SPEC CPU®2017 Floating Point Speed Result

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Dell Inc.

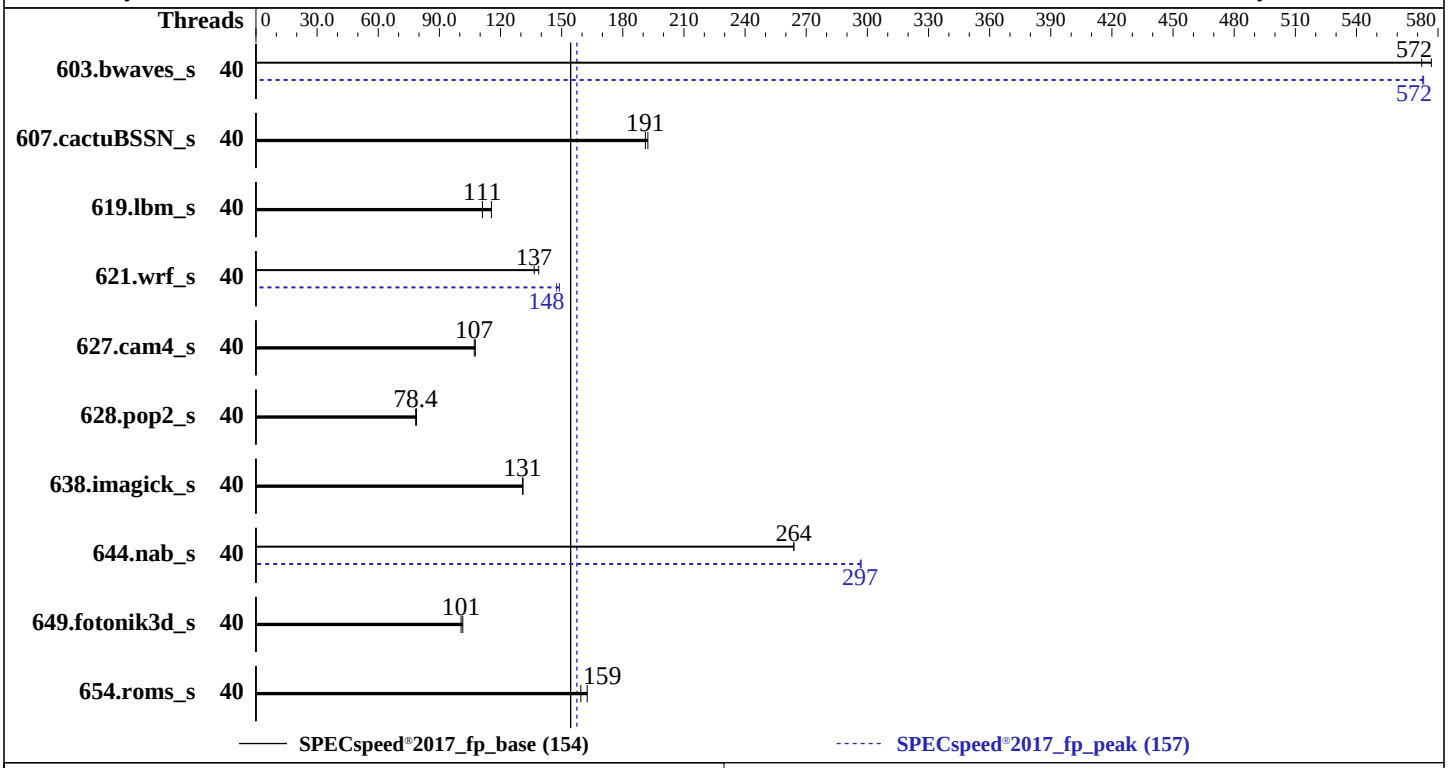
PowerEdge C6520 (Intel Xeon Silver 4316, 2.30 GHz)

SPECspeed®2017_fp_base = 154

SPECspeed®2017_fp_peak = 157

CPU2017 License: 55
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

Test Date: May-2021
Hardware Availability: Apr-2021
Software Availability: Dec-2020



