# SPEC CPU®2017 Integer Rate Result

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## IBM Corporation

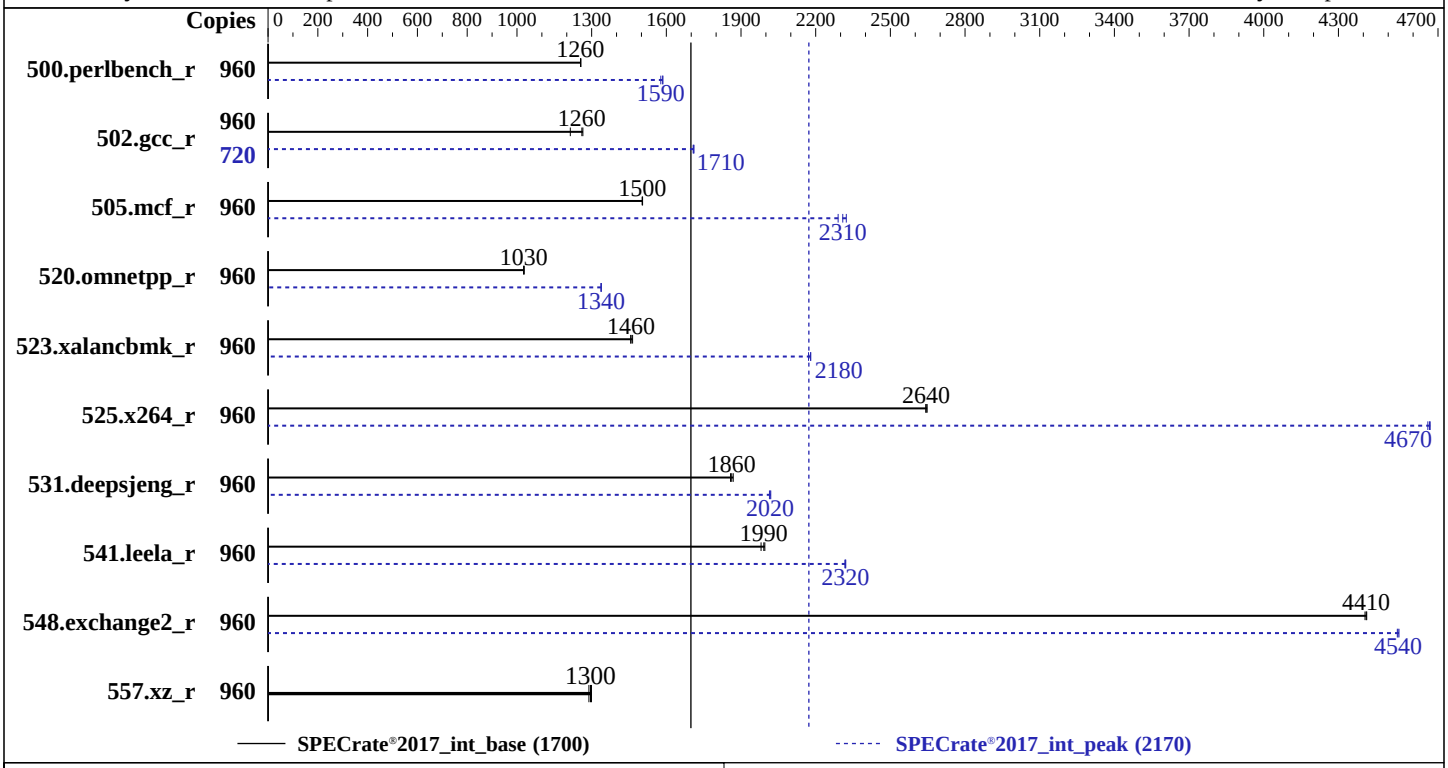
IBM Power E1080 (3.55 - 4 GHz, 120 core, AIX)

SPECrate®2017_int_base = 1700

SPECrate®2017_int_peak = 2170

**CPU2017 License:** 11
**Test Sponsor:** IBM Corporation
**Tested by:** IBM Corporation

**Test Date:** Aug-2021
**Hardware Availability:** Sep-2021
**Software Availability:** Sep-2021




## Hardware

| | |
|---|---|
| CPU Name: | Power10 |
| Max MHz: | 4000 |
| Nominal: | 3550 |
| Enabled: | 120 cores, 8 chips, 8 threads/core |
| Orderable: | 4, 8 Chips |
| Cache L1: | 96 KB I + 64 KB D on chip per core |
| L2: | 2 MB I+D on chip per core |
| L3: | 120 MB I+D on chip per chip shared NUCA / 15 cores |
| Other: | None |
| Memory: | 8 TB (128 x 64 GB 1Rx4 PC4-3200V-R) |
| Storage: | 1 x 512 GB NVMe SSD |
| Other: | None |

