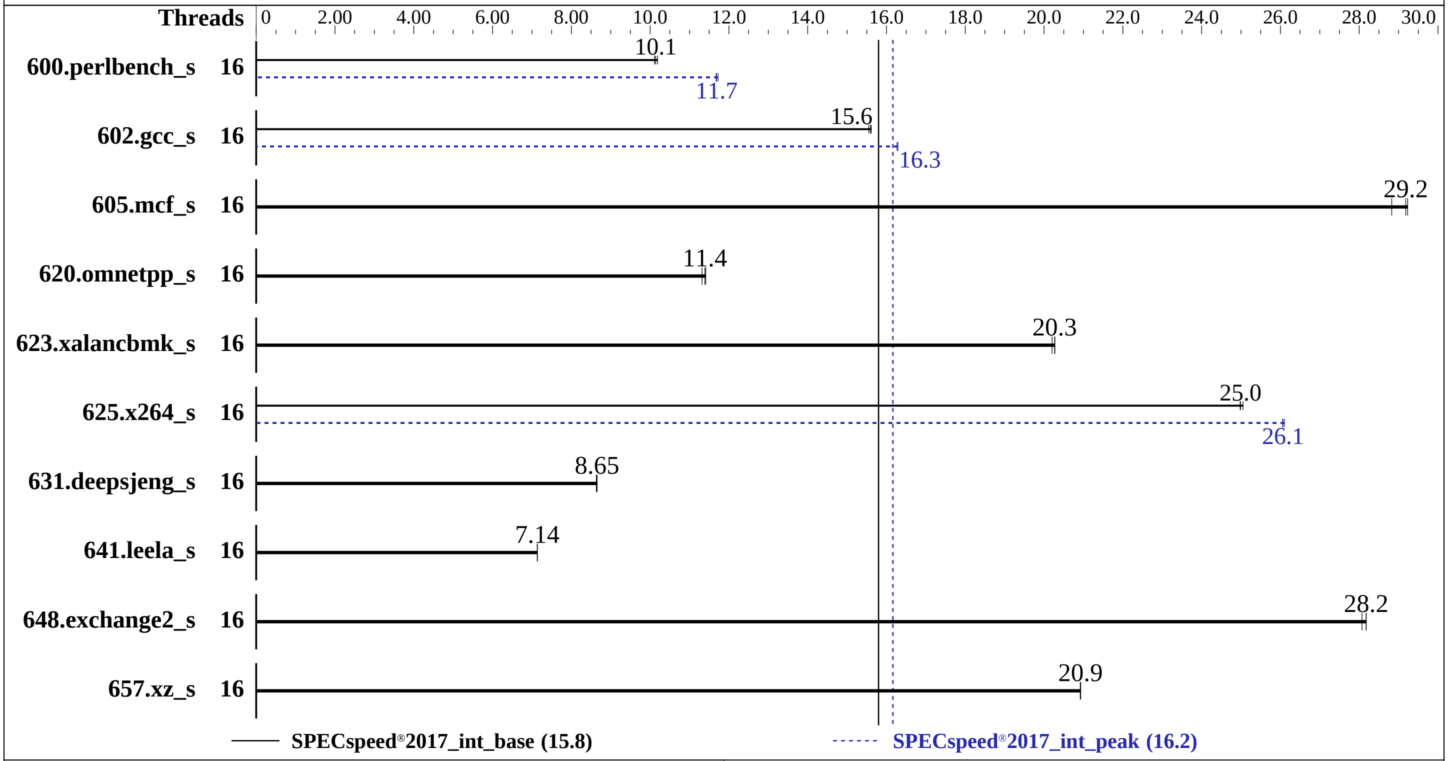
# Lenovo Global Technology

ThinkSystem ST250 V2
(3.20 GHz,Intel Xeon E-2388G)

SPECspeed®2017_int_base = 15.8

SPECspeed®2017_int_peak = 16.2

**CPU2017 License:** 9017
**Test Sponsor:** Lenovo Global Technology
**Tested by:** Lenovo Global Technology
**Test Date:** Feb-2022
**Hardware Availability:** Apr-2022
**Software Availability:** Jun-2021