Hardware

CPU Name:	Intel Xeon Silver 4316
Max MHz:	3400
Nominal:	2300
Enabled:	40 cores, 2 chips
Orderable:	1,2 chips
Cache L1:	32 KB I + 48 KB D on chip per core
L2:	1.25 MB I+D on chip per core
L3:	30 MB I+D on chip per chip
Other:	None
Memory:	1 TB (16 x 64 GB 2Rx4 PC4-3200AA-R, running at 2666)
Storage:	125 GB on tmpfs
Other:	None

Software

OS:	Red Hat Enterprise Linux 8.2 (Ootpa) 4.18.0-193.el8.x86_64
Compiler:	C/C++: Version 2021.1 of Intel oneAPI DPC++/C++ Compiler Build 20201113 for Linux; Fortran: Version 2021.1 of Intel Fortran Compiler Classic Build 20201112 for Linux; C/C++: Version 2021.1 of Intel C/C++ Compiler Classic Build 20201112 for Linux
Parallel:	Yes
Firmware:	Version 1.1.3 released Apr-2021
File System:	tmpfs
System State:	Run level 3 (multi-user)
Base Pointers:	64-bit
Peak Pointers:	64-bit
Other:	jemalloc memory allocator V5.0.1
Power Management:	BIOS and OS set to prefer performance at the cost of additional power usage.

Results Table

Benchmark	Base							Peak						
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
603.bwaves_s	40	102	577	**103**	**572**			40	**103**	**572**	103	573		
607.cactuBSSN_s	40	86.7	192	**87.2**	**191**			40	86.7	192	**87.2**	**191**		
619.lbm_s	40	**47.1**	**111**	45.3	116			40	**47.1**	**111**	45.3	116		
621.wrf_s	40	95.3	139	**96.9**	**137**			40	**89.6**	**148**	88.8	149		
627.cam4_s	40	82.3	108	**82.7**	**107**			40	82.3	108	**82.7**	**107**		
628.pop2_s	40	**152**	**78.4**	151	78.8			40	**152**	**78.4**	151	78.8		
638.imagick_s	40	110	131	**110**	**131**			40	110	131	**110**	**131**		
644.nab_s	40	**66.2**	**264**	66.2	264			40	58.8	297	**58.9**	**297**		
649.fotonik3d_s	40	**90.6**	**101**	89.8	101			40	**90.6**	**101**	89.8	101		
654.roms_s	40	**98.8**	**159**	96.9	163			40	**98.8**	**159**	96.9	163		

SPECspeed®2017_fp_base = 154

SPECspeed®2017_fp_peak = 157

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

Operating System Notes

```
Stack size set to unlimited using "ulimit -s unlimited"
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
KMP_AFFINITY = "granularity=fine,compact"
LD_LIBRARY_PATH =
     "/mnt/ramdisk/cpu2017-1.1.7-ic2021.1/lib/intel64:/mnt/ramdisk/cpu2017-1.
     1.7-ic2021.1/je5.0.1-64"
MALLOC_CONF = "retain:true"
OMP_STACKSIZE = "192M"
```

General Notes

```
Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM
memory using Redhat Enterprise Linux 8.0

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.

Transparent Huge Pages enabled by default
Prior to runcpu invocation
```

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General Notes (Continued)

```
 Filesystem page cache synced and cleared with:
 sync; echo 3>       /proc/sys/vm/drop_caches
 jemalloc, a general purpose malloc implementation
 built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5
 sources available from jemalloc.net or https://github.com/jemalloc/jemalloc/releases

Benchmark run from a 125 GB ramdisk created with the cmd: "mount -t tmpfs -o size=125G tmpfs /mnt/ramdisk"
```

