SPEC CPU®2017 Integer Rate Result

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GIGA-BYTE TECHNOLOGY CO., LTD.

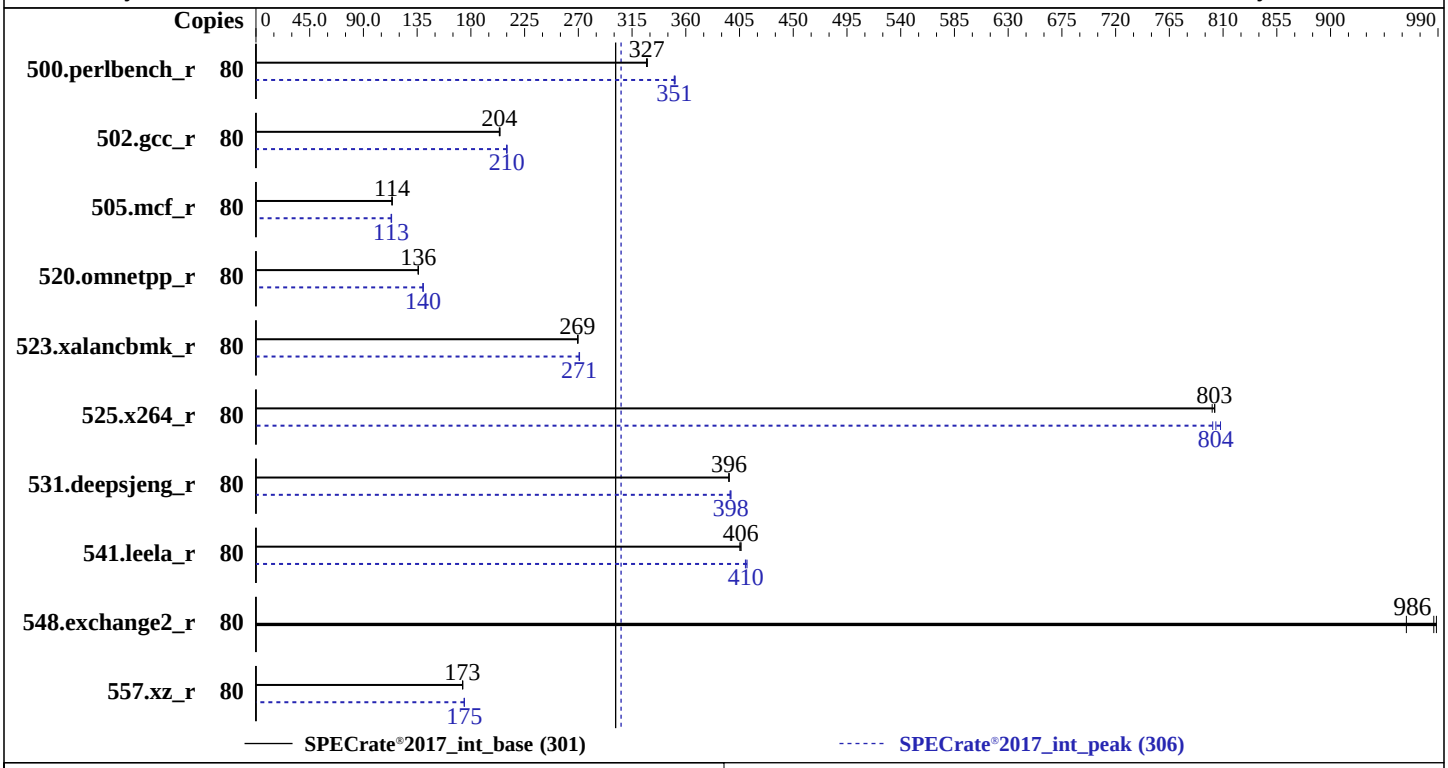
E252-P30-00 (Ampere Altra Q80-33 3.0 GHz)

SPECrate®2017_int_base = 301

SPECrate®2017_int_peak = 306

CPU2017 License: 9082
Test Sponsor: GIGA-BYTE TECHNOLOGY CO., LTD.
Tested by: GIGA-BYTE TECHNOLOGY CO., LTD.