## Software

| | |
|---|---|
| OS: | AIX 7.2 TL5 SP3 |
| Compiler: | C/C++: Version 17.1.0 of IBM Open XL C/C++ for AIX;<br>Fortran: Version 17.1.0 of IBM Open XL Fortran for AIX; |
| Parallel: | No |
| Firmware: | Version NH1010_041 released Sep-2021 |
| File System: | JFS2 |
| System State: | Run level 2 (multi-user) |
| Base Pointers: | 64-bit |
| Peak Pointers: | 32/64-bit |
| Other: | tcmalloc: tcmalloc memory allocator library v2.7.1 |
| Power Management: | Maximum Performance mode |

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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 | 960 | 1216 | 1260 | **1217** | **1260** | 1218 | 1260 | 960 | 964 | 1590 | **964** | **1590** | 969 | 1580 |
| 502.gcc_r | 960 | 1075 | 1260 | 1119 | 1210 | **1078** | **1260** | 720 | 597 | 1710 | 596 | 1710 | **596** | **1710** |
| 505.mcf_r | 960 | 1031 | 1500 | **1031** | **1500** | 1032 | 1500 | 960 | **672** | **2310** | 677 | 2290 | 668 | 2320 |
| 520.omnetpp_r | 960 | 1224 | 1030 | 1227 | 1030 | **1225** | **1030** | 960 | 942 | 1340 | **941** | **1340** | 941 | 1340 |
| 523.xalancbmk_r | 960 | 692 | 1460 | 696 | 1460 | **695** | **1460** | 960 | 465 | 2180 | 467 | 2170 | **465** | **2180** |
| 525.x264_r | 960 | 635 | 2650 | **636** | **2640** | 636 | 2640 | 960 | 361 | 4660 | **360** | **4670** | 360 | 4670 |
| 531.deepsjeng_r | 960 | 589 | 1870 | **591** | **1860** | 592 | 1860 | 960 | 546 | 2010 | 545 | 2020 | **545** | **2020** |
| 541.leela_r | 960 | 797 | 2000 | 803 | 1980 | **798** | **1990** | 960 | 686 | 2320 | **685** | **2320** | 685 | 2320 |
| 548.exchange2_r | 960 | 570 | 4410 | 571 | 4410 | **570** | **4410** | 960 | 554 | 4540 | **554** | **4540** | 554 | 4540 |
| 557.xz_r | 960 | 798 | 1300 | **800** | **1300** | 804 | 1290 | 960 | 798 | 1300 | **800** | **1300** | 804 | 1290 |

**SPECrate®2017_int_base = 1700**

**SPECrate®2017_int_peak = 2170**

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

## Submit Notes

```
The config file option 'submit' was used
to assign benchmark copies to specific processors using
the "bindprocessor" command (see flags file for details).
```

## Operating System Notes

```
AIX V7.2 TL5 SP3 running on Power10 in Power9 compatibility mode.
Following ulimits set to unlimited.
'ulimit -f unlimited' set file size to unlimited.
'ulimit -s unlimited' set stack size to unlimited.
'ulimit -c unlimited' set core file size to unlimited.
'ulimit -d unlimited' set data segment size to unlimited.
'ulimit -m unlimited' set max memory size to unlimited.

72000 16M large pages defined with vmo command.
'AIX_STDBUFSZ=524288' configures the I/O buffer size for the read and write system calls.
'mount -o remount,noatime /dev/hd1' for filesystems with a high rate of file access, performance
can be improved by disabling the update of the access time stamp.
```

## Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
LIBPATH = "/home/cpu2017/v1.1.8/tcmalloc"
MALLOCMULTIHEAP = "1"
MEMORY_AFFINITY = "MCM"
XLFRTEOPTS = "intrinthds=1"
```

**(Continued on next page)**

## Environment Variables Notes (Continued)

```
Environment variables set by runcpu during the 500.perlbench_r peak run:
MALLOCOPTIONS = "pool:0x20000000,buckets,no_mallinfo"