## Hardware

| | |
|---|---|
| CPU Name: | Intel Xeon E-2388G |
| Max MHz: | 5100 |
| Nominal: | 3200 |
| Enabled: | 8 cores, 1 chip, 2 threads/core |
| Orderable: | 1 chip |
| Cache L1: | 32 KB I + 48 KB D on chip per core |
| L2: | 512 KB I+D on chip per core |
| L3: | 16 MB I+D on chip per chip |
| Other: | None |
| Memory: | 128 GB (4 x 32 GB 2Rx8 PC4-3200AA-E, running at 2933) |
| Storage: | 1 x 960 GB SATA SSD |
| Other: | None |

## Software

| | |
|---|---|
| OS: | SUSE Linux Enterprise Server 15 SP3 (x86_64) Kernel 5.3.18-57-default |
| 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: | Lenovo BIOS Version TQE101Q 1.00 released Dec-2021 |
| File System: | xfs |
| 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 |
| 600.perlbench_s | 16 | 174 | 10.2 | **175** | **10.1** | 176 | 10.1 | 16 | 152 | 11.7 | 151 | 11.7 | **152** | **11.7** |
| 602.gcc_s | 16 | **255** | **15.6** | 255 | 15.6 | 256 | 15.6 | 16 | 245 | 16.3 | 244 | 16.3 | **245** | **16.3** |
| 605.mcf_s | 16 | 164 | 28.8 | 162 | 29.2 | **162** | **29.2** | 16 | 164 | 28.8 | 162 | 29.2 | **162** | **29.2** |
| 620.omnetpp_s | 16 | 143 | 11.4 | **143** | **11.4** | 144 | 11.3 | 16 | 143 | 11.4 | **143** | **11.4** | 144 | 11.3 |
| 623.xalancbmk_s | 16 | **69.9** | **20.3** | 69.9 | 20.3 | 70.1 | 20.2 | 16 | **69.9** | **20.3** | 69.9 | 20.3 | 70.1 | 20.2 |
| 625.x264_s | 16 | 70.4 | 25.1 | **70.6** | **25.0** | 70.6 | 25.0 | 16 | **67.7** | **26.1** | 67.7 | 26.1 | 67.6 | 26.1 |
| 631.deepsjeng_s | 16 | 166 | 8.65 | 166 | 8.64 | **166** | **8.65** | 16 | 166 | 8.65 | 166 | 8.64 | **166** | **8.65** |
| 641.leela_s | 16 | **239** | **7.14** | 239 | 7.14 | 239 | 7.14 | 16 | **239** | **7.14** | 239 | 7.14 | 239 | 7.14 |
| 648.exchange2_s | 16 | 104 | 28.2 | 105 | 28.1 | **104** | **28.2** | 16 | 104 | 28.2 | 105 | 28.1 | **104** | **28.2** |
| 657.xz_s | 16 | 296 | 20.9 | 295 | 20.9 | **295** | **20.9** | 16 | 296 | 20.9 | 295 | 20.9 | **295** | **20.9** |

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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,scatter"
LD_LIBRARY_PATH =
     "/home/cpu2017-1.1.8-ic2021.1-revB/lib/intel64:/home/cpu2017-1.1.8-ic202
     1.1-revB/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
 Transparent Huge Pages enabled by default
 Prior to runcpu invocation
 Filesystem page cache synced and cleared with:
 sync; echo 3>       /proc/sys/vm/drop_caches
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.
```


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## General Notes (Continued)

```
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
```

## Platform Notes

```
BIOS configuration:
C-States set to Legacy
DCA set to Enabled
Memory Power Management set to Automatic
System date/time for this result was not updated to right time
and actual testing date can be referred to "spec.cpu2017.test_date"

