Advanced Programming in the UNIX Environment

Week 04, Segment 4: Directory Size

Department of Computer Science Stevens Institute of Technology

Jan Schaumann

jschauma@stevens.edu https://stevens.netmeister.org/631/

```
apue$ ls -l
total 1
                                      0 Sep 23 00:40 fifo
prw-r--r-- 1 jschauma
                        wheel
                                      4 Sep 23 00:39 file
-rw-r--r-- 1 jschauma
                        wheel
                                      0 Sep 23 00:41 socket
                        wheel
srwxr-xr-x 1 jschauma
                                      1 Aug 10 22:51 stdout
                        wheel
crw-rw-rw- 1 root
                                      9 Sep 23 00:44 symlink -> (wherever
                        wheel
lrwxr-xr-x 1 jschauma
                                   0, 3 Aug 10 22:51 wd0
                        operator
brw-r---- 1 root
apue$ cat file
(foo)
```

apue\$

```
apue$ cd /
apue$ sudo newfs -b 4096 /dev/rwd1a
apue$ sudo mount /dev/wd1a /mnt
apue$ sudo chown jschauma /mnt
apue$ cd /mnt
apue$ df .
Filesystem 512-blocks Used Avail %Cap Mounted on
/dev/wd1a 96207 1 91396 0% /mnt
apue$
```

```
apue$ cd /
apue$ sudo newfs -b 4096 /dev/rwd1a
apue$ sudo mount /dev/wd1a /mnt
apue$ sudo chown jschauma /mnt
apue$ cd /mnt
apue$ df .
Filesystem 512-blocks
                                      Avail %Cap Mounted on
                             Used
/dev/wd1a
                 96207
                                       91396
                                              0% /mnt
apue$ mkdir dir
apue$ df .
Filesystem 512-blocks
                                      Avail %Cap Mounted on
                             Used
/dev/wd1a
                 96207
                                       91395
                                              0% /mnt
apue$
```

```
apue$ cd /
apue$ sudo newfs -b 4096 /dev/rwd1a
apue$ sudo mount /dev/wd1a /mnt
apue$ sudo chown jschauma /mnt
apue$ cd /mnt
apue$ df .
Filesystem 512-blocks
                                            Avail %Cap Mounted on
                                 Used
/dev/wd1a
                                            91396
                                                     0% /mnt
                    96207
apue$ mkdir dir
apue$ df .
Filesystem 512-blocks
                                            Avail %Cap Mounted on
                                 Used
/dev/wd1a
                                            91395 0% /mnt
                    96207
apue$ ls -lai
total 6
2 drwxr-xr-x 3 jschauma wheel
2 drwxr-xr-x 21 root wheel
4832 drwxr-xr-x 2 jschauma wheel
                                        512 Sep 22 17:57.
                                        512 Aug 10 22:54 ...
                                        512 Sep 22 17:57 dir
apue$
```

```
apue$ cd /
apue$ sudo newfs -b 4096 /dev/rwd1a
apue$ sudo mount /dev/wd1a /mnt
apue$ sudo chown jschauma /mnt
apue$ cd /mnt
apue$ df .
Filesystem 512-blocks
                                     Avail %Cap Mounted on
                           Used
/dev/wd1a
                                     91396 0% /mnt
                 96207
apue$ mkdir dir
apue$ df .
Filesystem 512-blocks
                                     Avail %Cap Mounted on
                           Used
/dev/wd1a
                 96207
                                     91395 0% /mnt
apue$ ls -lai
total 6
  2 drwxr-xr-x 3 jschauma wheel 512 Sep 22 17:57.
  2 drwxr-xr-x 21 root wheel
                                  512 Aug 10 22:54 ...
                                  512 Sep 22 17:57 dir
4832 drwxr-xr-x 2 jschauma wheel
apue$
```

```
apue$ cd /
apue$ sudo newfs -b 4096 /dev/rwd1a
apue$ sudo mount /dev/wd1a /mnt
apue$ sudo chown jschauma /mnt
apue$ cd /mnt
apue$ df .
Filesystem 512-blocks
                                     Avail %Cap Mounted on
                           Used
                                     91396 0% /mnt
/dev/wd1a
                96207
apue$ mkdir dir
apue$ df .
Filesystem 512-blocks
                          Used
                                     Avail %Cap Mounted on
/dev/wd1a
                96207
                                     91395 0% /mnt
apue$ ls -lai
total 6
  2 drwxr-xr-x 3 jschauma wheel 512 Sep 22 17:57.
  2 drwxr-xr-x 21 root wheel 512 Aug 10 22:54 ...
4832 drwxr-xr-x 2 jschauma wheel 512 Sep 22 17:57 dir
apue$ ls -lid /. /..
2 drwxr-xr-x 21 root wheel 512 Aug 10 22:54 /.
                            512 Aug 10 22:54 /..
                     wheel
2 drwxr-xr-x 21 root
apue$
```

```
apue$ cd dir
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 17:57 .
apue$
```

```
apue$ cd dir
apue$ ls -ld
drwxr-xr-x  2 jschauma  wheel  512 Sep 22 17:57 .
apue$ touch 3
apue$ ls -ld
drwxr-xr-x  2 jschauma  wheel  512 Sep 22 17:59 .
apue$
```

```
apue$ cd dir
apue$ ls -ld
drwxr-xr-x  2 jschauma  wheel  512 Sep 22 17:57 .
apue$ touch 3
apue$ ls -ld
drwxr-xr-x  2 jschauma  wheel  512 Sep 22 17:59 .
apue$ touch 4
apue$ ls -ld
drwxr-xr-x  2 jschauma  wheel  512 Sep 22 18:00 .
apue$
```

```
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 18:01 .
apue$ dd if=/dev/zero of=3 bs=1024 count=1024
1024+0 records in
1024+0 records out
1048576 bytes transferred in 0.007 secs (149796571 bytes/sec)
apue$ du -h 3
1.0M 3
apue$
```

```
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 18:01.
apue$ dd if=/dev/zero of=3 bs=1024 count=1024
1024+0 records in
1024+0 records out
1048576 bytes transferred in 0.007 secs (149796571 bytes/sec)
apue$ du -h 3
1.0M 3
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 18:01.
apue$
```

```
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 18:01.
apue$ ls -a | wc -l
      42
apue$ touch 43
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1024 Sep 22 18:04.
apue$ jot 42 43 | xargs touch
apue$ ls
10 14 18 22 26 3 33 37 40 44 48 51 55 59 62 66 7
11 15 19 23 27 30 34 38 41 45 49 52 56 6 63 67 70 74 78 81 9
12 16 20 24 28 31 35 39 42 46 5 53 57 60 64 68 71 75 79 82
13 17 21 25 29 32 36 4 43 47 50 54 58 61 65 69 72 76 8 83
apue$ ls -a | wc -l
      84
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel
                             1024 Sep 22 18:05.
apue$
```

```
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 18:01.
apue$ ls -a | wc -l
      42
apue$ touch 43
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1024 Sep 22 18:04.
apue$ jot 42 43 | xargs touch
apue$ ls
10 14 18 22 26 3 33 37 40 44 48 51 55 59 62 66 7
11 15 19 23 27 30 34 38 41 45 49 52 56 6 63 67 70 74 78 81 9
12 16 20 24 28 31 35 39 42 46 5 53 57 60 64 68 71 75 79 82
13 17 21 25 29 32 36 4 43 47 50 54 58 61 65 69 72 76 8 83
apue$ ls -a | wc -l
      84
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel
                             1024 Sep 22 18:05.
apue$ touch 85
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1536 Sep 22 18:06.
```

```
apue$ echo $(( 512 / 42 ))
12
apue$ ls -ld
drwxr-xr-x  2 jschauma  wheel  1536 Sep 22 18:06 .
apue$ rm 85
apue$
```

```
apue$ echo $(( 512 / 42 ))
12
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1536 Sep 22 18:06.
apue$ rm 85
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1536 Sep 22 18:06.
apue$ rm [4-9]*
apue$ ls -a | wc -l
      33
apue$
```

```
apue$ echo $(( 512 / 42 ))
12
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1536 Sep 22 18:06.
apue$ rm 85
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1536 Sep 22 18:06.
apue$ rm [4-9]*
apue$ ls -a | wc -l
      33
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1536 Sep 22 18:07.
apue$
```

```
apue$ echo $(( 512 / 42 ))
12
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1536 Sep 22 18:06.
apue$ rm 85
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1536 Sep 22 18:06.
apue$ rm [4-9]*
apue$ ls -a | wc -l
      33
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1536 Sep 22 18:07.
apue$ pwd
/mnt/dir
apue$ rm *
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1536 Sep 22 18:08.
apue$
```

```
apue$ cd ..
apue$ rm -fr dir
apue$ mkdir dir
apue$ cd dir
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 18:08 .
apue$
```

```
apue$ cd ..
apue$ rm -fr dir
apue$ mkdir dir
apue$ cd dir
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 18:08 .
apue$ touch $( yes a | head -1024 | tr -d '\n' )
```

```
apue$ cd ..
apue$ rm -fr dir
apue$ mkdir dir
apue$ cd dir
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 18:08.
apue$ touch $( yes a | head -1024 | tr -d '\n' )
name too long
apue$
      26
```

```
apue$ touch $( yes a | head -256 | tr -d '\n' )
apue$ touch $( yes a | head -255 | tr -d '\n' )
$ ls -l a*
-rw-r--r-- 1 jschauma wheel 0 Sep 22 18:14 aaaaaaaaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaaaaaaaaaaaaaaaaaa
apue$
```

```
apue$ touch $( yes a | head -256 | tr -d '\n' )
apue$ touch $( yes a | head -255 | tr -d '\n' )
$ ls -l a*
-rw-r--r-- 1 jschauma wheel 0 Sep 22 18:14 aaaaaaaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaaaaaaaaaaaaaaaaaa
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 18:14.
apue$
```

```
apue$ touch $( yes a | head -256 | tr -d '\n' )
apue$ touch $( yes a | head -255 | tr -d '\n' )
$ ls -l a*
-rw-r--r-- 1 jschauma wheel 0 Sep 22 18:14 aaaaaaaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaaaaaaaaaaaaaaaaaa
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 18:14.
apue$ touch $( yes b | head -255 | tr -d '\n' )
apue$ ls -a | wc -l
apue$
```

```
apue$ touch $( yes a | head -256 | tr -d '\n' )
apue$ touch $( yes a | head -255 | tr -d '\n' )
$ ls -l a*
-rw-r--r-- 1 jschauma wheel 0 Sep 22 18:14 aaaaaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaaaaaaaaaaaaaaaaaa
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 18:14.
apue$ touch $( yes b | head -255 | tr -d '\n' )
apue$ ls -a | wc -l
apue$ ls -ld
```

drwxr-xr-x 2 jschauma wheel 1024 Sep 22 18:17.

