Exercise 20.1 Defragmentation

Newcomers to **Linux** are often surprised at the lack of mention of filesystem **defragmentation** tools, since such programs are routinely used in the **Windows** world.

However, native filesystems in **UNIX**-type operating systems, including **Linux**, tend not to suffer serious problems with filesystem fragmentation.

This is primarily because they do not try to cram files onto the innermost disk regions where access times are faster. Instead, they spread free space out throughout the disk, so that when a file has to be created there is a much better chance that a region of free blocks big enough can be found to contain the entire file in either just one or a small number of pieces.

For modern hardware, the concept of innermost disk regions is obscured by the hardware anyway; and for **SSDs** defragmentation would actually shorten the lifespan of the storage media due to finite read/erase/write cycles.

Furthermore, the newer **journalling** filesystems (including **ext4**) work with **extents** (large contiguous regions) by design.

However, there does exist a tool for de-fragmenting **ext4** filesystems:

```
$ sudo e4defrag

Usage   : e4defrag [-v] file...| directory...| device...
        : e4defrag  -c  file...| directory...| device...
```

e4defrag is part of the **e2fsprogs** package and should be on all modern **Linux** distributions, although it doesn't come with **RHEL 6** which is somewhat long in tooth.

The only two options are:

- `-v`: Be verbose.
- `-c`: Don't actually do anything, just analyze and report.

The argument can be:

- A file
- A directory
- An entire device

Examples:

```
$ sudo e4defrag -c /var/log

<Fragmented files>                              now/best       size/ext
1. /var/log/lastlog                               5/1             9 KB
2. /var/log/sa/sa24                               3/1            80 KB
3. /var/log/rhsm/rhsm.log                         2/1           142 KB
4. /var/log/messages                              2/1          4590 KB
5. /var/log/Xorg.1.log.old                        1/1            36 KB

 Total/best extents                              120/112
 Average size per extent                         220 KB
 Fragmentation score                             1
 [0-30 no problem: 31-55 a little bit fragmented: 56- needs defrag]
 This directory (/var/log) does not need defragmentation.
 Done.

$ sudo e4defrag  /var/log
```



```
ext4 defragmentation for directory(/var/log)
[2/152]/var/log/Xorg.2.log:     100%    [ OK ]
[3/152]/var/log/Xorg.0.log.old: 100%    [ OK ]
[4/152]/var/log/messages-20141019.gz:   100%    [ OK ]
[5/152]/var/log/boot.log:       100%    [ OK ]
[7/152]/var/log/cups/page_log-20140924.gz:      100%    [ OK ]
[8/152]/var/log/cups/access_log-20141019.gz:    100%    [ OK ]
[9/152]/var/log/cups/access_log:        100%    [ OK ]
[10/152]/var/log/cups/error_log-20141018.gz:    100%    [ OK ]
[11/152]/var/log/cups/error_log-20141019.gz:    100%    [ OK ]
[12/152]/var/log/cups/access_log-20141018.gz:   100%    [ OK ]
[14/152]/var/log/cups/page_log-20141018.gz:     100%    [ OK ]
...
[152/152]/var/log/Xorg.1.log.old:       100%    [ OK ]

        Success:                        [ 112/152 ]
        Failure:                        [ 40/152 ]
```

Try running **e4defrag** on various files, directories, and entire devices, always trying with `-c` first.

You will generally find that **Linux** filesystems only tend to need defragmentation when they get very full, over 90 percent or so, or when they are small and have relatively large files, like when a **boot** partition is used.