 Sysinfo program /home/cpu2017-1.1.8-ic2021.1-revB/bin/sysinfo
 Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
 running on node1 Thu Apr 29 20:01:33 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) E-2388G CPU @ 3.20GHz
       1  "physical id"s (chips)
       16 "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 : 8
       siblings  : 16
       physical 0: cores 0 1 2 3 4 5 6 7

 From lscpu from util-linux 2.36.2:
      Architecture:                    x86_64
      CPU op-mode(s):                  32-bit, 64-bit
      Byte Order:                      Little Endian
      Address sizes:                   39 bits physical, 48 bits virtual
      CPU(s):                          16
      On-line CPU(s) list:             0-15
      Thread(s) per core:              2
      Core(s) per socket:              8
      Socket(s):                       1
      NUMA node(s):                    1
      Vendor ID:                       GenuineIntel
      CPU family:                      6
      Model:                           167
      Model name:                      Intel(R) Xeon(R) E-2388G CPU @ 3.20GHz
```

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## Platform Notes (Continued)

```
     Stepping:                        1
     CPU MHz:                         4365.592
     BogoMIPS:                        6384.00
     Virtualization:                  VT-x
     L1d cache:                       384 KiB
     L1i cache:                       256 KiB
     L2 cache:                        4 MiB
     L3 cache:                        16 MiB
     NUMA node0 CPU(s):               0-15
     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; Enhanced IBRS, IBPB conditional, 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 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 tsc_known_freq pni pclmulqdq dtes64 monitor ds_cpl vmx
     smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt
     tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault
     epb invpcid_single ssbd ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi flexpriority
     ept vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep bmi2 erms invpcid mpx avx512f
     avx512dq rdseed adx smap avx512ifma clflushopt intel_pt avx512cd sha_ni avx512bw
     avx512vl xsaveopt xsavec xgetbv1 xsaves dtherm ida arat pln pts avx512vbmi umip pku
     ospke avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg avx512_vpopcntdq
     rdpid fsrm md_clear flush_l1d arch_capabilities

From lscpu --cache:
     NAME ONE-SIZE ALL-SIZE WAYS TYPE        LEVEL  SETS PHY-LINE COHERENCY-SIZE
     L1d       48K     384K   12 Data            1    64        1             64
     L1i       32K     256K    8 Instruction     1    64        1             64
     L2       512K       4M    8 Unified         2  1024        1             64
     L3        16M      16M   16 Unified         3 16384        1             64

/proc/cpuinfo cache data
   cache size : 16384 KB

From numactl --hardware
WARNING: a numactl 'node' might or might not correspond to a physical chip.
  available: 1 nodes (0)
```

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## Platform Notes (Continued)

```
    node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
    node 0 size: 128743 MB
    node 0 free: 128254 MB
    node distances:
    node   0
      0:  10

  From /proc/meminfo
     MemTotal:       131833768 kB
     HugePages_Total:       0
     Hugepagesize:       2048 kB

  From /etc/*release* /etc/*version*
     os-release:
        NAME="SLES"
        VERSION="15-SP3"
        VERSION_ID="15.3"
        PRETTY_NAME="SUSE Linux Enterprise Server 15 SP3"
        ID="sles"
        ID_LIKE="suse"
        ANSI_COLOR="0;32"
        CPE_NAME="cpe:/o:suse:sles:15:sp3"

  uname -a:
     Linux node1 5.3.18-57-default #1 SMP Wed Apr 28 10:54:41 UTC 2021 (ba3c2e9) 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):   Not affected
  CVE-2019-11135 (TSX Asynchronous Abort):                 Not affected

  run-level 3 Apr 29 20:00

  SPEC is set to: /home/cpu2017-1.1.8-ic2021.1-revB
```

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## Platform Notes (Continued)

```
    Filesystem     Type  Size  Used Avail Use% Mounted on
    /dev/sda2      xfs   894G   75G  820G   9% /

 From /sys/devices/virtual/dmi/id
     Vendor:         Lenovo
     Product:        ThinkSystem ST250 V2
     Product Family: ThinkSystem
     Serial:         1234567890

 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:
     4x Micron Technology 18ASF4G72AZ-3G2B1 32 GB 2 rank 3200, configured at 2933