apue\$

```
apue$ touch $( yes a | head -256 | tr -d '\n' )
apue$ touch $( yes a | head -255 | tr -d '\n' )
$ ls -l a*
-rw-r--r-- 1 jschauma wheel 0 Sep 22 18:14 aaaaaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaaaaaaaaaaaaaaaaaa
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 512 Sep 22 18:14.
apue$ touch $( yes b | head -255 | tr -d '\n' )
apue$ ls -a | wc -l
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1024 Sep 22 18:17.
apue$ rm a* b*
apue$ ls -ld
drwxr-xr-x 2 jschauma wheel 1024 Sep 22 18:21.
apue$
```

```
apue$ cd /
apue$ sudo umount /mnt
apue$ sudo newfs -b 4096 /dev/rwd1a
apue$ sudo mount /dev/wd1a /mnt
apue$ sudo chown jschauma /mnt
```

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x 2 jschauma
                           wheel 512 Sep 22 02:56.
                           wheel 512 Sep 22 02:55 ..
  2 drwxr-xr-x 3 jschauma
                           wheel
9665 -rw-r--r-- 1 jschauma
                                    0 Sep 22 02:56 file
9666 -rw-r--r-- 1 jschauma
                           wheel 0 Sep 22 02:56 longer-filename
9667 -rw-r--r-- 1 jschauma
                           wheel 0 Sep 22 02:56 third-file
apue$
```

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                        512 Sep 22 02:56.
                   2 jschauma
                                wheel
                                        512 Sep 22 02:55 ...
                  3 jschauma
   2 drwxr-xr-x
                                wheel
                  1 jschauma
                                          0 Sep 22 02:56 file
                                wheel
9665 -rw-r--r--
                  1 jschauma
                                          O Sep 22 02:56 longer-filename
9666 -rw-r--r--
                                wheel
                  1 jschauma
                                          O Sep 22 02:56 third-file
9667 -rw-r--r--
                                wheel
apue$ hexdump -C .
           c0 25 00 00 0c 00 04 01
                                                                    .%.....
0000000
                                       2e 00 00 00 02 00 00 00
0000010
           0c 00 04 02 2e 2e 00 00
                                                                    | . . . . . . . . % . . . . . |
                                       c1 25 00
                                                 00
                                                    10
                                                        00 08 04
00000020
           66 69 6c 65 00 00
                               00 \quad 00
                                             \Theta \Theta
                                                 \Theta\Theta
                                                     18
                                                        00 08 0f
                                                                    |file....%....|
                                                                    |longer-filename.|
00000030
           6c 6f 6e 67 65 72 2d 66
                                          6c 65 6e 61 6d 65 00
           c3 25 00 00 c0 01 08 0a
                                       74 68 69 72 64 2d 66 69
                                                                    | .%....third-fi|
00000040
                                                                   |le....|
00000050
           6c 65 00 00 00 00 00 00
                                          \Theta\Theta
                                             00 \quad 00
                                                    00 \ 00 \ 00 \ 00
                                       00
00000060
                 00 \ 00
              \Theta\Theta
                        00 \ 00 \ 00
                                  \Theta\Theta
                                              \Theta \Theta
                                                 \Theta \Theta
                                                    00
                                                        00
                                                           00
                                                              \Theta\Theta
```

00000200

apue\$

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664) drwxr-xr-x
                  2 jschauma
                                      512 Sep 22 02:56.
                               wheel
                  3 jschauma
                               wheel
     drwxr-xr-x
                                      512 Sep 22 02:55 ...
                  1 jschauma
                                        0 Sep 22 02:56 file
                               wheel
9665 -rw-r--r--
                                        0 Sep 22 02:56 longer-filename
                1 jschauma
                               wheel
9666 -rw-r--r--
                  1 jschauma
                                        O Sep 22 02:56 third-file
                               wheel
9667 -rw-r--r--
apue$ hexdump -C.
0000000 (c0 25 00 00) 0c 00 04 01
                                     2e 00 00 00 02 00 00 00
                                                                | .%.....
          0c 00 04 02 2e 2e 00 00
                                                                | . . . . . . . . % . . . . . |
0000010
                                     c1 25 00
                                              \Theta\Theta
                                                  10
                                                     00 08 04
           66 69 6c 65 00 00
                                                                |file....%....|
00000020
                             \Theta\Theta
                                 \Theta\Theta
                                           \Theta\Theta
                                              00
                                                  18
                                                     00 08 0f
                                                                |longer-filename.|
00000030
           6c 6f 6e 67 65 72 2d 66
                                        6c 65 6e 61 6d 65 00
00000040
                                                                |.%....third-fi|
           c3 25 00 00 c0 01 08 0a
                                     74 68 69 72 64 2d 66 69
00000050
                                                                |le....|
           6c 65 00 00 00 00 00 00
                                        00 00 00 00 00 00
00000200
apue$ echo "ibase=16; 25C0" |
```

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9664

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                     512 Sep 22 02:56.
                 2 jschauma
                              wheel
   2 drwxr-xr-x 3 jschauma
                                     512 Sep 22 02:55 ...
                              wheel
                 1 jschauma
                                       0 Sep 22 02:56 file
                              wheel
9665 -rw-r--r--
                                       0 Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                              wheel
                 1 jschauma
                                       O Sep 22 02:56 third-file
                              wheel
9667 -rw-r--r--
apue$ hexdump -C .
          <u>ç0 25 00 00 (0c 00) 04 01</u>
                                    2e 00 00 00 02 00 00 00
0000000
                                                               [ .%.........
                                                               0c 00 04 02 2e 2e 00 00
0000010
                                    c1 25 00 00
                                                 10
                                                    00 08 04
          66 69 6c 65 00 00
                                                               |file....%....|
00000020
                             \Theta\Theta
                                \Theta\Theta
                                          \Theta \Theta
                                             00
                                                 18
                                                    00 08 0f
                                                               |longer-filename.|
00000030
          6c 6f 6e 67 65 72 2d 66
                                    69 6c 65 6e 61 6d 65 00
00000040
                                                               |.%....third-fi|
          c3 25 00 00 c0 01 08 0a
                                    74 68 69 72 64 2d 66 69
00000050
                                       00 \ 00 \ 00 \ 00 \ 00 \ 00
                                                               |le....|
          6c 65 00 00 00 00 00 00
00000200
apue$ echo "ibase=16; 0C" | bc
```

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                 2 jschauma
                                     512 Sep 22 02:56.
                              wheel
   2 drwxr-xr-x 3 jschauma
                                     512 Sep 22 02:55 ...
                              wheel
9665 -rw-r--r--
                1 jschauma
                                       0 Sep 22 02:56 file
                              wheel
                                       0 Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                              wheel
                 1 jschauma
                                       O Sep 22 02:56 third-file
                              wheel
9667 -rw-r--r--
apue$ hexdump -C .
0000000 co 25 00 00 0c 00(04)01
                                    2e 00 00 00 02 00 00 00
                                                               | .%.....
                                                               00000010
          0c 00 04 02 2e 2e 00 00
                                    c1 25 00
                                             \Theta\Theta
                                                 10
                                                    00 08 04
          66 69 6c 65 00 00
                                                               |file....%....|
00000020
                             \Theta\Theta
                                \Theta\Theta
                                          \Theta\Theta
                                             00
                                                 18
                                                    00 08 0f
                                                               |longer-filename.|
00000030
          6c 6f 6e 67 65 72 2d 66
                                       6c 65 6e 61 6d 65 00
00000040
                                                               |.%....third-fi|
          c3 25 00 00 c0 01 08 0a
                                    74 68 69 72 64 2d 66 69
                                                               |le....|
00000050
          6c 65 00 00 00 00 00 00
                                       00 \ 00 \ 00
                                                00 \ 00 \ 00 \ 00
00000200
apue$ echo "ibase=16; 25C0" |
```

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
                                     512 Sep 22 02:56.
                             wheel
9664 drwxr-xr-x
                 2 jschauma
                                                                   padding
                                     512 Sep 22 02:55 ...
                             wheel
                 3 jschauma
   2 drwxr-xr-x
                 1 jschauma
                                       0 Sep 22 02:56 file
                              wheel
9665 -rw-r--r--
                                       0 Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                              wheel
                 1 jschauma
                                       O Sep 22 02:56 third-file
                              wheel
9667 -rw-r--r--
apue$ hexdump -C .
                                    2e 00 00 00 02 00 00
          c0 25 00 00 0c 00 04(01)
                                                              | .%.....
0000000
                                    c1 25 00 00
                                                              | . . . . . . . . % . . . . . |
0000010
          0c 00 04 02 2e 2e 00
                                00
                                                10
                                                   00 08 04
                                                              |file....%....|
00000020
          66 69 6c 65 00 00
                            \Theta\Theta
                               00
                                    c2 25 00
                                             00
                                                18
                                                   00
          6c 6f 6e 67 65 72 2d 66
                                                              |longer-filename.|
00000030
                                    69 6c 65 6e 61 6d 65 00
00000040
          c3 25 00 00 c0 01 08 0a
                                    74 68 69 72 64 2d 66 69
                                                              |.%....third-fi|
                                                              |le....|
00000050
          6c 65 00 00 00 00 00 00
                                       00 \ 00 \ 00
                                                00 00 00 00
00000200
apue$ echo "ibase=16; FF" | bc
```