Environment variables set by runcpu during the 502.gcc_r peak run:
MALLOCTYPE = "watson2"

Environment variables set by runcpu during the 505.mcf_r peak run:
MALLOCTYPE = "watson2"

Environment variables set by runcpu during the 520.omnetpp_r peak run:
MALLOCOPTIONS = "pool:0x20000000"

Environment variables set by runcpu during the 523.xalancbmk_r peak run:
MALLOCOPTIONS = "pool:0x20000000"
MALLOCTYPE = "Yorktown"

Environment variables set by runcpu during the 525.x264_r peak run:
MALLOCTYPE = "watson2"

Environment variables set by runcpu during the 531.deepsjeng_r peak run:
MALLOCTYPE = "watson2"

Environment variables set by runcpu during the 541.leela_r peak run:
MALLOCTYPE = "watson2"

Environment variables set by runcpu during the 548.exchange2_r peak run:
MALLOCTYPE = "watson2"
```

## General Notes

```
Yes: 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.

tcmalloc, a general purpose malloc implementation
built with the AIX V7.2 and IBM XL C/C++ compiler 16.1.0 for AIX
used for all benchmarks in base
sources available from https://github.com/gilamn5tr/gperftools/archive/refs/heads/aix-enablement-upstream.zip
```

## Platform Notes

```
 Sysinfo program /home/cpu2017/v1.1.8/bin/sysinfo
 Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
 running on compden1.aus.stglabs.ibm.com Fri Aug 13 10:26:37 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

 WARNING regarding the output of 'prtconf':
    (1) The tester may need to adjust the sysinfo-supplied 'hw_nominal_mhz'.
    (2) The 'Number of Processors' reported by prtconf is the number of cores available to
    the partition.
 From prtconf:
    Host Name: compden1.aus.stglabs.ibm.com
    System Model: IBM,9080-HEX
    Processor Clock Speed: 3650 MHz
    Number Of Processors: 120
    Memory Size: 8180736 MB
    BIOS Version: NH1010_041

 WARNING regarding the output of 'lscfg':  this utility reports resources for the system,
 not the current partition.  Therefore, for a partition that has a subset of the full
 system resources:
    (1) The tester may need to adjust the sysinfo-supplied 'hw_ncores'.
    (2) The tester may need to adjust the sysinfo-supplied 'hw_nchips'.
    (3) Be aware that 'hw_memory' is set from 'prtconf', and is correct for the partition,
    but "Memory DIMM info from lscfg" reports the number of DIMMs in the entire server.
 Processors, from lscfg -vplsysplanar0

    ^^^Note: sum of ways = 0, differs from prtconf 'Number Of Processors'
 Memory DIMM info from lscfg:
     128x 01GY910

 Operating System: AIX 7.2.0.0   7200-05-03-2135

 disk: df -k /home/cpu2017/v1.1.8
    Filesystem    1024-blocks      Free %Used    Iused %Iused Mounted on
    /dev/hd1        525336576 457662164   13%   125636     1% /home

 (End of data from sysinfo program)
```

## Compiler Version Notes

```
==============================================================================
C       | 500.perlbench_r(peak) 502.gcc_r(peak)
```

**(Continued on next page)**

## Compiler Version Notes (Continued)

```
------------------------------------------------------------------------------
IBM Open XL C/C++ for AIX 17.1.0 (5725-C72, 5765-J18), clang version 13.0.0
Target: powerpc-ibm-aix7.2.0.0
Thread model: posix
InstalledDir: /opt/IBM/openxlC/17.1.0/bin
------------------------------------------------------------------------------

==============================================================================
C       | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak)
        | 525.x264_r(base, peak) 557.xz_r(base, peak)
------------------------------------------------------------------------------
IBM Open XL C/C++ for AIX 17.1.0 (5725-C72, 5765-J18), clang version 13.0.0
Target: powerpc64-ibm-aix7.2.0.0
Thread model: posix
InstalledDir: /opt/IBM/openxlC/17.1.0/bin
------------------------------------------------------------------------------

==============================================================================
C       | 500.perlbench_r(peak) 502.gcc_r(peak)
------------------------------------------------------------------------------
IBM Open XL C/C++ for AIX 17.1.0 (5725-C72, 5765-J18), clang version 13.0.0
Target: powerpc-ibm-aix7.2.0.0
Thread model: posix
InstalledDir: /opt/IBM/openxlC/17.1.0/bin
------------------------------------------------------------------------------

