COMPUTER SCIENCE TRIPOS Part IB – 2021 – Paper 4

6 Security (mgk25)

(*a*) Consider the access rights of user `alice` regarding the following files and directories on a Linux file system:

```
$ id
uid=1000(alice) gid=1000(alice) groups=505(safety)
$ ls -ld foo foo/* foo/*/*
drwxrwxrwx 4 root  root   4096 Apr 20 14:40 foo
-rw-rw-r-- 1 root  root    100 Apr 20 14:40 foo/bar
-rw-rw-r-- 1 alice alice   100 Apr 20 14:40 foo/baz
-rw----r-- 1 root  safety  100 Apr 20 14:40 foo/cux
drwx------ 2 root  root   4096 Apr 20 14:40 foo/dir1
drwxrwxr-t 2 root  alice  4096 Apr 20 14:40 foo/dir2
-rw-rw---- 1 root  root    100 Apr 20 14:40 foo/dir2/flop
-rw-rw-r-- 1 alice alice   100 Apr 20 14:40 foo/dir2/wibble
-rw-rw---- 1 root  safety  100 Apr 20 14:40 foo/dir2/wobble
```

(*i*) For each of the eight files and directories under `foo/`, list which of the following three operations user `alice` is able to perform: read (`R`), delete (`D`), rename (`N`). Your answer should be eight lines of the form

```
R-N  foo/qux
```

where the letters `RDN` indicate that the corresponding operation is allowed, and replacing any of these letters with `-` indicates that it is denied. [8 marks]

(*ii*) Which sequence of shell commands can user `alice` use to take ownership of file `foo/bar`, without affecting its content, such that it appears afterwards in the above directory listing as in

```
-rw-rw-r-- 1 alice alice   100 Apr 20 14:40 foo/bar
```

[2 marks]

(*iii*) Name *two* operations on the metadata of file `foo/bar` that user `alice` can execute only after taking ownership. [2 marks]

(*b*) List *four* mechanisms that a web server can use to maintain authentication session state across a web browser's HTTP requests that form part of the same login session, along with one disadvantage associated with each. [8 marks]