Test Date: Feb-2021
Hardware Availability: Mar-2021
Software Availability: Dec-2020



Hardware

CPU Name:	Ampere Altra Q80-33
Max MHz:	3300
Nominal:	3000
Enabled:	80 cores, 1 chip
Orderable:	1 chips
Cache L1:	64 KB I + 64 KB D on chip per core
L2:	1 MB I+D on chip per core
L3:	32 MB I+D on chip per chip
Other:	None
Memory:	256 GB (8 x 32 GB 2Rx4 PC4-3200AA-R)
Storage:	811 GB, NVME, M.2, PCIe Gen3
Other:	None

Software

OS:	CentOS Linux release 8.3.2011 4.18.0-240.1.1.el8_3.aarch64
Compiler:	C/C++/Fortran: Version 10.2.1 of Ampere GCC
Parallel:	No
Firmware:	Version F05 released Jan-2021
File System:	xfs
System State:	Run level 3 (multi-user)
Base Pointers:	64-bit
Peak Pointers:	64-bit
Other:	Jemalloc memory allocator library v5.2.1
Power Management:	OS set to prefer performance at the cost of additional power usage

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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	80	**389**	**327**	389	328	389	327	80	**363**	**351**	363	351	364	350
502.gcc_r	80	556	204	554	204	**555**	**204**	80	**539**	**210**	539	210	540	210
505.mcf_r	80	1133	114	**1134**	**114**	1135	114	80	1138	114	**1141**	**113**	1141	113
520.omnetpp_r	80	773	136	**772**	**136**	771	136	80	750	140	749	140	**750**	**140**
523.xalancbmk_r	80	**314**	**269**	313	270	314	269	80	312	271	**312**	**271**	312	271
525.x264_r	80	174	803	175	801	**174**	**803**	80	175	801	**174**	**804**	173	808
531.deepsjeng_r	80	231	396	**231**	**396**	231	396	80	231	397	231	398	**231**	**398**
541.leela_r	80	327	405	326	406	**326**	**406**	80	322	411	**323**	**410**	323	410
548.exchange2_r	80	212	989	**212**	**986**	218	964	80	212	989	**212**	**986**	218	964
557.xz_r	80	499	173	499	173	**499**	**173**	80	495	175	495	174	**495**	**175**

SPECrate®2017_int_base = 301

SPECrate®2017_int_peak = 306

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

Compiler Notes

```
Binaries were compiled on a system with 2x Ampere Altra Q80-33 CPU
chips + 256 GB memory using CentOS 8.3

Ampere GCC 10.2.1 is available via
https://github.com/AmpereComputing/ampere-gcc/releases
```

Submit Notes

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

Operating System Notes

```
'ulimit -s unlimited' was used to set environment stack size
Set dirty_ratio=8 to limit dirty cache to 8% of memory
i.e. echo 8 | sudo tee /proc/sys/vm/dirty_ratio
Set swappiness=1 to swap only if necessary
i.e. echo 1 | sudo tee /proc/sys/vm/swappiness
Set zone_reclaim_mode=1 to free local node memory and avoid remote memory
i.e. echo 1 | sudo tee /proc/sys/vm/zone_reclaim_mode
Set drop_caches=3 to reset caches before invoking runcpu
i.e. echo 3 | sudo tee /proc/sys/vm/drop_caches
Set numa_balancing=0 to disable automatic numa balancing
i.e. echo 0 | sudo tee /proc/sys/kernel/numa_balancing
Switch off all ktune and tuned settings
i.e. sudo tuned-adm off
```

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Operating System Notes (Continued)

```
Transparent huge pages set to 'never'
i.e. sudo bash -c "echo never > /sys/kernel/mm/transparent_hugepage/enabled"

runcpu command invoked through numactl i.e.
numactl --interleave=0-3 runcpu
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
     "/home/amptest/ampere_spec2017/jemalloc/install/lib:/home/amptest/ampere
     _spec2017/gcc/install/lib64/:/home/amptest/ampere_spec2017/gcc/install/l
     ib/:/home/ampere_spec2017/gcc/install/lib64:/home/ampere_spec2017/jemall
     oc/install/lib:"
```

General Notes

```
Jemalloc v5.2.1 is available via
https://github.com/jemalloc/jemalloc/releases/download/5.2.1/jemalloc-5.2.1.tar.bz2
It was built on CentOS 8.3 using Version 10.2.1 of Ampere GCC with configure options
--prefix=/home/amptest/jemalloc/install --with-lg-quantum=3

NA:  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.
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.
NA:  The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown)
     is mitigated in the system as tested and documented.
```

