

## Midterm 1–February 24

## Open book section (36 points)

The exam is to be turned in at 2:50 pm. The closed book section should be turned in before you open your books and notes to work the open book section. For the open book section, write your answers on separate pieces of paper.

## Problem 1. (24 points)

I'm logged into `napoleon`. (Honestly, I am). When I type the line:

```
% ls -ld /bin /tmp
```

which displays the inode numbers of `/bin` and `/tmp`, `napoleon` responds with the following two lines:

```
110 /bin
```

```
2 /tmp
```

Immediately, I type the line:

```
% ls -li /
```

which displays the inode numbers of all files and subdirectories referenced within the root directory. Among the many lines printed are the following:

```
110 /bin
```

```
168 /tmp
```

Why are different inode numbers given for `“/tmp”` in these two cases? Why is only one inode number given for `“/bin”` in both cases?

What data blocks were read to execute the two `ls` commands? Draw how the inodes for `/`, `/bin`, and `/tmp` refer to each other either by direct pointers or by indirect references through directory files and mount table entries.

## Problem 2. (12 points)

Assume the following:

- A data block is 4000 bytes long.
- An integer is 4 bytes long.
- An inode can hold 10 direct block references.
- A file 1000000 bytes long has been opened for reading at descriptor 7.
- The system call `lseek(7, 100023, 0)` has just been successfully executed.

What happens when a read of 100 bytes is attempted on file descriptor number 7? You only need explain how the kernel determines which data blocks must be brought into the cache to accomplish the read.