COMP10002 Foundations of Algorithms

Workshop Week 11

Wenbin Cao

October 17, 2019

GitHub Repo: https://github.com/AlanChaw/COMP10002-FoA

Outline

Chapter 11 - File Operations

- Text Files

- Binary Files

Chapter 13 - Number Representations

- Binary Numbers

- Twos-Complement Representation

File Operations

- Creating a new file
- Opening an existing file
- Closing a file
- Reading from a file
- Writing to a file

Text Files

In a text file, information is stored as a sequence of ASCII printable characters.

Open, write to file, then close file.

```
FILE* fptr;
fptr = fopen("./testFile.txt", "w");
assert(fptr != NULL);

fprintf(fptr, "hello world\n");

fclose(fptr);
```

Text Files

Read from a file by "getc()"

```
char c;

FILE* fptr;
fptr = fopen("./testFile.txt", "r");
assert(fptr != NULL);

while ((c=getc(fptr)) != EOF) {
    printf("%c", c);
}

fclose(fptr);
```

Text Files

Read from a file by "fscanf()"

```
char word[MAXLEN];

FILE* fptr;
fptr = fopen("./testFile.txt", "r");
assert(fptr != NULL);

while (fscanf(fptr, "%s", word) != EOF) {
    printf("%s ", word);
}

fclose(fptr);
```

Binary Files

Write to a binary file

```
fwrite(addressData, sizeData, numbersData, pointerToFile);
```

Read from a binary file

```
fread(addressData, sizeData, numbersData, pointerToFile);
```

Number Representations

Inside the computer, everything is stored as a sequence of binary digits, or bits.

- **Bit**: "0" or "1".
- **Byte**: 8 bits.
- **Word**: 32 or 64 bits, a.k.a 4 or 8 bytes.

Binary numbers

Binary -> Decimal

- $(1011)_2 = 1 * 2^3 + 0 * 2^2 + 1 * 2^1 + 1 * 2^0 = 11$
- $(0111)_2 = 0 * 2^3 + 1 * 2^2 + 1 * 2^1 + 1 * 2^0 = 7$

Decimal -> Binary

- $20 = 16 + 4 = 2^4 + 2^2 = (10100)_2$
- $150 = 128 + 16 + 4 + 2 = 2^7 + 2^4 + 2^2 + 2^1 = (10010110)_2$

Binary numbers - Representations

- Unsigned
- Sign-magnitude
- Twos-complement

Bit pattern	Integer representation		
	unsigned	sign-magn.	twos-comp.
0000	0	0	0
0001	1	1	1
0010	2	2	2
0011	3	3	3
0100	4	4	4
0101	5	5	5
0110	6	6	6
0111	7	7	7
1000	8	−0	−8
1001	9	−1	−7
1010	10	−2	−6
1011	11	−3	−5
1100	12	−4	−4
1101	13	−5	−3
1110	14	−6	−2
1111	15	−7	−1

Twos-complement representation

Leading bit has a weight of -2^{w-1}.

Advantages:

- Only one representation for 0.
- Integer arithmetic is easy to perform.

Examples:

- $5 - 2 = 5 + (-2) = (0101)_2 + (1110)_2 = (0011)_2 = 3$
- $3 - 7 = 3 + (-7) = (0011)_2 + (1001)_2 = (1100)_2 = -4$

Assignment 2

- Please read the FAQ page carefully.
- Try to make a submission everyday.
- Do not forget to verify the output and see the result.
- Complete the Authorship Declaration at the top of your program

Assignment 2

Segmentation fault problem

Why?

- Linux system (Dimefox) has a low tolerance for memory problems.
- It happens when you try to access a memory block which you are not allowed to.

How to solve?

- When you declare a pointer, remember to allocate memory for it.
- Make sure the memory size is calculated correctly.
- Check if the memory is allocated successfully. (Using assert)
- When you use a pointer, make sure it is not NULL.
- Before using arrays, check if it is NULL, check if the index is out of boundary.