Operating Systems
Accessing Files

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1 Objectives

Familiarize yourself with and use the essential system calls for operating on files.
Apply the appropriate techniques to text files and binary files.

2 System Calls

```
#include <sys/types.h>
#include <unistd.h> /* system calls: essential defs and decls */
#include <fcntl.h> /* O_RDONLY, O_WRONLY, O_CREAT, O_* */

int open(const char *path, int oflag [, mode]);
ssize_t read(int fildes, void *buf, size_t nbyte);
ssize_t write(int fildes, const void *buf, size_t nbyte);
off_t lseek(int fd, off_t offset, int whence);
int close(int fildes);
```

3 Exercises

1. Implement in C a `mycat` program with functionality similar to the `cat` command, which reads from the `stdin` and writes to the `stdout`.

   (a) Now implement an advanced version of `mycat` which, like the `cat` command, can take a file as an argument. In this case, `mycat` must read from the file and write to `stdout`.

2. Implement in C a `mycp` program with functionality similar to the `cp` command. Vary the size of the `buffer` used and measure the time required to copy a large file.

3. Consider a structure (`struct`) with a person's data (name, age, ...) and a binary file containing records organized according to this structure. Do not assume that the whole file fits in memory.

   Write a program that, depending on the option, allows:

   `-i` - Add people to a binary data file.

   `-l` - List the first `N` people in the binary data file.

   `-u` - Update the age of a given person in the binary data file.

Examples:

```
$ pessoas  -i "José Mourinho" 59
$ pessoas  -l 10
$ pessoas  -u "José Mourinho" 60
```

Measure the time it takes to insert 1,000,000 people (names and ages generated by you). Do you notice any performance degradation as the file grows?

4. Make the `-i` option write to the `stdout` the position in the file of the inserted record, and add the possibility of updating the age of records by that position with the `-o` option.

Example:

```
$ pessoas -i "José Mourinho" 59
registo 973
$ pessoas -o 973 60
```

Measure the time it takes to change ages using both methods. Do you notice any performance degradation as the file grows?

Note: Use `scripts` to automate the tests you run on your programs, so you can repeat them easily.