Platform Notes

```
 BIOS Settings:
           Logical Processor : Disabled
   Virtualization Technology : Disabled

              System Profile : Custom
        CPU Power Management : Maximum Performance
                         C1E : Disabled
                    C States : Autonomous
         Memory Patrol Scrub : Disabled
    Energy Efficiency Policy : Performance
 CPU Interconnect Bus Link
            Power Management : Disabled

 Sysinfo program /mnt/ramdisk/cpu2017-1.1.7-ic2021.1/bin/sysinfo
 Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c
 running on localhost.localdomain Fri May 21 00:27:43 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
    model name : Intel(R) Xeon(R) Silver 4316 CPU @ 2.30GHz
       2  "physical id"s (chips)
       40 "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 : 20
       siblings  : 20
       physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
       physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

 From lscpu:
      Architecture:        x86_64
      CPU op-mode(s):      32-bit, 64-bit
```

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Platform Notes (Continued)

```
      Byte Order:            Little Endian
      CPU(s):                40
      On-line CPU(s) list:   0-39
      Thread(s) per core:    1
      Core(s) per socket:    20
      Socket(s):             2
      NUMA node(s):          2
      Vendor ID:             GenuineIntel
      CPU family:            6
      Model:                 106
      Model name:            Intel(R) Xeon(R) Silver 4316 CPU @ 2.30GHz
      Stepping:              6
      CPU MHz:               1819.428
      BogoMIPS:              4600.00
      Virtualization:        VT-x
      L1d cache:             48K
      L1i cache:             32K
      L2 cache:              1280K
      L3 cache:              30720K
      NUMA node0 CPU(s):     0-19
      NUMA node1 CPU(s):     20-39
      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 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 invpcid_single ssbd
      mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi flexpriority ept vpid 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 wbnoinvd dtherm ida arat pln pts avx512vbmi umip pku ospke
      avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg tme avx512_vpopcntdq
      la57 rdpid md_clear pconfig flush_l1d arch_capabilities

  /proc/cpuinfo cache data
     cache size : 30720 KB

  From numactl --hardware  WARNING: a numactl 'node' might or might not correspond to a
  physical chip.
    available: 2 nodes (0-1)
    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: 515458 MB
    node 0 free: 505623 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: 516088 MB
    node 1 free: 509527 MB
```


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Platform Notes (Continued)

```
  node distances:
  node   0   1
    0:  10  20
    1:  20  10

From /proc/meminfo
   MemTotal:       1056303836 kB
   HugePages_Total:       0
   Hugepagesize:       2048 kB

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

From /etc/*release* /etc/*version*
   os-release:
      NAME="Red Hat Enterprise Linux"
      VERSION="8.2 (Ootpa)"
      ID="rhel"
      ID_LIKE="fedora"
      VERSION_ID="8.2"
      PLATFORM_ID="platform:el8"
      PRETTY_NAME="Red Hat Enterprise Linux 8.2 (Ootpa)"
      ANSI_COLOR="0;31"
   redhat-release: Red Hat Enterprise Linux release 8.2 (Ootpa)
   system-release: Red Hat Enterprise Linux release 8.2 (Ootpa)
   system-release-cpe: cpe:/o:redhat:enterprise_linux:8.2:ga

uname -a:
   Linux localhost.localdomain 4.18.0-193.el8.x86_64 #1 SMP Fri Mar 27 14:35:58 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: Enhanced IBRS, IBPB:
                                                         conditional, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): No status reported
CVE-2019-11135 (TSX Asynchronous Abort):                 Not affected
```

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Platform Notes (Continued)

```
 run-level 3 May 20 21:39

 SPEC is set to: /mnt/ramdisk/cpu2017-1.1.7-ic2021.1
    Filesystem     Type   Size  Used Avail Use% Mounted on
    tmpfs          tmpfs  125G   11G  115G   9% /mnt/ramdisk

 From /sys/devices/virtual/dmi/id
     Vendor:         Dell Inc.
     Product:        PowerEdge C6520
     Product Family: PowerEdge
     Serial:         SDPT078

 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:
     16x 00AD063200AD HMAA8GR7AJR4N-XN 64 GB 2 rank 3200, configured at 2666

 BIOS:
    BIOS Vendor:       Dell Inc.
    BIOS Version:      1.1.3
    BIOS Date:         04/27/2021
    BIOS Revision:     1.1

 (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
C               | 619.lbm_s(base, peak) 638.imagick_s(base, peak)
                | 644.nab_s(base)
------------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
  64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C               | 644.nab_s(peak)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
  Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------
```