==============================================================================
C       | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak)
        | 525.x264_r(base, peak) 557.xz_r(base, peak)
------------------------------------------------------------------------------
IBM Open XL C/C++ for AIX 17.1.0 (5725-C72, 5765-J18), clang version 13.0.0
Target: powerpc64-ibm-aix7.2.0.0
Thread model: posix
InstalledDir: /opt/IBM/openxlC/17.1.0/bin
------------------------------------------------------------------------------

==============================================================================
C++     | 520.omnetpp_r(peak) 523.xalancbmk_r(peak)
------------------------------------------------------------------------------
IBM Open XL C/C++ for AIX 17.1.0 (5725-C72, 5765-J18), clang version 13.0.0
Target: powerpc-ibm-aix7.2.0.0
Thread model: posix
InstalledDir: /opt/IBM/openxlC/17.1.0/bin
------------------------------------------------------------------------------

==============================================================================
C++     | 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base,
```

**(Continued on next page)**

## Compiler Version Notes (Continued)

```
        | peak) 541.leela_r(base, peak)
------------------------------------------------------------------------------
IBM Open XL C/C++ for AIX 17.1.0 (5725-C72, 5765-J18), clang version 13.0.0
Target: powerpc64-ibm-aix7.2.0.0
Thread model: posix
InstalledDir: /opt/IBM/openxlC/17.1.0/bin
------------------------------------------------------------------------------

==============================================================================
C++     | 520.omnetpp_r(peak) 523.xalancbmk_r(peak)
------------------------------------------------------------------------------
IBM Open XL C/C++ for AIX 17.1.0 (5725-C72, 5765-J18), clang version 13.0.0
Target: powerpc-ibm-aix7.2.0.0
Thread model: posix
InstalledDir: /opt/IBM/openxlC/17.1.0/bin
------------------------------------------------------------------------------

==============================================================================
C++     | 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base,
        | peak) 541.leela_r(base, peak)
------------------------------------------------------------------------------
IBM Open XL C/C++ for AIX 17.1.0 (5725-C72, 5765-J18), clang version 13.0.0
Target: powerpc64-ibm-aix7.2.0.0
Thread model: posix
InstalledDir: /opt/IBM/openxlC/17.1.0/bin
------------------------------------------------------------------------------