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
                                    512 Sep 22 02:56.
9664 drwxr-xr-x
                 2 jschauma
                             wheel
  2 drwxr-xr-x
                 3 jschauma
                                    512 Sep 22 02:55 ...
                             wheel
                 1 jschauma
                                      0 Sep 22 02:56 file
9665 -rw-r--r--
                             wheel
                                      0 Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                             wheel
                                      0 Sep 22 02:56 third-file
                 1 jschauma
                             wheel
9667 -rw-r--r--
apue$ hexdump -C .
                                   2e 00 00 00 02 00 00 00
0000000
          co 25 00 00 0c 00 04 01
                                                              | .%.....
                                                              0000010
          0c 00 04 02 2e 2e 00 00
                                   c1 25 00
                                            \Theta\Theta
                                                   \Theta\Theta
                                                      08 04
                                                10
                                                             |file....%....|
00000020
          66 69 6c 65 00 00
                            00 00
                                         \Theta \Theta
                                            00
                                                18
                                                   00
                                                      08 Of
                                                             |longer-filename.|
00000030
          6c 6f 6e 67 65 72 2d 66
                                      6c 65 6e 61 6d 65 00
00000040
          c3 25 00 00 c0 01 08 0a
                                                              |.%....third-fi|
                                    74 68 69 72 64 2d 66 69
                                                             |le....|
00000050
          6c 65 00 00 00 00 00 00
                                      00 \ 00 \ 00
                                                00 00 00 00
00000200
apue$ echo "ibase=16; 02" | bc
```

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                    512 Sep 22 02:56.
                 2 jschauma
                             wheel
   2 drwxr-xr-x 3 jschauma
                                    512 Sep 22 02:55 ...
                             wheel
                1 jschauma
                                      0 Sep 22 02:56 file
                             wheel
9665 -rw-r--r--
                                      0 Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                             wheel
                 1 jschauma
                                      O Sep 22 02:56 third-file
                             wheel
9667 -rw-r--r--
apue$ hexdump -C .
                                                             .%.....
0000000
          c0 25 00 00 0c 00 04 01
                                               02 00 00 00
                                   2e 00 00 00
                                               10 00 08 04
00000010 (0c 00) 04 02 2e 2e 00 00
                                   c1 25 00 00
                                                             | . . . . . . . . . . . . . . |
                            00 00
          66 69 6c 65 00 00
                                                             |file....%....|
00000020
                                   c2 25 00
                                            00
                                               18
                                                  00 08 0f
                                                             |longer-filename.|
00000030
          6c 6f 6e 67 65 72 2d 66
                                   69 6c 65 6e 61 6d 65 00
                                                             |.%....third-fi|
00000040
          c3 25 00 00 c0 01 08 0a
                                   74 68 69 72 64 2d 66 69
                                                             |le....|
00000050
          6c 65 00 00 00 00 00 00
                                      00 00 00 00 00 00
00000200
```

00000200 apue\$ echo "ibase=16; 0C" | bc

12

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                    512 Sep 22 02:56.
                 2 jschauma
                             wheel
   drwxr-xr-x 3 jschauma
                                    512 Sep 22 02:55 ...
                             wheel
9665 -rw-r--r- 1 jschauma
                                      0 Sep 22 02:56 file
                             wheel
                                      0 Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                             wheel
                1 jschauma
                                      O Sep 22 02:56 third-file
                             wheel
9667 -rw-r--r--
apue$ hexdump -C .
          c0 25 00 00 0c 00 04 01
                                                             | .%.....
0000000
                                   2e 00 00 00 02 00 00
          0c 00(04)02 2e 2e 00 00
0000010
                                            \Theta\Theta
                                                             c1 25 00
                                               10
                                                  00 08 04
                6c 65 00 00
                                                             |file....%....|
00000020
                            00 \quad 00
                                         \Theta\Theta
                                            \Theta\Theta
                                               18
                                                  00 08 0f
                                                             |longer-filename.|
00000030
          6c 6f 6e 67 65 72 2d 66
                                   69 6c 65 6e 61 6d 65 00
                                                             | .%....third-fi|
00000040
          c3 25 00 00 c0 01 08 0a
                                   74 68 69 72 64 2d 66 69
00000050
                                                             |le....|
          6c 65 00 00 00 00 00 00
                                      00 00 00 00 00 00
00000200
```

00000200 apue\$ echo "ibase=16; 0C" | bc

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
                                    512 Sep 22 02:56
9664 drwxr-xr-x
                 2 jschauma
                             wheel
                                    512 Sep 22 02:55 (...
                             wheel
   2 drwxr-xr-x 3 jschauma
                                      0 Sep 22 02:56 file
                1 jschauma
                             wheel
9665 -rw-r--r--
9666 -rw-r--r- 1 jschauma
                                      0 Sep 22 02:56 longer-filename
                             wheel
                 1 jschauma
                                      O Sep 22 02:56 third-file
                             wheel
9667 -rw-r--r--
apue$ hexdump -C .
          c0 25 00 00 0c 00 04 01
                                                             | .%....
0000000
                                   2e 00 00 00 02 00 00
          0c 00 04(02)2e 2e 00 00
                                                             0000010
                                   c1 25 00
                                            \Theta\Theta
                                               10
                                                  00 08 04
          66 69 6c 65 00 00
                                                             |file....%....|
00000020
                            00 \quad 00
                                         \Theta\Theta
                                            \Theta\Theta
                                               18
                                                  00 08 0f
                                                             |longer-filename.|
00000030
          6c 6f 6e 67 65 72 2d 66
                                   69 6c 65 6e 61 6d 65 00
00000040
                                                             |.%....third-fi|
          c3 25 00 00 c0 01 08 0a
                                   74 68 69 72 64 2d 66 69
00000050
                                                             |le....|
          6c 65 00 00 00 00 00 00
                                      00 00 00 00 00 00
00000200
apue$ echo "ibase=16; 02" | bc
```

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
                                    512 Sep 22 02:56.
9664 drwxr-xr-x
                             wheel
                 2 jschauma
  2 drwxr-xr-x 3 jschauma
                                    512 Sep 22 02:55 ...
                             wheel
9665) - rw-r--r--
               1 jschauma
                                      0 Sep 22 02:56 file
                             wheel
9666 -rw-r--r- 1 jschauma
                                     0 Sep 22 02:56 longer-filename
                             wheel
                                      0 Sep 22 02:56 third-file
9667 -rw-r--r-- 1 jschauma
                             wheel
apue$ hexdump -C .
                                                            | .%.......
0000000
          c0 25 00 00 0c 00 04 01
                                   2e 00 00 00 02 00 00 00
                                  C1 25 00 00 10 00 08 04
                                                            00000010
          0c 00 04 02 2e 2e 00 00
                                   c2 25 00
                                           \Theta \Theta
                                                            |file....%....|
00000020
          66 69 6c 65 00 00
                                              18
                           00 00
                                                 00 08 0f
                                                            |longer-filename.|
00000030
          6c 6f 6e 67 65 72 2d 66
                                     6c 65 6e 61 6d 65 00
00000040
          c3 25 00 00 c0 01 08 0a
                                                            | .%....third-fi|
                                   74 68 69 72 64 2d 66 69
                                                            |le....|
00000050
                                     00 \ 00 \ 00 \ 00 \ 00 \ 00
          6c 65 00 00 00 00 00 00
00000200
```

00000200 apue\$ echo "ibase=16; 25C1" | bo 9665

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                     512 Sep 22 02:56.
                 2 jschauma
                              wheel
   2 drwxr-xr-x 3 jschauma
                                     512 Sep 22 02:55 ...
                              wheel
                 1 jschauma
                                       0 Sep 22 02:56 file
                              wheel
9665 -rw-r--r--
                                       0 Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                              wheel
                 1 jschauma
                                       O Sep 22 02:56 third-file
                              wheel
9667 -rw-r--r--
apue$ hexdump -C .
                                                              .%.....
0000000
          c0 25 00 00 0c 00 04 01
                                    2e 00 00 00 02 00 00 00
                                    c1 25 00 00 (10 00) 08 04
                                                               | . . . . . . . . % . . . . . |
00000010
          0c 00 04 02 2e 2e 00 00
                                    c2 25 00
          66 69 6c 65 00 00
                                             00
                                                18 00 08 0f
                                                              |file....%....|
00000020
                            \Theta\Theta
                                \Theta\Theta
          6c 6f 6e 67 65 72 2d 66
                                    69 6c 65 6e 61 6d 65 00
                                                              |longer-filename.|
00000030
00000040
          c3 25 00 00 c0 01 08 0a
                                    74 68 69 72 64 2d 66 69
                                                               |.%....third-fi|
                                                              |le....|
00000050
          6c 65 00 00 00 00 00 00
                                       00 00 00 00 00 00
00000200
```

apue\$ echo "ibase=16; 10" | bc 16

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                      512 Sep 22 02:56.
                  2 jschauma
                              wheel
                 3 jschauma
                                      512 Sep 22 02:55 ...
                              wheel
   2 drwxr-xr-x
9665 -rw-r--r--
                 1 jschauma
                                        0 Sep 22 02:56 file
                              wheel
                                        0 Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                              wheel
                 1 jschauma
                                        O Sep 22 02:56 third-file
                              wheel
9667 -rw-r--r--
apue$ hexdump -C .
                                                               .%.....
0000000
          c0 25 00 00 0c 00 04 01
                                    2e 00 00 00 02 00
                                                       00
                                                           \Theta\Theta
                                                 10 00 08 04
                                                               | . . . . . . . . % . . . . . |
00000010
          0c 00 04 02 2e 2e 00 00
                                     c1 25 00
                                              \Theta
                                                               |file....%....|
00000020
          66 69 6c 65 00 00
                                     c2 25 00
                                              00
                                                 18
                             \Theta\Theta
                                \Theta\Theta
                                                    00
                                                               |longer-filename.|
00000030
          6c 6f 6e 67 65 72 2d 66
                                       6c 65 6e 61 6d 65 00
00000040
                                                                |.%....third-fi|
          c3 25 00 00 c0 01 08 0a
                                     74 68 69 72 64 2d 66 69
                                                               |le....|
00000050
          6c 65 00 00 00 00 00 00
                                       00 00 00 00 00 00
00000200
```

apue\$ echo "ibase=16; 25C1" | bc

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
                                     512 Sep 22 02:56.
9664 drwxr-xr-x
                 2 jschauma
                              wheel
   2 drwxr-xr-x 3 jschauma
                                     512 Sep 22 02:55 ...
                              wheel
                 1 jschauma
                                       0 Sep 22 02:56(file)
                              wheel
9665 -rw-r--r--
                                       O Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                              wheel
                                       0 Sep 22 02:56 third-file
                 1 jschauma
                              wheel
9667 -rw-r--r--
apue$ hexdump -C .
0000000
                                                              | .%..........
          c0 25 00 00 0c 00 04 01
                                    2e 00 00 00 02 00 00
                                                               | . . . . . . . . % . . . . . |
                                                   00 08 04
0000010
          0c 00 04 02 2e 2e 00 00
                                    c1 25 00
                                             \Theta
                                                10
                                                   80 00
                                                              |file....%....|
00000020
          66 69 6c 65 00 00 00 00
                                    c2 25 00
                                             \Theta\Theta
                                                18
          6c 6f 6e 67 65 72 2d 66
                                                              |longer-filename.|
00000030
                                    69 6c 65 6e 61 6d 65 00
00000040
          c3 25 00 00 c0 01 08 0a
                                                              |.%....third-fi|
                                    74 68 69 72 64 2d 66 69
00000050
                                                              |le....|
          6c 65 00 00 00 00 00 00
                                       00 00 00 00 00 00
00000200
```

