclib=AMDLIBM -ffast-math -fstruct-layout=7
```

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SPEC CPU®2017 Floating Point Rate Result

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Hewlett Packard Enterprise
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ProLiant DL385 Gen10 Plus v2
(3.05 GHz, AMD EPYC 7373X)

SPECrate®2017_fp_base = 392

SPECrate®2017_fp_peak = 398

CPU2017 License: 3	**Test Date:** Feb-2022
Test Sponsor: HPE	**Hardware Availability:** Mar-2022
Tested by: HPE	**Software Availability:** Jan-2022

Peak Optimization Flags (Continued)

544.nab_r (continued):
```
-mllvm -unroll-threshold=50 -fremap-arrays
-flv-function-specialization -mllvm -inline-threshold=1000
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -lamdlibm -ljemalloc
```

C++ benchmarks:

508.namd_r: `-m64 -std=c++98 -mno-adx -mno-sse4a`
```
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false
-Wl,-mllvm -Wl,-enable-licm-vrp -flto
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math
-finline-aggressive -mllvm -unroll-threshold=100
-flv-function-specialization -mllvm -enable-licm-vrp
-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch
-mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -lamdlibm -ljemalloc
```

510.parest_r: `basepeak = yes`

Fortran benchmarks:

503.bwaves_r: `basepeak = yes`

549.fotonik3d_r: `-m64 -Wl,-mllvm -Wl,-enable-X86-prefetching`
```
-Wl,-mllvm -Wl,-enable-licm-vrp -flto
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -Kieee
-Mrecursive -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -enable-licm-vrp
-lamdlibm -ljemalloc -lflang
```

554.roms_r: `-m64 -Wl,-mllvm -Wl,-enable-X86-prefetching`
```
-Wl,-mllvm -Wl,-enable-licm-vrp -flto
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -Mrecursive
-mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -enable-licm-vrp
```

(Continued on next page)

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Hewlett Packard Enterprise
(Test Sponsor: HPE)

ProLiant DL385 Gen10 Plus v2
(3.05 GHz, AMD EPYC 7373X)

SPECrate®2017_fp_base = 392

SPECrate®2017_fp_peak = 398

CPU2017 License: 3		**Test Date:**	Feb-2022
Test Sponsor:	HPE	**Hardware Availability:**	Mar-2022
Tested by:	HPE	**Software Availability:**	Jan-2022

Peak Optimization Flags (Continued)

554.roms_r (continued):
```
-Hz,1,0x1 -mllvm -fuse-tile-inner-loop -lamdlibm
-ljemalloc -lflang
```

Benchmarks using both Fortran and C:

521.wrf_r: `-m64 -Wl,-mllvm -Wl,-enable-X86-prefetching`
```
-Wl,-mllvm -Wl,-enable-licm-vrp -flto
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math
-fstruct-layout=7 -mllvm -unroll-threshold=50
-fremap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -Mrecursive -lamdlibm
-ljemalloc -lflang
```

527.cam4_r: `basepeak = yes`

Benchmarks using both C and C++:

511.povray_r: `basepeak = yes`

526.blender_r: `-m64 -std=c++98 -mno-adx -mno-sse4a`
```
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false
-Wl,-mllvm -Wl,-enable-licm-vrp -flto
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math
-fstruct-layout=7 -mllvm -unroll-threshold=50
-fremap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -finline-aggressive
-mllvm -unroll-threshold=100 -mllvm -reroll-loops
-mllvm -aggressive-loop-unswitch -lamdlibm -ljemalloc
```

Benchmarks using Fortran, C, and C++:
```
-m64 -std=c++98 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false -Wl,-mllvm -Wl,-enable-licm-vrp
-flto -Wl,-mllvm -Wl,-function-specialize
```

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Hewlett Packard Enterprise
(Test Sponsor: HPE)

ProLiant DL385 Gen10 Plus v2
(3.05 GHz, AMD EPYC 7373X)

SPECrate®2017_fp_base = 392

SPECrate®2017_fp_peak = 398

CPU2017 License: 3		**Test Date:**	Feb-2022
Test Sponsor: HPE		**Hardware Availability:**	Mar-2022
Tested by: HPE		**Software Availability:**	Jan-2022

Peak Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):
```
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast -march=znver3
-fveclib=AMDLIBM -ffast-math -fstruct-layout=7
-mllvm -unroll-threshold=50 -fremap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true -mllvm -function-specialize
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -unroll-threshold=100 -mllvm -loop-unswitch-threshold=200000
-finline-aggressive -mllvm -reroll-loops
-mllvm -aggressive-loop-unswitch -mllvm -extra-vectorizer-passes
-mllvm -convert-pow-exp-to-int=false -Mrecursive -lamdlibm -ljemalloc
-lflang
```

Peak Other Flags

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

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

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

Benchmarks using both Fortran and C:
```
-Wno-unused-command-line-argument
```

Benchmarks using both C and C++:
```
-Wno-unused-command-line-argument
```

Benchmarks using Fortran, C, and C++:
```
-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

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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SPEC CPU®2017 Floating Point Rate Result

Hewlett Packard Enterprise
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ProLiant DL385 Gen10 Plus v2
(3.05 GHz, AMD EPYC 7373X)

SPECrate®2017_fp_base = 392

SPECrate®2017_fp_peak = 398

CPU2017 License:	3	**Test Date:**	Feb-2022
Test Sponsor:	HPE	**Hardware Availability:**	Mar-2022
Tested by:	HPE	**Software Availability:**	Jan-2022

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

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