==============================================================================
Fortran | 548.exchange2_r(base, peak)
------------------------------------------------------------------------------
IBM Open XL Fortran for AIX 17.1.0 (5725-C74, 5765-J19)
Version: 17.01.0000.0000
Driver Level: 200728-1954 (252) ID: 915518f5b
Fortran Front End and Run Time Level: 200728-1954 (252) ID: 1be655d9d
Fortran Transformer Level: 200730-1513 (267) ID: d7d107fc9
LLVM IR Builder ID: e62648dbf4b9
------------------------------------------------------------------------------
```

## Base Compiler Invocation

C benchmarks:
/opt/IBM/openxlC/17.1.0/bin/ibm-clang

C++ benchmarks:
/opt/IBM/openxlC/17.1.0/bin/ibm-clang++_r

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## Base Compiler Invocation (Continued)

Fortran benchmarks:
/opt/IBM/openxlf/17.1.0/bin/xlf95_r

## Base Portability Flags

500.perlbench_r: -DSPEC_AIX -DSPEC_LP64
502.gcc_r: -DSPEC_AIX -DSPEC_NEED_ASPRINTF -DSPEC_LP64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_AIX -DSPEC_LP64
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_AIX -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

## Base Optimization Flags

C benchmarks:
-m64 -Wl,-bbigtoc -Wl,-blpdata
-Wl,-bplugin_opt:--enable-ppc-gen-scalar-mass
-Wl,-bplugin_opt:--data-layout-opt=1
-Wl,-bplugin_opt:-fold-complex-pointer-compare=false -mcpu=pwr9
-mabi=vec-extabi -mllvm -enable-ppc-gen-scalar-mass
-mllvm -vector-library=MASSV -flto -mllvm -data-layout-opt=1 -O3
-fcommon -mllvm -fold-complex-pointer-compare=false
-L/opt/IBM/xlmass/10.1.0/lib -lmass -L/opt/IBM/openxlf/17.1.0/lib
-lxlopt

C++ benchmarks:
-m64 -Wl,-bbigtoc -Wl,-blpdata
-Wl,-bplugin_opt:--enable-ppc-gen-scalar-mass
-Wl,-bplugin_opt:-fold-complex-pointer-compare=false -mcpu=pwr9
-mabi=vec-extabi -mllvm -enable-ppc-gen-scalar-mass
-mllvm -vector-library=MASSV -flto -O3 -L/opt/IBM/xlmass/10.1.0/lib
-lmass -L/opt/IBM/openxlf/17.1.0/lib -lxlopt

Fortran benchmarks:
-q64 -bbigtoc -blpdata
-Wl,-bplugin_opt:-fold-complex-pointer-compare=false -O3 -qarch=pwr9
-qvecnvol -mllvm -enable-ppc-gen-scalar-mass
-mllvm -vector-library=MASSV -qlto -L/opt/IBM/xlmass/10.1.0/lib -lmass

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## Base Optimization Flags (Continued)

Fortran benchmarks (continued):
-L/opt/IBM/openxlf/17.1.0/lib -lxlopt

## Peak Compiler Invocation

C benchmarks:
/opt/IBM/openxlC/17.1.0/bin/ibm-clang

C++ benchmarks:
/opt/IBM/openxlC/17.1.0/bin/ibm-clang++_r

Fortran benchmarks:
/opt/IBM/openxlf/17.1.0/bin/xlf95_r

## Peak Portability Flags

500.perlbench_r: -DSPEC_AIX
502.gcc_r: -DSPEC_AIX -DSPEC_NEED_ASPRINTF
505.mcf_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_AIX
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_AIX -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

## Peak Optimization Flags

C benchmarks:

500.perlbench_r: -m32 -Wl,-bplugin_opt:--enable-ppc-gen-scalar-mass
-Wl,-bmaxdata:0xD0000000/dsa
-Wl,-bplugin_opt:--ppc-set-dscr=1
-Wl,-bplugin_opt:-inline-hot-callsites-aggressively
-Wl,-blpdata -Wl,-bbigtoc -O3 -mcpu=pwr9
-mabi=vec-extabi -flto -mllvm -enable-ppc-gen-scalar-mass
-mllvm -vector-library=MASSV -fprofile-generate
-fprofile-use=default.profdata -fno-strict-aliasing
-L/opt/IBM/xlmass/10.1.0/lib -lmass
-L/opt/IBM/openxlf/17.1.0/lib -lxlopt

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## Peak Optimization Flags (Continued)

502.gcc_r: -m32 -Wl,-bplugin_opt:--enable-ppc-gen-scalar-mass
-Wl,-bmaxdata:0x50000000
-Wl,-bplugin_opt:-fold-complex-pointer-compare=false
-Wl,-blpdata -Wl,-bbigtoc -O3 -mcpu=pwr9
-mabi=vec-extabi -flto -mllvm -enable-ppc-gen-scalar-mass
-mllvm -vector-library=MASSV -fprofile-generate