apue\$ echo "ibase=16; 25C0" | bc

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                   512 Sep 22 02:56.
                2 jschauma
                            wheel
   2 drwxr-xr-x 3 jschauma
                                   512 Sep 22 02:55 ...
                            wheel
9665 -rw-r--r- 1 jschauma
                                     0 Sep 22 02:56 file
                            wheel
(9666) -rw-r--r-- 1 jschauma
                            wheel
                                     O Sep 22 02:56 longer-filename
9667 -rw-r--r--
                1 jschauma
                                     O Sep 22 02:56 third-file
                            wheel
apue$ hexdump -C .
          c0 25 00 00 0c 00 04 01
                                                           | .%.....
0000000
                                  2e 00 00 00 02 00 00 00
00000010
          0c 00 04 02 2e 2e 00 00
                                  c1 25 00 00
                                                           10
                                                 00 08 04
                                  C2 25 00 00 18 00 08 0f
                                                           |file....%....|
00000020
          66 69 6c 65 00 00
                           00 \quad 00
                                  69 6c 65 6e 61 6d 65 00
          6c 6f 6e 67 65 72 2d 66
                                                           |longer-filename.|
00000030
                                                           | .%....third-fi|
00000040
          c3 25 00 00 c0 01 08 0a
                                  74 68 69 72 64 2d 66 69
                                                           |le....|
0000050
          6c 65 00 00 00 00 00 00
                                     00 00 00 00 00 00
00000200
```

apue\$ echo "ibase=16; 25C2" | bc

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                    512 Sep 22 02:56.
                 2 jschauma
                             wheel
   2 drwxr-xr-x 3 jschauma
                                    512 Sep 22 02:55 ...
                             wheel
                 1 jschauma
                                      0 Sep 22 02:56 file
                             wheel
9665 -rw-r--r--
                                      0 Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                             wheel
                 1 jschauma
                                      O Sep 22 02:56 third-file
                             wheel
9667 -rw-r--r--
apue$ hexdump -C .
          c0 25 00 00 0c 00 04 01
                                                              .%.....
0000000
                                   2e 00 00 00 02 00 00 00
                                                              00000010
          0c 00 04 02 2e 2e 00 00
                                         \Theta\Theta
                                            \Theta\Theta
                                                10 00
                                                      08 04
                                   c2 25 00 00 (18 00) 08 0f
          66 69 6c 65 00 00
                            00 00
                                                             |file....%....|
00000020
                                               61 6d 65 00
                                   69 6c 65 6e
          6c 6f 6e 67 65 72
                                                             |longer-filename.|
00000030
                            2d 66
00000040
                                    74 68
                                                  2d 66 69
                                                              |.%....third-fi|
          c3 25 00 00 c0 01 08 0a
                                         69 72
                                                64
                                                             |le....|
00000050
          6c 65 00 00 00 00 00 00
                                         00 \quad 00
                                                \Theta\Theta
                                      00
                                                   00
                                                      00 00
00000200
apue$ echo "ibase=16; 18" | bc
```

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                      512 Sep 22 02:56.
                  2 jschauma
                              wheel
   2 drwxr-xr-x 3 jschauma
                                      512 Sep 22 02:55 ...
                              wheel
9665 <u>-rw-r--r--</u> 1 jschauma
                                        0 Sep 22 02:56 file
                              wheel
9666 - rw-r--r--
                                        0 Sep 22 02:56 longer-filename
                1 jschauma
                              wheel
9667 -rw-r--r--
                 1 jschauma
                                        O Sep 22 02:56 third-file
                              wheel
apue$ hexdump -C .
0000000
          c0 25 00 00 0c 00 04 01
                                                               | .%....
                                    2e 00 00 00 02 00 00 00
00000010
          0c 00 04 02 2e 2e 00 00
                                                                | . . . . . . . . % . . . . . |
                                           00
                                              \Theta\Theta
                                                 10
                                                    \Theta\Theta
                                                       08 04
                                                 18 00(08)0f
                                              \Theta
          66 69 6c 65 00 00 00 00
                                                               |file....%....|
00000020
                                     c2 25 00
                                                               |longer-filename.|
00000030
          6c 6f 6e 67 65 72 2d 66
                                       6c 65 6e 61 6d 65 00
                                                                |.%....third-fi|
00000040
          c3 25 00 00 c0 01 08 0a
                                     74 68 69 72 64 2d 66 69
                                                               |le....|
00000050
          6c 65 00 00 00 00 00 00
                                       00 00 00 00 00 00
00000200
apue$ echo "ibase=16; 18" | bc
```

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
                                     512 Sep 22 02:56.
9664 drwxr-xr-x
                 2 jschauma
                              wheel
   2 drwxr-xr-x 3 jschauma
                                     512 Sep 22 02:55 ...
                              wheel
                 1 jschauma
                                       0 Sep 22 02:56 file
                              wheel
9665 -rw-r--r--
                                       0 Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                              wheel
                 1 jschauma
                                       0 Sep 22 02:56 third-file
                              wheel
9667 -rw-r--r--
apue$ hexdump -C .
                                                               | .%....
0000000
          c0 25 00 00 0c 00 04 01
                                    2e 00 00 00 02 00 00 00
0000010
          0c 00 04 02 2e 2e 00 00
                                                               . . . . . . . . . % . . . . . .
                                    c1 25 00
                                             \Theta\Theta
                                                 10
                                                    00
                                                       08 04
                                                    00 08 0f
                                                               |file....|
00000020
          66 69 6c 65 00 00
                                                 18
                             00 00
                                    c2 25 00
                                              \Theta
                                                               |longer-filename.|
          6c 6f 6e 67 65 72 2d 66
                                    69 6c 65 6e 61 6d 65
00000030
          c3 25 00
                                                 64 2d 66 69
00000040
                   00 c0 01 08 0a
                                             72
                                                               |.%....third-fi|
                                    74 68
                                          69
00000050
                                                               |le....|
          6c 65 00 00 00 00 00 00
                                          00 \quad 00
                                                 \Theta\Theta
                                       00
                                                    00
                                                       00
00000200
```

apue\$ echo "ibase=16; 0F" | bc

15

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                    512 Sep 22 02:56.
                 2 jschauma
                             wheel
   2 drwxr-xr-x 3 jschauma
                                    512 Sep 22 02:55 ...
                             wheel
9665 -rw-r--r- 1 jschauma
                                     0 Sep 22 02:56 file
                             wheel
9666 -rw-r--r- 1 jschauma
                                     O Sep 22 02:56 longer-filename
                             wheel
(9667) - rw-r--r--
               1 jschauma
                                     O Sep 22 02:56 third-file
                             wheel
apue$ hexdump -C .
0000000
          c0 25 00 00 0c 00 04 01
                                                            | .%.....
                                  2e 00 00 00 02 00 00 00
0000010
          0c 00 04 02 2e 2e 00 00
                                                            c1 25 00
                                           00
                                              10
                                                 00 08 04
                                                            |file....%....|
00000020
          66 69 6c 65 00 00
                           00 \quad 00
                                   c2 25 00
                                           \Theta\Theta
                                              18
                                                 00 08 0f
          6c 6f 6e 67 65 72 2d 66
                                                            |longer-filename.|
00000030
                                   69 6c 65 6e 61 6d 65 00
         c3 25 00 00 c0 01 08 0a
00000040
                                  74 68 69 72 64 2d 66 69
                                                            | .%....third-fi|
                                                            |le....|
00000050
          6c 65 00 00 00 00 00 00
                                   00 00 00 00 00 00 00
00000200
apue$ echo "ibase=16; 25C3" |
```

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                        512 Sep 22 02:56.
                  2 jschauma
                                wheel
   2 drwxr-xr-x 3 jschauma
                                        512 Sep 22 02:55 ...
                                wheel
                  1 jschauma
                                          0 Sep 22 02:56 file
                                wheel
9665 -rw-r--r--
                                          0 Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                                wheel
                  1 jschauma
                                          O Sep 22 02:56 third-file
9667 -rw-r--r--
                                wheel
apue$ hexdump -C .
           c0 25 00 00 0c 00 04 01
                                                                   | .%.....
0000000
                                      2e 00 00 00 02 00 00 00
00000010
           0c 00 04 02 2e 2e 00 00
                                                                   | . . . . . . . . % . . . . . |
                                             \Theta\Theta
                                                \Theta\Theta
                                                    10
                                                       00
                                                          08 04
                                                                   |file....%....|
00000020
           66 69 6c 65 00 00
                              \Theta\Theta
                                  \Theta\Theta
                                             \Theta \Theta
                                                \Theta\Theta
                                                    18
                                                          08 Of
                                                       \Theta\Theta
                                       69 6c 65 6e 61 6d 65 00
                                                                   |longer-filename.|
00000030
           6c 6f 6e 67 65 72 2d 66
           c3 25 00 00 c0 01 08 0a
00000040
                                                                   |.%....third-fi|
                                       74 68 69 72 64 2d 66 69
           6c 65 00 00 00 00 00
                                          00 \ 00 \ 00
                                                                   |le....|
00000050
                                  00
                                       00
                                                    00
                                                       00 00 00
00000200
apue$ echo "ibase=16; 01C0" | bc
```

