

OS Problem Sheet #6

Warning: Whenever you prefix a shell command with `sudo`, make sure you know what you are doing. And never work as root unless you know what you are doing.

Problem 6.1: *file systems*

(1+1+1+1+1+2+2+1 = 10 points)

On Linux systems, you can create a file system in a regular file and then mount it into your file system tree:

```
dd of=osp6.ext2 bs=1k seek=4024 count=0
sudo mkfs -t ext2 osp6.ext2
sudo modprobe loop
mkdir -p mnt
sudo mount osp6.ext2 mnt
```

Your new filesystem will appear under the `mnt` directory.

- The new file system is not empty. What is the purpose of the directory that is contained in the new file system?
- Change the current working directory so that you are located in the new file system. Run the shell command `stat -f .` and explain the difference between free blocks and available blocks.
- Change the current working directory such that it is outside the new file system. Delete the underlying file `osp6.ext2`. What happens to the mounted file system?
- Change the current working directory such that you are located in the new file system again. Create a large file in the new file system using the following command:

```
sudo dd of=big-file bs=1k seek=4024 count=0
```

Run `stat -f .` again. How have the free block and free inode numbers changed? Can you explain what is going on here?

- Change the current working directory such that you are located in the new file system again. Execute the following commands:

```
sudo chattr +i big-file
sudo rm big-file
```

- Change the current working directory such that you are located outside of the new file system again. Install a static version of `busybox` on your system (e.g., `'sudo apt install busybox-static'` on a Debian system). Now copy the `busybox` program into your new file system and the run a `chroot` command:

```
sudo mkdir -p mnt/bin
sudo cp /bin/busybox mnt/bin/busybox
sudo ln mnt/bin/busybox mnt/bin/sh
sudo chroot mnt /bin/sh
```

Explain what has happened. Why was it important to have a statically linked version of `busybox`?

- From within `busybox` in a change root environment, what do you have to do in order to run a command like `vi`? What do you have to do in order to run commands like `ps` or `top`?

h) Change the current working directory such that it is outside the new file system. Run the following commands:

```
stat -f .  
sudo umount ./mnt  
stat -f .
```

What do you observe?