Platform Notes

```
BIOS settings:
Chipset > ANC Mode >  Set to Quadrant

Sysinfo program /home/ampere_spec2017/spec2017/bin/sysinfo
Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c
running on localhost.localdomain Thu Feb 18 11:32:15 2021

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
*
```

(Continued on next page)

Platform Notes (Continued)

```
 * Did not identify cpu model.  If you would
 * like to write your own sysinfo program, see
 * www.spec.org/cpu2017/config.html#sysinfo
 *
 *
 * 0 "physical id" tags found.  Perhaps this is an older system,
 * or a virtualized system.  Not attempting to guess how to
 * count chips/cores for this system.
 *
       80 "processors"
    cores, siblings (Caution: counting these is hw and system dependent. The following
    excerpts from /proc/cpuinfo might not be reliable.  Use with caution.)

  From lscpu:
       Architecture:        aarch64
       Byte Order:          Little Endian
       CPU(s):              80
       On-line CPU(s) list: 0-79
       Thread(s) per core:  1
       Core(s) per socket:  80
       Socket(s):           1
       NUMA node(s):        4
       Vendor ID:           ARM
       Model:               1
       Stepping:            r3p1
       CPU max MHz:         3300.0000
       CPU min MHz:         1000.0000
       BogoMIPS:            50.00
       L1d cache:           64K
       L1i cache:           64K
       L2 cache:            1024K
       NUMA node0 CPU(s):   0-19
       NUMA node1 CPU(s):   20-39
       NUMA node2 CPU(s):   40-59
       NUMA node3 CPU(s):   60-79
       Flags:               fp asimd evtstrm aes pmull sha1 sha2 crc32 atomics fphp asimdhp
       cpuid asimdrdm lrcpc dcpop asimddp ssbs

  From numactl --hardware  WARNING: a numactl 'node' might or might not correspond to a
  physical chip.
    available: 4 nodes (0-3)
    node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
    node 0 size: 64513 MB
    node 0 free: 63887 MB
    node 1 cpus: 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39
    node 1 size: 65459 MB
    node 1 free: 64983 MB
```

(Continued on next page)

Platform Notes (Continued)

```
  node 2 cpus: 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59
  node 2 size: 65459 MB
  node 2 free: 65122 MB
  node 3 cpus: 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79
  node 3 size: 65424 MB
  node 3 free: 64415 MB
  node distances:
  node   0   1   2   3
    0:  10  11  11  12
    1:  11  10  12  11
    2:  11  12  10  11
    3:  12  11  11  10

From /proc/meminfo
   MemTotal:       267117312 kB
   HugePages_Total:       0
   Hugepagesize:     524288 kB

/sbin/tuned-adm active
    No current active profile.

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

/usr/bin/lsb_release -d
   CentOS Linux release 8.3.2011

From /etc/*release* /etc/*version*
   centos-release: CentOS Linux release 8.3.2011
   centos-release-upstream: Derived from Red Hat Enterprise Linux 8.3
   os-release:
      NAME="CentOS Linux"
      VERSION="8"
      ID="centos"
      ID_LIKE="rhel fedora"
      VERSION_ID="8"
      PLATFORM_ID="platform:el8"
      PRETTY_NAME="CentOS Linux 8"
      ANSI_COLOR="0;31"
   redhat-release: CentOS Linux release 8.3.2011
   system-release: CentOS Linux release 8.3.2011
   system-release-cpe: cpe:/o:centos:centos:8

uname -a:
   Linux localhost.localdomain 4.18.0-240.1.1.el8_3.aarch64 #1 SMP Thu Nov 19 22:13:39
   UTC 2020 aarch64 aarch64 aarch64 GNU/Linux
```