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                     512 Sep 22 02:56.
                 2 jschauma
                              wheel
   2 drwxr-xr-x 3 jschauma
                                     512 Sep 22 02:55 ...
                              wheel
                1 jschauma
                                       0 Sep 22 02:56 file
                              wheel
9665 -rw-r--r--
9666 -rw-r--r- 1 jschauma
                                       0 Sep 22 02:56 longer-filename
                              wheel
                                       0 Sep 22 02:56 third-file
                 1 jschauma
                              wheel
9667 -rw-r--r--
apue$ hexdump -C .
0000000
          c0 25 00 00 0c 00 04 01
                                                              | .%.....
                                    2e 00 00 00 02 00 00 00
00000010
          0c 00 04 02 2e 2e 00 00
                                                              | . . . . . . . . % . . . . . |
                                    c1 25 00
                                             00
                                                10
                                                   00 08 04
                                                              |file....%....|
00000020
          66 69 6c 65 00 00 00
                               \Theta\Theta
                                    c2 25 00
                                             \Theta\Theta
                                                18
                                                   00 08 0f
                                                              |longer-filename.|
00000030
          6c 6f 6e 67 65 72 2d 66
                                    69 6c 65 6e 61 6d 65 00
                                    74 68 69 72 64 2d 66 69
          c3 25 00 00 c0 01 08 (0a
                                                              | .%....third-fi|
00000040
                                    00 00 00 00
                               00
          6c 65 00 00 00 00
                                                              |le....|
00000050
                                                00 00 00 00
00000200
```

00000200 apue\$ echo "ibase=16; 0A" | bc

```
apue$ cd dir
apue$ touch file longer-filename third-file
apue$ ls -lai
total 2
9664 drwxr-xr-x
                                        512 Sep 22 02:56.
                  2 jschauma
                                wheel
   2 drwxr-xr-x 3 jschauma
                                        512 Sep 22 02:55 ...
                                wheel
                  1 jschauma
                                          0 Sep 22 02:56 file
                                wheel
9665 -rw-r--r--
                                          0 Sep 22 02:56 longer-filename
9666 -rw-r--r- 1 jschauma
                                wheel
                  1 jschauma
                                          O Sep 22 02:56 third-file
9667 -rw-r--r--
                                wheel
apue$ hexdump -C .
           c0 25 00 00 0c 00 04 01
                                                                   | .%.....
0000000
                                      2e 00 00 00 02 00 00 00
00000010
           0c 00 04 02 2e 2e 00 00
                                                                   | . . . . . . . . % . . . . . |
                                             \Theta\Theta
                                                \Theta\Theta
                                                    10
                                                       00
                                                          08 04
                                                                   |file....%....|
00000020
           66 69 6c 65 00 00
                              \Theta\Theta
                                  \Theta\Theta
                                             \Theta \Theta
                                                \Theta\Theta
                                                    18
                                                          08 Of
                                                       \Theta\Theta
                                       69 6c 65 6e 61 6d 65 00
                                                                   |longer-filename.|
00000030
           6c 6f 6e 67 65 72 2d 66
           c3 25 00 00 c0 01 08 0a
00000040
                                                                   |.%....third-fi|
                                       74 68 69 72 64 2d 66 69
           6c 65 00 00 00 00 00
                                          00 \ 00 \ 00
                                                                   |le....|
00000050
                                  00
                                       00
                                                    00
                                                       00 00 00
00000200
apue$ echo "ibase=16; 01C0" | bc
```

```
apue$ rm longer-filename
apue$ hexdump -C .
                                                             00 02 00 00 00
0000000
              c0 25 00 00 0c 00 04 01
                                                2e 00
                                                        00
                                                                                    | .%.....
              0c 00 04 02 2e 2e 00 00
0000010
                                                c1 25 00
                                                                 28 00 08 04
                                                             \Theta\Theta
                                                                                    | . . . . . . . . % . . ( . . . |
00000020
                                                                                    |file....%....|
              66 69 6c 65 00
                                  \Theta\Theta
                                                        \Theta \Theta
                                      00
                                           00
                                                c2 25
                                                             \Theta\Theta
                                                                 18
                                                                     \Theta\Theta
                                                                         08 Of
              6c 6f 6e 67 65 72 2d 66
00000030
                                                    6c 65 6e 61 6d 65
                                                                             \Theta\Theta
                                                                                    |longer-filename.|
              c3 25
                                                         69 72
00000040
                     00 \ 00 \ c0
                                                                 64 2d
                                  01
                                      08
                                          0a
                                                    68
                                                                         66 69
                                                                                    |.%....third-fi|
0000050
                     00 \quad 00
                                  \Theta\Theta
                                                        00
                              \Theta\Theta
                                      \Theta\Theta
                                                    \Theta\Theta
                                                             \Theta\Theta
                                                                 00
                                                                         \Theta\Theta
              6c 65
                                           00
                                                00
                                                                     \Theta\Theta
                                                                             \Theta\Theta
                                                                                    |le....|
00000060
              00 00
                      00 \ 00 \ 00 \ 00
                                      \Theta\Theta
                                           00
                                                00
                                                    \Theta \Theta
                                                        \Theta\Theta
                                                             \Theta\Theta
                                                                 \Theta\Theta
                                                                     \Theta\Theta
                                                                         00 00
```

*

```
apue$ rm longer-filename
apue$ hexdump -C .
             c0 25 00 00 0c 00 04 01
0000000
                                               2e 00
                                                      00
                                                           00 02 00 00 00
                                                                                 | .%......
             0c 00 04 02 2e 2e 00 00
0000010
                                                                                 | . . . . . . . . % . . ( . . . |
                                               c1 25 00
                                                               28 00 08 04
                                                           \Theta\Theta
00000020
             66 69 6c 65 00
                                 \Theta\Theta
                                                      00
                                                                                 file....%....
                                     \Theta\Theta
                                         00
                                               c2 25
                                                           \Theta\Theta
                                                               18
                                                                       08 Of
                                                                   00
             6c 6f 6e 67
                                                                                 Clonger-filename.
00000030
                             65 72 2d 66
                                                       65 6e 61 6d 65
                                                                           00
                                                                                 | .%....third-fi|
00000040
                                                       69 72
             c3 25
                     00 \quad 00
                             c0
                                     08
                                                   68
                                                               64 2d 66 69
                                 01
                                         0a
0000050
                     00 \ 00
                                 \Theta\Theta
                                                       00
                             \Theta\Theta
                                     \Theta\Theta
                                         00
                                                   \Theta\Theta
                                                           \Theta\Theta
                                                               \Theta\Theta
                                                                       \Theta\Theta
             6c 65
                                               00
                                                                   \Theta\Theta
                                                                           00
                                                                                 le.....
00000060
             00 00
                     00 \quad 00
                             \Theta\Theta
                                 \Theta\Theta
                                     \Theta\Theta
                                         00
                                               00
                                                   00
                                                       \Theta\Theta
                                                           00
                                                               \Theta\Theta
                                                                   \Theta\Theta
                                                                       00 00
```

```
apue$ rm longer-filename
apue$ hexdump -C .
              c0 25 00 00 0c 00 04 01
0000000
                                                 2e 00
                                                         \Theta\Theta
                                                             00 02 00 00 00
                                                                                    | .%......
              0c 00 04 02 2e 2e 00 00
0000010
                                                                                     | . . . . . . . . % . . ( . . . |
                                                 c1 25
                                                         \Theta\Theta
                                                                 28 00 08 04
                                                             \Theta\Theta
00000020
              66 69 6c 65 00
                                  \Theta\Theta
                                                                                    file....%....
                                       \Theta\Theta
                                           00
                                                         00
                                                                 18
                                                             \Theta
                                                                      \Theta \Theta
                                                                          08
                                                                              0 f
              6c 6f 6e 67
                                                                                    Clonger-filename.
00000030
                                      2d 66
                              65 72
                                                         65 6e 61 6d 65
                                                                              00
                                                                                    | .%....third-fi|
00000040
                                                         69 72
              c3 25
                      00 \quad 00
                              c0
                                       08
                                                     68
                                                                 64 2d 66 69
                                  01
                                           0a
0000050
                      00 \ 00
                                  \Theta\Theta
                                                         00
              6c 65
                              \Theta\Theta
                                       \Theta\Theta
                                           00
                                                     \Theta\Theta
                                                             \Theta\Theta
                                                                 \Theta\Theta
                                                                          \Theta\Theta
                                                 00
                                                                     \Theta\Theta
                                                                              00
                                                                                    le.....
00000060
              00 00
                      00 \quad 00
                              \Theta\Theta
                                  \Theta\Theta
                                       \Theta\Theta
                                           00
                                                 00
                                                     00
                                                         \Theta\Theta
                                                             00
                                                                 \Theta\Theta
                                                                     \Theta\Theta
                                                                         00 00
```

```
apue$ rm longer-filename
apue$ hexdump -C .
             c0 25 00 00 0c 00 04 01
0000000
                                              2e 00
                                                     \Theta \Theta
                                                         \Theta\Theta
                                                             02
                                                                 \bigcirc0
                                                                     \Theta\Theta
                                                                         \Theta\Theta
                                                                               | .%......
                                              c1 25 00 00 (28 00) 08 04
             0c 00 04 02 2e 2e 00 00
                                                                               0000010
                                                              18
                                                                 00
                                                                               |file....%....|
0000020
                                                          00
                                                                     80
                                                     00
                     6c 65
                                        \Theta
                                                                         0 f
                             00
                                     \Theta
0000030
                                                                               longer-filename.
                                                          6e
                                                                         00
                     6e
                                         66
                                                                  6d
                                                                     66 69
00000040
             c3 25
                     \Theta\Theta
                                    80
                                                      69
                                                              64
                                                                               | .%....third-fi|
                        \Theta \Theta
                             C 0
                                01
                                        0a
                                                                 2 d
0000050
                    00 00
                                00
                                                      00
             6c 65
                            \Theta\Theta
                                    \Theta\Theta
                                        00
                                                          00
                                                             \Theta\Theta
                                                                     \Theta\Theta
                                                  00
                                                                 00
                                                                         00
                                              00
                                                                               le.....
00000060
             00 00
                    00 \ 00
                            \Theta \Theta
                                \Theta\Theta
                                    \Theta\Theta
                                        00
                                                 \Theta \Theta
                                                     \Theta\Theta
                                                         00
                                                             \Theta\Theta
                                                                 \Theta\Theta
                                                                     00 00
                                              00
                                                                               00000200
apue$ echo "ibase=16; 28" |
```