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Compiler Version Notes (Continued)

```
==============================================================================
C               | 619.lbm_s(base, peak) 638.imagick_s(base, peak)
                | 644.nab_s(base)
------------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
  64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C               | 644.nab_s(peak)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
  Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C++, C, Fortran | 607.cactuBSSN_s(base, peak)
------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler Classic for applications running on
  Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
  64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
  Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
Fortran         | 603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak)
                | 654.roms_s(base, peak)
------------------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
  Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
Fortran, C      | 621.wrf_s(base, peak) 627.cam4_s(base, peak)
                | 628.pop2_s(base, peak)
------------------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
  Intel(R) 64, Version 2021.1 Build 20201112_000000
```

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Compiler Version Notes (Continued)

```
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
  64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
icc

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using Fortran, C, and C++:
icpc icc ifort

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
627.cam4_s: -DSPEC_LP64 -DSPEC_CASE_FLAG
628.pop2_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
-assume byterecl
638.imagick_s: -DSPEC_LP64
644.nab_s: -DSPEC_LP64
649.fotonik3d_s: -DSPEC_LP64
654.roms_s: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-m64 -std=c11 -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
-mbranches-within-32B-boundaries

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Base Optimization Flags (Continued)

Fortran benchmarks:
-m64 -Wl,-z,muldefs -DSPEC_OPENMP -xCORE-AVX512 -ipo -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -qopenmp -nostandard-realloc-lhs
-mbranches-within-32B-boundaries -L/usr/local/jemalloc64-5.0.1/lib
-ljemalloc

Benchmarks using both Fortran and C:
-m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp
-DSPEC_OPENMP -mbranches-within-32B-boundaries -nostandard-realloc-lhs
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Benchmarks using Fortran, C, and C++:
-m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp
-DSPEC_OPENMP -mbranches-within-32B-boundaries -nostandard-realloc-lhs
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Peak Compiler Invocation

C benchmarks (except as noted below):
icc

644.nab_s: icx

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using Fortran, C, and C++:
icpc icc ifort

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

619.lbm_s: `basepeak = yes`

638.imagick_s: `basepeak = yes`

644.nab_s: `-m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse -funroll-loops -fiopenmp -DSPEC_OPENMP -qopt-mem-layout-trans=4 -fimf-accuracy-bits=14:sqrt -mbranches-within-32B-boundaries -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`

Fortran benchmarks:

603.bwaves_s: `-m64 -Wl,-z,muldefs -prof-gen`(pass 1) `-prof-use`(pass 2) `-DSPEC_SUPPRESS_OPENMP -DSPEC_OPENMP -ipo -xCORE-AVX512 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -nostandard-realloc-lhs -mbranches-within-32B-boundaries -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`

649.fotonik3d_s: `basepeak = yes`

654.roms_s: `basepeak = yes`

Benchmarks using both Fortran and C:

621.wrf_s: `-m64 -std=c11 -Wl,-z,muldefs -prof-gen`(pass 1) `-prof-use`(pass 2) `-ipo -xCORE-AVX512 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -DSPEC_SUPPRESS_OPENMP -qopenmp -DSPEC_OPENMP -mbranches-within-32B-boundaries -nostandard-realloc-lhs -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`

627.cam4_s: `basepeak = yes`

628.pop2_s: `basepeak = yes`

Benchmarks using Fortran, C, and C++:

607.cactuBSSN_s: `basepeak = yes`

The flags files that were used to format this result can be browsed at

http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.html
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-Intel-ICX-rev1.1.html

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

http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.xml
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-Intel-ICX-rev1.1.xml

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