 BIOS:
    BIOS Vendor:       Lenovo
    BIOS Version:      TQE101Q-1.00
    BIOS Date:         12/29/2021
    BIOS Revision:     1.0
    Firmware Revision: 0.90

 (End of data from sysinfo program)
```

## Compiler Version Notes

```
==============================================================================
C       | 600.perlbench_s(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.
------------------------------------------------------------------------------

==============================================================================
C       | 600.perlbench_s(base) 602.gcc_s(base, peak) 605.mcf_s(base, peak)
        | 625.x264_s(base, peak) 657.xz_s(base, 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       | 600.perlbench_s(peak)
```

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## Compiler Version Notes (Continued)

```
------------------------------------------------------------------------------
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       | 600.perlbench_s(base) 602.gcc_s(base, peak) 605.mcf_s(base, peak)
        | 625.x264_s(base, peak) 657.xz_s(base, 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++     | 620.omnetpp_s(base, peak) 623.xalancbmk_s(base, peak)
        | 631.deepsjeng_s(base, peak) 641.leela_s(base, 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.
------------------------------------------------------------------------------

==============================================================================
Fortran | 648.exchange2_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.
------------------------------------------------------------------------------
```

## Base Compiler Invocation

C benchmarks:
`icx`

C++ benchmarks:
`icpx`

Fortran benchmarks:
`ifort`

## Base Portability Flags

600.perlbench_s: `-DSPEC_LP64 -DSPEC_LINUX_X64`
602.gcc_s: `-DSPEC_LP64`
605.mcf_s: `-DSPEC_LP64`
620.omnetpp_s: `-DSPEC_LP64`
623.xalancbmk_s: `-DSPEC_LP64 -DSPEC_LINUX`
625.x264_s: `-DSPEC_LP64`
631.deepsjeng_s: `-DSPEC_LP64`
641.leela_s: `-DSPEC_LP64`
648.exchange2_s: `-DSPEC_LP64`
657.xz_s: `-DSPEC_LP64`

## Base Optimization Flags

C benchmarks:
```
-DSPEC_OPENMP -std=c11 -m64 -fiopenmp -Wl,-z,muldefs -xCORE-AVX512
-O3 -ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

C++ benchmarks:
```
-DSPEC_OPENMP -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin/
-lqkmalloc
```

Fortran benchmarks:
```
-m64 -xCORE-AVX512 -O3 -ipo -no-prec-div -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-mbranches-within-32B-boundaries
```

## Peak Compiler Invocation

C benchmarks (except as noted below):
`icx`

600.perlbench_s: `icc`

C++ benchmarks:
`icpx`

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## Peak Compiler Invocation (Continued)

Fortran benchmarks:
ifort

## Peak Portability Flags

Same as Base Portability Flags

## Peak Optimization Flags

C benchmarks:

600.perlbench_s: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2)
-xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -fno-strict-overflow
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

602.gcc_s: -m64 -std=c11 -Wl,-z,muldefs -fprofile-generate(pass 1)
-fprofile-use=default.profdata(pass 2) -xCORE-AVX512 -flto
-Ofast(pass 1) -O3 -ffast-math -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

605.mcf_s: basepeak = yes

625.x264_s: -DSPEC_OPENMP -fiopenmp -std=c11 -m64 -Wl,-z,muldefs
-xCORE-AVX512 -flto -O3 -ffast-math
-qopt-mem-layout-trans=4 -fno-alias
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

657.xz_s: basepeak = yes

C++ benchmarks:

620.omnetpp_s: basepeak = yes

623.xalancbmk_s: basepeak = yes

631.deepsjeng_s: basepeak = yes

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# Peak Optimization Flags (Continued)

641.leela_s: `basepeak = yes`

Fortran benchmarks:

648.exchange2_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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-RocketB-A.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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-RocketB-A.xml



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 2021-04-29 08:01:33-0400.
Report generated on 2022-03-02 16:37:20 by CPU2017 PS formatter v6442.
Originally published on 2022-03-01.