

CSc 352

Binary File IO

Benjamin Dicken

File Content

- Recall that files on a UNIX system are iNodes, that have pointers to data blocks, where the actual data of a file is stored
- Those blocks are just a bunch of 1's and 0's
- We can choose how to interpret when we read
- We can choose the format when we write

File Content

- Many of the files we have dealt with on UNIX in this course have been “text” files
 - *.c *.py *.txt *.stl makefile
 - This is just because we wrote text to those, and used programs that interpret files as text (vim)
- What have we used that are *NOT* text files?
- A “binary file” is just a file that we treat as information represented in RAW binary, rather than ASCII characters

```
#include <stdio.h>
#include <stdlib.h>
#include <stdint.h>
```

```
int main() {
```

```
    uint32_t number = 10000000;
```

```
    FILE* text = fopen("text", "w");
```

```
    fprintf(text, "%u", number);
```

```
    fclose(text);
```

```
    FILE* binary = fopen("binary", "wb");
```


```
    fwrite(&number, 1, sizeof(number), binary);
```

```
    fclose(binary);
```

```
    return 0;
```

```
}
```

What is this?



What is this?



Tools for viewing file contents

```
$ hexdump file_name
```

```
$ xxd -b file_name
```

```
#include <stdio.h>
#include <stdlib.h>
#include <stdint.h>

int main() {
    uint64_t number = 20;

    FILE* text = fopen("text", "w");
    fprintf(text, "%lu", number);
    fclose(text);

    FILE* binary = fopen("binary", "wb");
    fwrite(&number, 1, sizeof(number), binary);
    fclose(binary);

    return 0;
}
```

Which file represents the number more efficiently?

Data Representation

Each row represents:

studentID, exam 1, exam 2, final exam

How many bytes would it take to represent this with a CSV ASCII file?

How many bytes would it take to represent this in binary? How compact could we get it?

grade_info.csv

19311233,80,90,100

91246834,75,85,82

21245122,43,76,87

18673124,90,75,90

Implement Conversion

Write the code to:

- Open this text file
- Re-write the same data to **binary_grade_info.bin**
- Close the file

grade_info.csv

```
19311233,80,90,100
91246834,75,85,82
21245122,43,76,87
18673124,90,75,90
```


ELF

Executable and Linkable Format

The standard binary executable format for UNIX systems on x86 processors

A type of binary file!

Investigate ELF Files

```
$ file a.out
```

```
$ ldd a.out
```

```
$ readelf -h a.out
```

```
$ objdump -d a.out
```