COM2002 INTERMEDIATE PROGRAMMING
2024 – 2025 SPRING

Laboratory Week: 14 – 18 April 2025

Topic : Input/Output

Program-1 : Caesar cipher (caesar.c)

Definition : The program encrypts the message in a file.

- Prompts the user to enter the name of a file containing the message to be encrypted.
- Writes the encrypted message to a file with the same name but an added extension of ".enc".
- There is no limit on the size of the file to be encrypted or on the length of each line in the file.

Caesar cipher [2]: The Caesar cipher involves replacing each letter of the alphabet with the letter standing three places further down the alphabet. For example,

plain: meet me after the toga party

cipher: PHHW PH DIWHU WKH WRJD SDUWB

Note that the alphabet is wrapped around, so that the letter following Z is A. We can define the transformation by listing all possibilities, as follows:

plain:	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
cipher:	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C

Let us assign a numerical equivalent to each letter:

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Then the algorithm can be expressed as follows. For each plaintext letter *p*, substitute the ciphertext letter *C*:

$$C = E(3, p) = (p + 3) \bmod 26$$

A shift may be of any amount, so that the general Caesar algorithm is

$$C = E(k, p) = (p + k) \bmod 26$$

where *k* takes on a value in the range 1 to 25. The decryption algorithm is simply

$$p = D(k, C) = (C - k) \bmod 26$$

Modify the caesar.c program-1: The program obtains the name of file from the command line.

Modify the caesar.c program-2: The program decrypts the message in an encrypted file.

Reference: K. N. King "C Programming: A Modern Approach", Norton Publishing, 2nd Edition, 2008.
[2]William Stallings, Cryptography and Network Security Principles and Practices, 4th Edition, 2005.

Program-2 : large-small-median (large_small_median.c)

Definition : The program that reads integers from a text file whose name is given as command-line argument. Each line of the file may contain any number of integers (including none) separated by one or more spaces. Have the program display the largest number in the file, the smallest number, and the median (the number closest to the middle if the integers were sorted). If the file contains an even number of integers, there will be two numbers in the middle; the program should display their average (rounded down). Assume that the file contains no more than 10,000 integers.

Hint: Store the integers in an array and then sort the array.

Program-3 : Phone numbers (phone_numbers.c)

Definition : The program reads a series of the phone numbers from a file and displays them in a standard format. Each line of the file will contain a single phone number, but the numbers may be in a variety of formats. You may assume that each line contains 10 digits, possibly mixed with other characters (which should be ignored). For example, suppose that the file contains the following lines:

404.817.6900
(215) 686-1776
312-746-6000
877 275 5273
6173434200

The output of the program should have the following appearance:

(404) 817-6900
(215) 686-1776
(312) 746-6000
(877) 275-5273
(617) 343-4200

Have the program obtain the file name from the command line.

Program-4 : File copy (fcopy.c)

Definition : The program makes a copy of a file. The names of the original file and the new file will be specified on the command line when the program is executed. The program will issue an error message if there are not exactly two file names on the command line or if either file cannot be opened.