National Taiwan Normal University
CSIE Programming II

Instructor: Po-Wen Chi
Due Date: 2021.06.01 PM 11:59

Assignment 5

Policies:

- Zero tolerance for late submission.

- You need to prepare a README file about how to make and run your program. Moreover, you need to provide your name and your student ID in the README file.

- For the writing assignment, I only accept pdf. MS. doc/docx format is not acceptable. Moreover, please use Chinese instead of English except foreign students.

- Do not forget your Makefile. For your convenience, each assignment needs only one Makefile. Please put all executable programs in the directory the same with your Makefile.

- The executable programs should be hw0401, hw0402 . . ..

- You should pack your homework in one zip file. The file name should be StudentId_hw04.zip.

5.1 Base64 (30 pts)

In computer science, **Base64** is a group of binary-to-text encoding schemes that represent binary data in an ASCII string format by translating it into a radix-64 representation. The term Base64 originates from a specific MIME content transfer encoding. Each Base64 digit represents exactly 6 bits of data. Three 8-bit bytes (i.e., a total of 24 bits) can therefore be represented by four 6-bit Base64 digits.

The Base64 index table can be found in the following link.
https://en.wikipedia.org/wiki/Base64

Because Base64 is a six-bit encoding, and because the decoded values are divided into 8-bit octets on a modern computer, every four characters of Base64-encoded text represents three octets of unencoded text or data. This means that when the length of the unencoded input is not a multiple of three, the encoded output must have padding added so that its length is a multiple of four. The padding character is =, which indicates that no further bits are needed to fully encode the input. The padding character is

not essential for decoding, since the number of missing bytes can be inferred from the length of the encoded text.

Now I want you to develop the following program.

```
$ ./hw0501 [options]
    -e, --enc        Encode a file to a text file.
    -d, --dec        Decode a text file to a file.
    -o, --output     Output file name.
./hw0501 -e maldives.bmp -o maldives.txt
./hw0501 -O maldives.bmp -d maldives.txt
```

Note that all options' arguments are mandatory. By the way, do not use **popen** or **system** to call **base64** command directly.

5.2   CPU Usage (30 pts)

I want you to monitor the CPU usage of your computer. Do not worry, I will tell you how to get the CPU information. You can use the following command.

```
cat /proc/stat
```

You do not need to care cpu0, cpu1, ...You just need to read the line starts with cpu. Do you know what those numbers mean? I will not tell you. Please read the manual.

```
man 5 proc
```

Give you a hint. Do you know how to search in the manual? The search keyword is **proc/stat**. What you need to do is to summation all cpu usage times, minus the cpu idle time and calculate the ratio.

```
$ ./hw0502
CPU usage: 5.12%
CPU usage: 6.73%
...
```

Your program should run continuously until Ctrl+C.

5.3   DBLP (40 pts)

DBLP is a computer science bibliography website. DBLP listed more than 5.4 million journal articles, conference papers, and other publications on computer science in December 2020, up from about 14,000 in 1995 and 3.66 million in July 2016. All important journals on computer science are tracked. Proceedings papers of many conferences are also tracked.

Now I want you to develop a tool for the user to query a keyword and the tool should show the first ten papers of the query result. The tool should use **libcurl**. Do not worry, you can assume that the library is successfully

installed in the TA's computer. Of course, if the result number is less than 10, just display all query results.
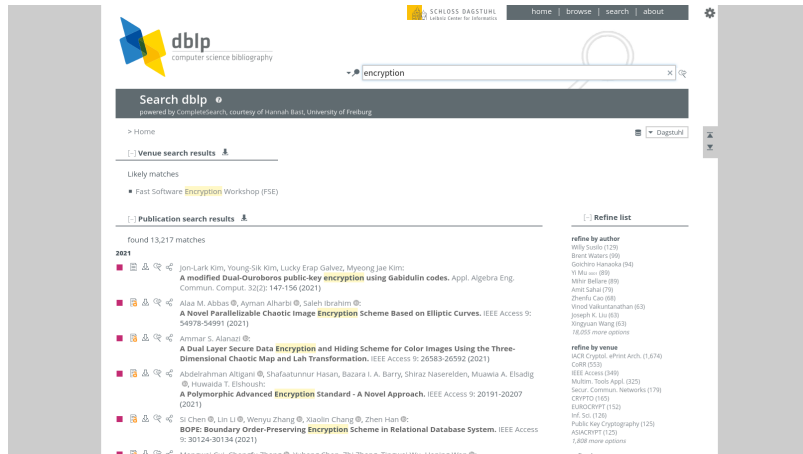

FIGURE 5.1: DBLP Query Example.

```
$ ./hw0503 -q encryption
Paper 01:
    Title: A modified Dual-Ouroboros public-key encryption
    using Gabidulin codes.
    Author: Jon-Lark Kim, Young-Sik Kim, Lucky Erap Galvez,
    Myeong Jae Kim.
    Source: Appl. Algebra Eng. Commun. Comput. 32(2): 147-156
    Year: 2021
Paper 02:
    Title: A Novel Parallelizable Chaotic Image Encryption
    Scheme Based on Elliptic Curves.
    Author: Alaa M. Abbas, Ayman Alharbi, Saleh Ibrahim.
    Source:  IEEE Access 9: 54978-54991
    Year: 2021
<I skip the rest papers ... >
```

Do not forget your Makefile.

5.4 Bonus: # and ## Operators in C (5 pts)

In this class, I do not introduce these two operators. I will give you two example codes.

```c
#include <stdio.h>
#define mkstr(s) #s
int main(void)
{
    printf(mkstr(geeksforgeeks));
```

```
6      return 0;
7 }
```

```c
1 #include <stdio.h>
2 #define concat(a, b) a##b
3 int main(void)
4 {
5     int xy = 30;
6     printf("%d", concat(x, y));
7     return 0;
8 }
```

Please explain the code and find another two scenarios that you can use these two operators.