```
apue$ echo hello > shorty
apue$ hexdump -C .
            c0 25 00 00 0c 00 04 01
0000000
                                             2e 00 00
                                                        00 02 00
                                                                   00
                                                                             | .%.....
                                                                       \Theta\Theta
                                            c1 25 00 00 (10 00) 08 04
            0c 00 04 02 2e 2e 00 00
                                                                             | . . . . . . . . % . . . . . |
0000010
                                            c2 25 00
                                                            18 00 08
                                                                             |file....%....|
00000020
                    6c 65
                                                        00
             66 69
                               \Theta
                                   \Theta
                                                                       06
                            \Theta
                                       \Theta
                                   00 00
                                                    65 6e 61 6d 65
0000030
                    6f 72 74 79
                                                                              shorty..ilename.
             73 68
                                                6c
                                                                       \Theta\Theta
00000040
                                                    69 72
             c3 25
                    00 \ 00 \ c0
                                   08
                                                           64 2d 66 69
                               01
                                       0a
                                                68
                                                                             |.%....third-fi|
00000050
             6c 65 00 00 00 00
                                                    00
                                   \Theta\Theta
                                       00
                                                \Theta\Theta
                                                        \Theta\Theta
                                                            \Theta\Theta
                                                                   \Theta\Theta
                                            \Theta\Theta
                                                               \Theta\Theta
                                                                             |le....|
                                                                       \Theta\Theta
00000060
            00 00
                    00 \ 00 \ 00 \ 00
                                   \Theta\Theta
                                       00
                                                \Theta\Theta
                                                    \Theta\Theta
                                                        \Theta\Theta
                                                           00 00 00 00
                                             00
                                                                             00000200
apue$ echo "ibase=16; 10"
```

```
apue$ echo hello > shorty
apue$ hexdump -C .
0000000
             c0 25 00 00 0c 00 04 01
                                             2e 00 00
                                                         00 02 00 00 00
                                                                               | .%.....
0000010
             0c 00 04 02 2e 2e 00 00
                                              c1 25 00
                                                         \Theta\Theta
                                                             10
                                                                 00
                                                                     08 04
                                                                               . . . . . . . . . % . . . . . .
                                                         00 18 00 08 06
                                                                               |file....%....|
00000020
                                              c2 25 00
             66 69 6c 65 00
                                \Theta\Theta
                                    00
                                        00
0000030
                                                                               shorty..ilename.
             73 68 6f
                            74 79
                                                     65
                                                         6e
                                                                         00
                                    \Theta
                                        \Theta
                        00 c0
                                                     69
                                                         72
                                                             64
00000040
             c3 25
                    \Theta\Theta
                                    08
                                                 68
                                                                 2d
                                                                     66 69
                                01
                                        0 a
                                                                               |.%....third-fi|
00000050
                    00 \quad 00
                                \Theta\Theta
                                                     00
                            \Theta\Theta
                                    \Theta\Theta
                                        00
                                                         \Theta\Theta
                                                             \Theta\Theta
                                                                     \Theta\Theta
             6c 65
                                                 00
                                                                 00
                                                                         00
                                              00
                                                                               |le....|
                    00 00 00 00
00000060
             00 00
                                    \Theta\Theta
                                        00
                                                 \Theta \Theta
                                                     \Theta\Theta
                                                         \Theta\Theta
                                                             \Theta\Theta
                                              00
                                                                 \Theta\Theta
                                                                     00
                                                                        \Theta\Theta
                                                                               00000200
apue$ echo "ibase=16; 18" |
```

```
apue$ echo hello > shorty
apue$ hexdump -C .
0000000
             c0 25 00 00 0c 00 04 01
                                             2e 00 00 00 02 00 00 00
                                                                               | .%.......
             0c 00 04 02 2e 2e 00 00
                                                                               | . . . . . . . . % . . . . . |
0000010
                                             c1 25 00
                                                         \Theta\Theta
                                                             10
                                                                 00 08
                                                                         04
                                                         00 18 00 08 06
                                                                               |file....%....|
00000020
                                              c2 25 00
             66 69
                    6c 65 00
                                \Theta\Theta
                                    \Theta\Theta
                                        00
00000030
                                                 6c 65 6e 61 6d 65
             73 68 6f
                                                                               |shorty..ilename.|
                            74 79
                                    \Theta
                                        \Theta
                                                                         00
             c3 25
00000040
                    00 \ 00 \ c0 \ 01
                                    80
                                                     69 72 64 2d 66 69
                                        0a
                                                 68
                                                                               |.%....third-fi|
0000050
                    00 \quad 00
                            00 \quad 00
                                                     \Theta\Theta
             6c 65
                                    \Theta\Theta
                                        00
                                                 \Theta\Theta
                                                         \Theta\Theta
                                                             \Theta\Theta
                                                                     \Theta\Theta
                                             \Theta\Theta
                                                                 \Theta\Theta
                                                                         00
                                                                               |le....|
                    00 \ 00 \ 00 \ 00
00000060
             00 00
                                    \Theta\Theta
                                        00
                                                 \Theta \Theta
                                                     \Theta\Theta
                                                         \Theta\Theta
                                                             00 00 00 00
                                              00
                                                                               00000200
apue$ echo "ibase=16; 18" |
```

```
apue$ rm shorty
apue$ hexdump -C .
0000000
             c0 25 00 00 0c 00 04 01
                                             2e 00
                                                    \Theta \Theta
                                                        \Theta\Theta
                                                            02 00
                                                                    \Theta\Theta
                                                                        \Theta\Theta
                                                                              | .%......
                                             c1 25 00 00 (28 00) 08 04
                                                                              0000010
             0c 00 04 02 2e 2e 00 00
                                                             18
                                                                \Theta\Theta
                                                                              |file....|
0000020
                                00
                                                    00
                                                         00
                                                                    08
             66 69
                    6c 65
                            \Theta\Theta
                                    00
                                        00
                                                                        06
                                                     65
0000030
                        72
                                79
                                                        6e
                                                            61
                                                                               shorty..ilename.
             73 68
                            74
                                    00
                                        00
                                                                6d
                                                                    65
                                                                        00
                    6f
00000040
             c3 25
                    \Theta\Theta
                                                     69
                                                        72
                                                             64
                                                                    66 69
                        00
                                00
                                    08
                                        0a
                                                 68
                                                                2 d
                            14
                                                                              |.%....third-fi|
0000050
                    00 00
                                00
                                                     00
             6c 65
                            \Theta\Theta
                                    \Theta\Theta
                                        00
                                                         00
                                                            \Theta\Theta
                                                                    \Theta\Theta
                                                 00
                                                                00
                                                                        00
                                                                              |le....|
                                             00
00000060
             00 00
                    00 \ 00
                            \Theta\Theta
                                \Theta\Theta
                                    \Theta\Theta
                                        00
                                                 \Theta \Theta
                                                    \Theta\Theta
                                                        \Theta\Theta
                                                            \Theta\Theta
                                                                \Theta\Theta
                                                                    00 00
                                             00
                                                                              00000200
apue$ echo "ibase=16; 28" |
40
```

```
apue$ rm shorty
apue$ touch a-significantly-longer-name
apue$ hexdump -C .
            c0 25 00 00 0c 00 04 01
0000000
                                          2e 00
                                                 \Theta\Theta
                                                     \Theta\Theta
                                                        02
                                                            00
                                                               00
                                                                         .%.....
                                                                   \Theta\Theta
                                                                         0000010
            0c 00 04 02 2e 2e
                                 00
                                     00
                                                 00
                                                     \Theta\Theta
                                                        28
                                                            00
                                                               08 04
00000020
            66 69 6c 65 00 00
                                 \Theta\Theta
                                                 \Theta \Theta
                                                     \Theta\Theta
                                                        18
                                     00
                                                            00
                                                               08
                                                                         |file....%....|
                                                                   06
00000030
            73 68 6f 72 74 79
                                             6c 65 6e 61 6d 65 00
                                 00
                                     00
                                                                         shorty..ilename.
00000040
            c3 25 00 00 14 00
                                             68 69 72 64 2d 66 69
                                 08 0a
                                                                         | .%....third-fi|
                                          ac 01 08 1b 61 2d 73 69
00000050
            6c 65 00 00 c2 25 00 00
                                                                         |le...%...a-si|
                                          74 6c 79 2d 6c 6f 6e 67
00000060
               6e 69 66 69 63 61 6e
                                                                         gnificantly-long
0000070
                                                 00
                   2d 6e 61 6d 65
                                     00
                                          00
                                             00
                                                     00
                                                        00
                                                            \Theta\Theta
                                                                00
                                                                   \Theta\Theta
                                                                         er-name.....
00000080
                   \Theta\Theta
                      \Theta\Theta
                             \Theta\Theta
                                                 00
                                                     00
               \Theta\Theta
                          00
                                 \Theta\Theta
                                     00
                                          00
                                             00
                                                        \Theta\Theta
                                                            \Theta\Theta
                                                                00
            \Theta \Theta
                                                                   00
```