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Platform Notes (Continued)

```
 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
 CVE-2017-5753 (Spectre variant 1):                     Mitigation: __user pointer
                                                        sanitization
 CVE-2017-5715 (Spectre variant 2):                     Not affected
 CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
 CVE-2019-11135 (TSX Asynchronous Abort):               Not affected

 run-level 3 Feb 18 10:42

 SPEC is set to: /home/ampere_spec2017/spec2017
    Filesystem          Type  Size  Used Avail Use% Mounted on
    /dev/mapper/cl-home xfs   811G  119G  692G  15% /home

 From /sys/devices/virtual/dmi/id
     Vendor:         GIGABYTE
     Product:        E252-P30-00
     Product Family: Server
     Serial:         0123456789012345678 9AB

 Additional information from dmidecode 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:
     1x Array 1 Manufacturer 10 Array 1 Part Number 10
     1x Array 1 Manufacturer 12 Array 1 Part Number 12
     1x Array 1 Manufacturer 14 Array 1 Part Number 14
     1x Array 1 Manufacturer 16 Array 1 Part Number 16
     1x Array 1 Manufacturer 2 Array 1 Part Number 2
     1x Array 1 Manufacturer 4 Array 1 Part Number 4
     1x Array 1 Manufacturer 6 Array 1 Part Number 6
     1x Array 1 Manufacturer 8 Array 1 Part Number 8
     8x Samsung M393A4K40DB3-CWE 32 GB 2 rank 3200

 BIOS:
    BIOS Vendor:       GIGABYTE
    BIOS Version:      F05
    BIOS Date:         01/19/2021
    BIOS Revision:     5.15
    Firmware Revision: 1.3
```