-fprofile-use=default.profdata
-mllvm -fold-complex-pointer-compare=false
-L/opt/IBM/xlmass/10.1.0/lib -lmass
-L/opt/IBM/openxlf/17.1.0/lib -lxlopt

505.mcf_r: -m64 -Wl,-bplugin_opt:--enable-ppc-gen-scalar-mass
-Wl,-bplugin_opt:--data-layout-opt=3 -Wl,-blpdata
-Wl,-bbigtoc -O3 -mcpu=pwr9 -mabi=vec-extabi -flto
-mllvm -enable-ppc-gen-scalar-mass
-mllvm -vector-library=MASSV -fprofile-generate
-fprofile-use=default.profdata -mllvm -data-layout-opt=3
-L/opt/IBM/xlmass/10.1.0/lib -lmass
-L/opt/IBM/openxlf/17.1.0/lib -lxlopt

525.x264_r: -m64 -Wl,-bplugin_opt:--enable-ppc-gen-scalar-mass
-Wl,-blpdata -Wl,-bbigtoc
-Wl,-bplugin_opt:-enable-aggressive-vectorization -O3
-mcpu=pwr9 -mabi=vec-extabi -flto
-mllvm -enable-ppc-gen-scalar-mass
-mllvm -vector-library=MASSV -fprofile-generate
-fprofile-use=default.profdata -fcommon -frestrict-args
-mllvm -enable-aggressive-vectorization
-mllvm -ppc-enable-redxnintr -L/opt/IBM/xlmass/10.1.0/lib
-lmass -L/opt/IBM/openxlf/17.1.0/lib -lxlopt

557.xz_r: basepeak = yes

C++ benchmarks:

520.omnetpp_r: -m32 -Wl,-bplugin_opt:--enable-ppc-gen-scalar-mass
-Wl,-bmaxdata:0x30000000 -Wl,-bplugin_opt:--ppc-set-dscr=1
-Wl,-blpdata -Wl,-bbigtoc -O3 -mcpu=pwr9
-mabi=vec-extabi -flto -mllvm -enable-ppc-gen-scalar-mass
-mllvm -vector-library=MASSV -fprofile-generate
-fprofile-use=default.profdata
-Wl,-bplugin_opt:-dynamic-cast-opt=on
-L/opt/IBM/xlmass/10.1.0/lib -lmass
-L/opt/IBM/openxlf/17.1.0/lib -lxlopt

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## Peak Optimization Flags (Continued)

523.xalancbmk_r: -m32 -Wl,-bplugin_opt:--enable-ppc-gen-scalar-mass
-Wl,-bmaxdata:0x30000000
-Wl,-bplugin_opt:-inline-hot-callsites-aggressively
-Wl,-bplugin_opt:-enable-partial-inlining -Wl,-blpdata
-Wl,-bbigtoc -mllvm -enable-partial-inlining
-mllvm -enable-vec-find=true -O3 -mcpu=pwr9
-mabi=vec-extabi -flto -mllvm -enable-ppc-gen-scalar-mass
-mllvm -vector-library=MASSV -fprofile-generate
-fprofile-use=default.profdata -L/opt/IBM/xlmass/10.1.0/lib
-lmass -L/opt/IBM/openxlf/17.1.0/lib -lxlopt

531.deepsjeng_r: -m64 -Wl,-bplugin_opt:--ppc-set-dscr=1
-Wl,-bplugin_opt:--enable-ppc-gen-scalar-mass
-Wl,-bplugin_opt:-inline-hot-callsites-aggressively
-Wl,-blpdata -Wl,-bbigtoc -O3 -mcpu=pwr9
-mabi=vec-extabi -flto -mllvm -enable-ppc-gen-scalar-mass
-mllvm -vector-library=MASSV -fprofile-generate
-fprofile-use=default.profdata -L/opt/IBM/xlmass/10.1.0/lib
-lmass -L/opt/IBM/openxlf/17.1.0/lib -lxlopt

541.leela_r: -m64 -Wl,-bplugin_opt:--enable-ppc-gen-scalar-mass
-Wl,-bplugin_opt:-inline-hot-callsites-aggressively
-Wl,-blpdata -Wl,-bbigtoc
-mllvm -aggressive-late-full-unroll
-mllvm -array-compress=true
-mllvm -enable-lvi-memoryssa=true -O3 -mcpu=pwr9
-mabi=vec-extabi -flto -mllvm -enable-ppc-gen-scalar-mass
-mllvm -vector-library=MASSV -fprofile-generate
-fprofile-use=default.profdata -L/opt/IBM/xlmass/10.1.0/lib
-lmass -L/opt/IBM/openxlf/17.1.0/lib -lxlopt

Fortran benchmarks:
-q64 -Wl,-bplugin_opt:--ppc-set-dscr=1 -blpdata -bbigtoc -qlto -O3
-qarch=pwr9 -qvecnvol -mllvm -enable-ppc-gen-scalar-mass
-mllvm -vector-library=MASSV -qprofile-generate
-qprofile-use=default.profdata -L/opt/IBM/xlmass/10.1.0/lib -lmass
-L/opt/IBM/openxlf/17.1.0/lib -lxlopt

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/IBM_AIX_7.2_S-RevB.html
http://www.spec.org/cpu2017/flags/IBM_Open_XL_AIX_flags-RevB.html

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

http://www.spec.org/cpu2017/flags/IBM_AIX_7.2_S-RevB.xml
http://www.spec.org/cpu2017/flags/IBM_Open_XL_AIX_flags-RevB.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 v1.1.8 on 2021-08-13 11:26:35-0400.
Report generated on 2021-09-01 14:13:05 by CPU2017 PS formatter v6442.
Originally published on 2021-09-01.