```
apue$ rm shorty
apue$ touch a-significantly-longer-name
apue$ hexdump -C <.
             c0 25 00 00 0c 00 04 01
0000000
                                             2e 00
                                                    \Theta\Theta
                                                         \Theta\Theta
                                                            02_
                                                                00
                                                                    \Theta\Theta
                                                                              | .%..........
                                                                        \Theta\Theta
                                                                              25 00 00 (28 00) 08 04
0000010
             0c 00 04 02 2e 2e
                                    00 00
                                             c2 25
                                                            18
                                                                00
                                                                              |file....%....|
00000020
                                    \Theta\Theta
                                                     00
                                                         00
                    6c 65
                            \Theta\Theta
                                \Theta\Theta
                                        00
                                                                    08
                                                                        06
0000030
                                                     65
                                                        6e
                                                                        00
                                                                              shorty..ilename.
                68
                                79
                                        00
                                                            61
                                                                6d
                                                                    65
                                    00
                                                                              [ .%....third-fi]
00000040
                    \Theta\Theta
                        \Theta\Theta
                            14
                                00
                                    80
                                        0a
                                                     69
                                                             64
0000050
                                                                              |le...%...a-si|
             6c 65 00
                        \Theta \Theta
                            c2 25
                                    00
                                       \Theta\Theta
                                                    08
                                                        1b 61 2d 73 69
                                             74 6c 79 2d 6c 6f 6e 67
00000060
                6e 69 66 69 63 61 6e
                                                                               gnificantly-long
0000070
                    2d 6e 61 6d
                                    65
                                        00
                                             00
                                                 00
                                                     00
                                                         00
                                                            \Theta\Theta
                                                                \Theta\Theta
                                                                    00
                                                                        00
                                                                              er-name.....
00000080
                \Theta\Theta
                    \Theta\Theta
                        \Theta\Theta
                                \Theta\Theta
                                                     00
                                                         00
                            00
                                    \Theta\Theta
                                        00
                                             00
                                                 00
                                                            \Theta\Theta
                                                                \Theta\Theta
                                                                    00
             \Theta\Theta
                                                                        00
                                                                              00000200
apue$ echo "ibase=16; 28"
40
```

```
apue$ rm shorty
apue$ touch a-significantly-longer-name
apue$ hexdump -C <.
            c0 25 00 00 0c 00 04 01
                                                                          | .%.....
0000000
                                           2e 00
                                                  00
                                                     \Theta\Theta
                                                         02
                                                             00 \ 00 \ 00
                                                                          0000010
            0c 00 04 02 2e 2e
                                  00
                                     \Theta\Theta
                                                  \Theta\Theta
                                                         28
                                                     \Theta\Theta
                                                             00
                                                                08 04
                                                                          |file....%....|
00000020
            66 69 6c 65 00 00
                                  \Theta\Theta
                                                  \Theta \Theta
                                                     \Theta\Theta
                                                         18
                                     00
                                                             00
                                                                08
                                                                    06
00000030
            73 68 6f 72 74 79
                                  \Theta\Theta
                                              6c 65 6e 61 6d 65 00
                                     00
                                                                          shorty..ilename.
            c3 25 00 00 (14 00) 08 0a
                                           74 68 69 72 64 2d 66 69
00000040
                                                                          | .%....third-fi|
            6c 65 00 00 c2 25 00 00
                                                                          |le...%...a-si|
00000050
                                                  08 1b 61 2d 73 69
            67 6e 69 66 69 63 61 6e
                                           74 6c 79 2d 6c 6f 6e 67
00000060
                                                                          gnificantly-long
0000070
                   2d 6e 61 6d
                                  65
                                     00
                                           00
                                              00
                                                  00
                                                      00
                                                         \Theta\Theta
                                                             \Theta\Theta
                                                                 00
                                                                    \Theta\Theta
                                                                          |er-name.....|
00000080
                                                  00
               \Theta\Theta
                   \Theta\Theta
                       00
                          00
                              \Theta\Theta
                                  \Theta\Theta
                                      00
                                              00
                                                      00
                                                         \Theta\Theta
                                                             \Theta\Theta
                                                                 00
            \Theta \Theta
                                           00
                                                                    00
                                                                          00000200
apue$ echo "ibase=16; 14" |
20
```

```
apue$ rm shorty
apue$ touch a-significantly-longer-name
apue$ hexdump -C <.
           c0 25 00 00 0c 00 04 01
0000000
                                        2e 00
                                               \Theta\Theta
                                                   00
                                                      02
                                                         00
                                                             00
                                                                \Theta\Theta
                                                                      | .%..........
                                                                      0000010
           0c 00 04 02 2e 2e
                                \Theta\Theta
                                   00
                                               00
                                                      28
                                                   00
                                                          00
                                                             08 04
00000020
           66 69 6c 65 00
                            \Theta\Theta
                                \Theta\Theta
                                               00
                                                   00
                                                      18
                                   00
                                                          \Theta\Theta
                                                             08
                                                                      |file....%....|
                                                                 06
00000030
               68 6f 72 74 79
                                            6c 65 6e 61 6d 65 00
                                00
                                   00
                                                                      shorty..ilename.
00000040
                  00 00
                            \Theta\Theta
                                08
                                         74 68 69 72 64
                                                         2d 66 69
                         14
                                   0a
                                                                      | .%....third-fi|
                         c2 25
                                        ac 01) 08 1b 61 2d 73 69
                                                                      |le...%...a-si|
00000050
                  00 \quad 00
                                00
                                   00
                                                  2d 6c 6f 6e 67
00000060
               6e 69 66 69 63 61 6e
                                            6c 79
                                                                      gnificantly-long
0000070
                                    \Theta
                                        00
                                            00
                                               00
                                                   00
                                                      00
                                                          00
                                                             00
                                                                 00
                  2 d
                      6e
                         61
                             6d
                                65
                                                                      er-name.....
00000080
                     \Theta\Theta
                         00
                             00
                                00
                                               00
               \Theta\Theta
                  \Theta\Theta
                                    00
                                            00
                                                   00
                                                      00
                                        00
                                                          \Theta\Theta
                                                             00 00
```

```
apue$ rm shorty
apue$ touch a-significantly-longer-name
apue$ hexdump -C <.
           c0 25 00 00 0c 00 04 01
                                                                       | .%.....
0000000
                                         2e 00
                                                00
                                                   00 02
                                                          00 \ 00 \ 00
                                                                       0c 00 04 02 2e 2e 00
0000010
                                                       28
                                    \Theta\Theta
                                                00
                                                   \Theta\Theta
                                                          00 08 04
00000020
            66 69 6c 65 00 00
                                 \Theta\Theta
                                                \Theta \Theta
                                                   \Theta \Theta
                                                       18
                                    00
                                                          00
                                                              08
                                                                       |file....%....|
                                                                  06
00000030
            73 68 6f 72 74 79
                                            6c 65 6e 61 6d 65 00
                                 00
                                    00
                                                                        shorty..ilename.
00000040
            c3 25 00 00 14 00
                                         74 68 69 72 64 2d 66 69
                                08 0a
                                                                       | .%....third-fi|
                                         ac 01 08 1b 61 2d 73 69
                                                                       |le...%...a-si|
           6c 65 00 00 c2 25 00 00
00000050
                                         74 6c 79 2d 6c 6f 6e 67
               6e 69 66 69 63 61 6e
00000060
                                                                        gnificantly-long
                  2d 6e 61 6d 65
0000070
                                                00
                                    00
                                         00
                                            00
                                                    00
                                                       \Theta\Theta
                                                           \Theta\Theta
                                                              00
                                                                  \Theta\Theta
                                                                       |er-name.....|
00000080
               \Theta\Theta
                  00 \ 00
                             \Theta\Theta
                                                00
                                                    00
                         \Theta\Theta
                                 \Theta\Theta
                                    00
                                         00
                                            00
                                                       \Theta\Theta
                                                          \Theta\Theta
                                                              00
            00
                                                                  \Theta\Theta
                                                                       00000200
apue$ echo "ibase=16; 25C2" |
```

```
apue$ touch $(yes a | head -255 | tr -d '\n')
apue$ touch $(yes b | head -255 | tr -d '\n')
apue$ hexdump -C <.
           c0 25 00 00 0c 00 04 01
0000000
                                        2e 00 00 00 02
                                                        \Theta\Theta
                                                            00 \quad 00
                                                                     0c 00 04 02 2e 2e 00 00
0000010
                                        c1 25 00 00
                                                     28
                                                        00 08 04
                                                                     | . . . . . . . . % . . ( . . . |
00000020
           66 69 6c 65 00 00 00 00
                                        c2 25 00 00 18 00 08 06
                                                                     |file....%....|
00000030
           73 68 6f 72 74 79 00 00
                                        69 6c 65 6e 61 6d 65 00
                                                                     shorty..ilename.|
00000040
           c3 25 00 00 14 00 08 0a
                                        74 68 69 72 64 2d 66 69
                                                                     |.%....third-fi|
00000050
           6c 65 00 00 c2 25 00 00
                                        ac 01 08 1b 61 2d 73 69
                                                                     |le...%....a-si|
           67 6e 69 66 69 63 61 6e
00000060
                                        74 6c 79 2d 6c 6f 6e 67
                                                                     |gnificantly-long|
00000070
           65 72 2d 6e 61 6d 65 00
                                        c4 25 00 00 88 01 08 ff
                                                                     er-name.....
00000080
           61 61 61 61 61 61 61
                                           61 61 61 61 61 61
                                                                     aaaaaaaaaaaaa
00000170
                     61
                         61
                            61
                               61
                  61
                                   61
                                           61
                                              61
                                                     61
                                                         61
                                                                00
                                                  61
                                                            61
                                                                     aaaaaaaaaaaa.
              00
                  \Theta\Theta
                     00
                        00
                            00
00000180
                               \Theta\Theta
                                           00
                                              00
                                                  00
                                                     00
                                                         00
                                                            \Theta\Theta
                                   00
                                        00
                                                               00
           00
                                                                     . . . . . . . . . . . . . . . . . . .
00000200
              25
                  00
                     00
                         \Theta\Theta
                            02
                                                                     [ . K . . . . . . bbbbbbb [
                               08
                                                     62
           c 5
                                   ff
                                           62
                                              62
                                                  62
                                                         62 62
00000210
                        62
                            62 62
                                                                     dddddddddddddd
              62
                  62
                     62
                                           62
                                              62
                                                  62
                                                     62
                                   62
                                                         62 62 62
                                                                     bbbbbb.....
00000300
           62 62 62 62 62 62
                                   00
                                        00
                                           \Theta \Theta
                                              \Theta \Theta
                                                  00 00
                                                        00 00
                                                               00
00000310
              00 \ 00 \ 00 \ 00
                            \Theta\Theta
                               00
                                        00 00
                                              00
                                                 \Theta\Theta
                                                     00 \quad 00
                                                            00
           \Theta\Theta
                                   00
                                                               00
```