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Platform Notes (Continued)

```
 (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
C       | 500.perlbench_r(base, peak) 502.gcc_r(base, peak) 505.mcf_r(base,
        | peak) 525.x264_r(base, peak) 557.xz_r(base, peak)
------------------------------------------------------------------------------
gcc (Ampere Computing Build 11923 20201215) 10.2.1 20201216
Copyright (C) 2020 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
------------------------------------------------------------------------------

==============================================================================
C++     | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base, peak)
        | 531.deepsjeng_r(base, peak) 541.leela_r(base, peak)
------------------------------------------------------------------------------
g++ (Ampere Computing Build 11923 20201215) 10.2.1 20201216
Copyright (C) 2020 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
------------------------------------------------------------------------------

==============================================================================
Fortran | 548.exchange2_r(base, peak)
------------------------------------------------------------------------------
GNU Fortran (Ampere Computing Build 11923 20201215) 10.2.1 20201216
Copyright (C) 2020 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
gcc

C++ benchmarks:
g++

Fortran benchmarks:
gfortran

Base Portability Flags

500.perlbench_r: `-DSPEC_LINUX_AARCH64 -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:
```
-mabi=lp64 -std=c99 -L/home/amptest/ampere_spec2017/gcc/install/lib64
-L/home/amptest/ampere_spec2017/gcc/install/lib
-L/home/amptest/ampere_spec2017/jemalloc/install/lib -g -O3
-mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=96 --param max-inline-insns-auto=64
--param inline-unit-growth=96 -fgnu89-inline -ljemalloc
```

C++ benchmarks:
```
-mabi=lp64 -std=c++03 -L/home/amptest/ampere_spec2017/gcc/install/lib64
-L/home/amptest/ampere_spec2017/gcc/install/lib
-L/home/amptest/ampere_spec2017/jemalloc/install/lib -g -O3
-mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=256 --param max-inline-insns-auto=128
--param inline-unit-growth=256 -ffinite-loops -ljemalloc
```

Fortran benchmarks:
```
-mabi=lp64 -L/home/amptest/ampere_spec2017/gcc/install/lib64
-L/home/amptest/ampere_spec2017/gcc/install/lib
-L/home/amptest/ampere_spec2017/jemalloc/install/lib -g -O3
-mcpu=neoverse-n1 -funroll-loops -flto=32
--param ipa-cp-eval-threshold=1 --param ipa-cp-unit-growth=80
--param ipa-cp-max-recursive-depth=8 -fno-inline-functions-called-once
-fstack-arrays -flto-partition=one -ljemalloc
```

Base Other Flags

C benchmarks:
```
-fcommon -Wl,-Map,mapfile
```

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Base Other Flags (Continued)

C++ benchmarks:
`-Wl,-Map,mapfile`

Fortran benchmarks:
`-Wl,-Map,mapfile`

Peak Compiler Invocation

C benchmarks:
`gcc`

C++ benchmarks:
`g++`

Fortran benchmarks:
`gfortran`

Peak Portability Flags

`Same as Base Portability Flags`

Peak Optimization Flags

C benchmarks:

500.perlbench_r: `-mabi=lp64 -std=c99`
`-L/home/amptest/ampere_spec2017/gcc/install/lib64`
`-L/home/amptest/ampere_spec2017/gcc/install/lib`
`-L/home/amptest/ampere_spec2017/jemalloc/install/lib`
`-fprofile-generate -fprofile-use -g -Ofast`
`-mcpu=neoverse-n1 -funroll-loops -flto=32`
`--param early-inlining-insns=96`
`--param max-inline-insns-auto=64`
`--param inline-unit-growth=96 -fno-strict-aliasing`
`-fno-unsafe-math-optimizations -fno-finite-math-only`
`-ljemalloc`

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Peak Optimization Flags (Continued)

502.gcc_r: -mabi=lp64 -std=c99
-L/home/amptest/ampere_spec2017/gcc/install/lib64
-L/home/amptest/ampere_spec2017/gcc/install/lib
-L/home/amptest/ampere_spec2017/jemalloc/install/lib
-fprofile-generate -fprofile-use -g -Ofast
-mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=96
--param max-inline-insns-auto=64
--param inline-unit-growth=96 -fno-strict-aliasing
-fgnu89-inline -ljemalloc

505.mcf_r: -mabi=lp64 -std=c99
-L/home/amptest/ampere_spec2017/gcc/install/lib64
-L/home/amptest/ampere_spec2017/gcc/install/lib
-L/home/amptest/ampere_spec2017/jemalloc/install/lib
-fprofile-generate -fprofile-use -g -Ofast
-mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=96
--param max-inline-insns-auto=64
--param inline-unit-growth=96 -fno-strict-aliasing
-ljemalloc

525.x264_r: -mabi=lp64 -std=c99
-L/home/amptest/ampere_spec2017/gcc/install/lib64
-L/home/amptest/ampere_spec2017/gcc/install/lib
-L/home/amptest/ampere_spec2017/jemalloc/install/lib -g
-Ofast -mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=96
--param max-inline-insns-auto=64
--param inline-unit-growth=96 -ljemalloc

557.xz_r: -mabi=lp64 -std=c99
-L/home/amptest/ampere_spec2017/gcc/install/lib64
-L/home/amptest/ampere_spec2017/gcc/install/lib
-L/home/amptest/ampere_spec2017/jemalloc/install/lib
-fprofile-generate -fprofile-use -g -Ofast
-mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=96
--param max-inline-insns-auto=64
--param inline-unit-growth=96 -ljemalloc

C++ benchmarks:

520.omnetpp_r: -mabi=lp64 -std=c++03
-L/home/amptest/ampere_spec2017/gcc/install/lib64
-L/home/amptest/ampere_spec2017/gcc/install/lib

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Peak Optimization Flags (Continued)

520.omnetpp_r (continued):
-L/home/amptest/ampere_spec2017/jemalloc/install/lib
-fprofile-generate -fprofile-use -g -Ofast
-mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=256
--param max-inline-insns-auto=128
--param inline-unit-growth=256 -ffinite-loops -ljemalloc

523.xalancbmk_r: Same as 520.omnetpp_r

531.deepsjeng_r: -mabi=lp64 -std=c++03
-L/home/amptest/ampere_spec2017/gcc/install/lib64
-L/home/amptest/ampere_spec2017/gcc/install/lib
-L/home/amptest/ampere_spec2017/jemalloc/install/lib -g
-Ofast -mcpu=neoverse-n1 -funroll-loops -flto=32
--param early-inlining-insns=256
--param max-inline-insns-auto=128
--param inline-unit-growth=256 -ffinite-loops -ljemalloc

541.leela_r: Same as 520.omnetpp_r

Fortran benchmarks:

548.exchange2_r: basepeak = yes

Peak Other Flags

C benchmarks (except as noted below):
-Wl,-Map,mapfile

525.x264_r: -fcommon -Wl,-Map,mapfile

557.xz_r: -w -Wl,-Map,mapfile

C++ benchmarks:
-Wl,-Map,mapfile

Fortran benchmarks:
-Wl,-Map,mapfile

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/gcc.2021-07-21.html
http://www.spec.org/cpu2017/flags/GIGA-BYTE-platform-settings-Altra-rev.2.html

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

http://www.spec.org/cpu2017/flags/gcc.2021-07-21.xml
http://www.spec.org/cpu2017/flags/GIGA-BYTE-platform-settings-Altra-rev.2.xml

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

Tested with SPEC CPU®2017 v1.1.5 on 2021-02-17 22:32:14-0500.
Report generated on 2021-08-24 12:36:58 by CPU2017 PS formatter v6442.
Originally published on 2021-07-20.