```
apue$ rm aaa*
apue$ touch ccc ddd eee
apue$ hexdump -C <.
0000000
           c0 25 00 00 0c 00 04 01
                                         2e 00 00 00 02
                                                          00
                                                             00 \quad 00
                                                                       | .%.........
0000010
           0c 00 04 02 2e 2e 00
                                                       10 00 08 04
                                    \Theta\Theta
                                         c1 25
                                               00 \quad 00
                                                                       | . . . . . . . . % . . ( . . . |
00000020
           66 69 6c 65 00 00 00 00
                                         c4 25 00 00 0c 00 08 03
                                                                       |file....%....|
00000030
           63 63 63 00 c5 25 00
                                         0c 00 08 03 64 64 64 00
                                    00
                                                                       | CCC . . % . . . . . . ddd . |
00000040
           c3 25 00 00 14 00 08
                                            68 69 72 64 2d 66 69
                                    0 a
                                                                       |.%....third-fi|
00000050
           6c 65 00 00 c2 25 00 00
                                         ac 01 08 1b 61 2d 73 69
                                                                       |le...%....a-si|
00000060
                                         74 6c 79 2d 6c 6f 6e 67
           67 6e 69 66 69 63 61 6e
                                                                       |gnificantly-long|
00000070
           65 72 2d 6e 61 6d 65 00
                                         c4 25 00 00 88 01 08 03
                                                                       er-name.....
00000080
           65 65 65 00 61 61 61
                                            61 61 61 61
                                                          61 61 61
                                                                       eee.aaaaaaaaaaa
00000170
                      61
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                             61
                  61
                                61
                                    61
                                            61
                                                61
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                                                              61
                                                                       aaaaaaaaaaaa.
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                  \Theta\Theta
                      00
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00000180
                                \Theta\Theta
                                            00
                                                   00
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                                                          00
                                                              \Theta\Theta
                                    00
                                         00
                                                00
                                                                 00
           00
                                                                       00000200
               25
                  \Theta\Theta
                      \Theta\Theta
                         \Theta\Theta
                                                                       [ . K . . . . . . bbbbbbb [
                             02
                                08
           c 5
                                    ff
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                                                62
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                                                       62
                                                          62 62
00000210
                             62 62
                                                                       dddddddddddddd
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                                                62
                                                   62
                                                       62
                                                          62 62
                                    62
                                                                       bbbbbb.....
00000300
           62 62 62 62 62 62
                                    00
                                         00
                                            \Theta \Theta
                                                \Theta \Theta
                                                   00 00
                                                          00 00
                                                                 00
00000310
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                             \Theta\Theta
                                00
                                         00 00
                                                00
                                                   \Theta\Theta
                                                       00 \quad 00
                                                              00
           \Theta\Theta
                                    00
                                                                 00
```

```
apue$ rm aaa*
apue$ touch ccc ddd eee
apue$ hexdump -C <.
0000000
           c0 25 00 00 0c 00 04 01
                                        2e 00 00 00 02
                                                         00
                                                             00 00
                                                                      | .%.........
0000010
           0c 00 04 02 2e 2e 00
                                   \Theta\Theta
                                        c1 25
                                               00 \quad 00
                                                      10 00 08 04
                                                                      | . . . . . . . . % . . ( . . . |
00000020
           66 69 6c 65 00 00 00 00
                                        c4 25 00 00 0c 00 08 03
                                                                      |file....%....|
00000030
           63 63 63 00 c5 25 00
                                              08 03 64 64 64 00
                                   00
                                        0c 00
                                                                      | CCC..%....ddd. |
00000040
           c3 25 00 00 14 00 08
                                           68 69 72 64 2d 66 69
                                   0 a
                                                                      |.%....third-fi|
00000050
           6c 65 00 00 c2 25 00 00
                                        ac 01 08 1b 61 2d 73 69
                                                                      |le...%....a-si|
00000060
                                        74 6c 79 2d 6c 6f 6e 67
           67 6e 69 66 69 63 61 6e
                                                                      |gnificantly-long|
00000070
           65 72 2d 6e 61 6d 65 00
                                        c4 25 00 00 88 01 08 03
                                                                      er-name.....
00000080
           65 65 65 00 61 61 61
                                           61 61 61 61
                                                         61 61 61
                                                                      eee.aaaaaaaaaaa
00000170
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                         61
                            61
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                                               61
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                  \Theta\Theta
                     00
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                            00
00000180
                                \Theta\Theta
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                                                             \Theta\Theta
                                   00
                                        00
                                               00
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           00
                                                                      00000200
              25
                  \Theta\Theta
                     \Theta\Theta
                         \Theta\Theta
                                                                      [ . K . . . . . . bbbbbbb [
                            02
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                                   ff
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                                               62
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                                                      62
                                                         62 62
00000210
                            62 62
                                                                      dddddddddddddd
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                                   62
                                                                      bbbbbb.....
00000300
           62 62 62 62 62 62
                                   00
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                                           \Theta \Theta
                                               \Theta \Theta
                                                  00 00
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                                                                00
00000310
              00 \ 00 \ 00 \ 00
                            \Theta\Theta
                                00
                                        00 00
                                               00
                                                  \Theta\Theta
                                                      00 \quad 00
                                                             00
           \Theta\Theta
                                   00
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```

```
apue$ rm aaa*
apue$ touch ccc ddd eee
apue$ hexdump -C <.
0000000
           c0 25 00 00 0c 00 04 01
                                       2e 00 00 00 02
                                                        00
                                                           00 00
                                                                    | .%.........
0000010
           0c 00 04 02 2e 2e 00
                                  \Theta\Theta
                                       c1 25
                                             00 \quad 00
                                                    10 00 08 04
                                                                    | . . . . . . . . % . . ( . . . |
00000020
           66 69 6c 65 00 00 00 00
                                       c4 25
                                             00 00 0c 00 08 03
                                                                    |file....%....|
00000030
           63 63 63 00 c5 25 00
                                             08 03 64 64 64 00
                                  00
                                       0c 00
                                                                    ccc..%....ddd.
00000040
           c3 25 00 00 14 00 08
                                  0 a
                                          68 69 72 64 2d 66 69
                                                                    |.%....third-fi|
00000050
           6c 65 00 00 c2 25 00 00
                                       ac 01 08 1b 61 2d 73 69
                                                                    |le...%....a-si|
00000060
                                       74 6c 79 2d 6c 6f 6e 67
           67 6e 69 66 69 63 61 6e
                                                                    |gnificantly-long|
00000070
           65 72 2d 6e 61 6d 65 00
                                       c4 25 00 00 88 01 08 03
                                                                    er-name.....
00000080
           65 65 65 00 61 61 61
                                          61 61 61 61 61 61
                                                                    eee.aaaaaaaaaaa
00000170
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                                                                    aaaaaaaaaaaa.
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                                  00
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              25
                 \Theta\Theta
                     \Theta\Theta
                        \Theta\Theta
                                                                    [ . K . . . . . . bbbbbbb [
                           02
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           c 5
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00000210
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00000300
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00000310
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                                              00
                                                 \Theta\Theta
                                                    00 \ 00
                                                           00
           \Theta\Theta
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```

```
apue$ rm aaa*
apue$ touch ccc ddd eee
apue$ hexdump -C <.
0000000
            c0 25 00 00 0c 00 04 01
                                           2e 00
                                                 00 00 02
                                                            \Theta\Theta
                                                                00 00
                                                                          | .%.........
0000010
            0c 00 04 02 2e 2e 00
                                                 \Theta \Theta
                                                                          | . . . . . . . . % . . ( . . . |
                                     00
                                           c1 25
                                                     \Theta\Theta
                                                         10
                                                            00 08
                                                                    04
00000020
            66 69 6c 65 00 00 00 00
                                          c4 25
                                                 00 00 0c 00 08 03
                                                                         |file....%....|
00000030
                   63 00 c5 25 00
                                                 08 03 64 64 64 00
                                     \Theta\Theta
                                          0c 00
                                                                         ccc..%....ddd.
00000040
            c3 25 00 00 14 00 08
                                              68 69 72 64 2d 66 69
                                     0 a
                                                                          |.%....third-fi|
0000050
            6c 65 00 00 c2 25 00
                                           ac 01 08 1b 61 2d 73 69
                                     \Theta\Theta
                                                                         |le...%....a-si|
00000060
            67 6e 69 66 69 63 61 6e
                                           74 6c 79 2d 6c 6f 6e 67
                                                                          |gnificantly-long|
            65 72 2d 6e 61 6d 65 00
                                          c4 25 00 00 (88 01) 08 03
00000070
                                                                          er-name.....
            65 65 65 00 61 61 61
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00000080
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                                                         61 61 61 61
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00000170
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00000180
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           c 5
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00000200
                   \Theta\Theta
                       \Theta\Theta
                          \Theta\Theta
                              02
                                 08
                                                                          [ . K . . . . . . bbbbbbb [
                                     ff
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00000210
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                              62 62
                                                                          dddddddddddddd
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                                                                          bbbbbb.....
00000300
            62 62 62 62 62 62
                                     00
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                                                            00 00
                                                                    00
00000310
               00 \ 00 \ 00 \ 00
                              \Theta\Theta
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                                                     \Theta\Theta
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            \Theta\Theta
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```

Directory Size

On a traditional Unix File System (UFS / FFS):

- a directory consists of a number of blocks, often chosen so they can be written to disk in an atomic operations, *i.e.*, 512 byte blocks
- the size of the directory is independent of the sizes of the files therein
- the size of the directory is dependent on the length of the filenames it contains
- directories may increase in size, but do not decrease in size

Other file systems may behave differently - try it out for yourself!

- NetBSD /tmp tmpfs
- macOS HFS+
- Linux NFS / ext4

Jan Schaumann 2020-09-22