Swinburne University Of Technology

Faculty of Science, Engineering and Technology

LABORATORY COVER SHEET

Subject Code: COS30008
Subject Title: Data Structures and Patterns
Lab number and title: 4 Part 2, File I/O
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Figure 1: Julius Caesar Bust Vatican Museum.

Construct a small Win32 console application that implements a simple Caesar cipher. In addition to encoding plain English-alphabet text files, the program should also record the corresponding character frequencies before and after a text has been scrambled. Use proper file I/O to supply input and output capabilities to your program. Please note, even though the input file is a text file, you will have to open it in binary mode and use unformatted input and output. The cipher must not ignore whitespace characters.

More on Caesar cipher here:

https://learncryptography.com/classical-encryption/caesar-cipher

http://www.rowanwatson.com/c-caesar-cipher/

Reading from and writing to files in C++:

http://www.cplusplus.com/doc/tutorial/files/

The class `Caesar.h` is specified as follows:

```cpp
#pragma once
#include <iostream>
#include <fstream> // file stream library
class Caesar
{
private:
    int fCharacterFrequenciesBefore[26];
    int fCharacterFrequenciesAfter[26];

public:
    Caesar();

    void shiftByFour(std::ifstream& aInput, std::ofstream& aOutput);

    friend std::ostream& operator<<(std::ostream& aOStream, const Caesar& aObject);
};
```

The class `Caesar` implements the Caesar cipher and records the character frequencies before and after the encoding. The constructor initializes all data members with 0 whereas the non-member **operator<<** prints the character frequencies (will count both uppercase and lowercase letters together) as shown in the console output screenshot below.

Remember to add the CaesarInput.txt provided to the project's directory. (Right click project in Solution Explorer > Select "Open Folder in File Explorer" to see where the file directory is.

The void function `shiftByFour` is the heart of this process.

Here is a description of what the function should contain.

Variables:

i.   A string variable to store input text line

ii.   A string to store the output text which is to be written to the file

iii. A Boolean to store if the current character is in lowercase or not, initialized as false

iv.   A char variable to store the current character

What the function should do:

- Output to the console the lines of the input text.
    - While there are still lines to be read from the ifstream do the following:
        - cout the input text line
        - Use a for loop to loop the length of the input text line and assign the current character to the char variable declared.
            - If char is an alphabet, then do the following:
                - If char is lowercase, set lowercase flag to true
                - Set char to uppercase
                - Add to character frequencies before variable before performing shift
                - Perform the Caesar shift of 4 on the char [c = 'A' + ((c - 'A' + 4) % 26);]
                - Add to character frequencies after variable after performing shift
                - If lowercase flag is true, set char back to lowercase. Reset lowercase flag to false.
            - End if
            - Add char to output text string
        - End for loop
        - Add new line for output text for each new input line
    - End while loop
- Write output text to console
- Write output text to ofstream

In addition, you need to define a `main` function that opens the input(CaesarInput.txt) and output(CaesarOutput.txt) files and outputs error messages if any of the state flags are set, defines a variable of type `Caesar`, invokes the method `shiftByFour`, and prints the character statistics to `cout`. Remember to close the ifstream and ofstream when you are done.

CaesarInput.txt text, Console Output Screenshots and CaesarOutput.txt screenshots are available below.

CaesarInput.txt text

```
ACT I SCENE I
London. A Street.

Enter Gloucester.


Gloucester. Now is the winter of our discontent Made glorious
summer by this sun of York;
And all the clouds that lour'd upon our house In the deep
bosom of the ocean buried.
Now are our brows bound with victorious wreaths; Our bruised
arms hung up for monuments;
Our stern alarums changed to merry meetings; Our dreadful
marches to delightful measures.
Grim-visag'd war hath smooth'd his wrinkled front; And now, -
instead of mounting barbed steeds,
To fright the souls of fearful adversaries, - He capers
nimbly in a lady's chamber
To the lascivious pleasing of a lute.
But I, that am not shap'd for sportive tricks, Nor made to
court an amorous looking-glass;
I, that am rudely stamp'd, and want love's majesty To strut
before a wanton ambling nymph;
I, that am curtail'd of this fair proportion, Cheated of
feature by dissembling nature, Deform'd, unfinish'd, sent
before my time
Into this breathing world, scarce half made up, And that so
lamely and unfashionable
That dogs bark at me, as I halt by them; Why, I, in this weak
piping time of peace, Have no delight to pass away the time,
Unless to see my shadow in the sun
And descant on mine own deformity:
And therefore, since I cannot prove a lover, To entertain
these fair well-spoken days,
I am determined to prove a villain,
And hate the idle pleasures of these days. Plots have I laid,
inductions dangerous, By drunken prophecies, libels, and
dreams, To set my brother Clarence and the king
In deadly hate the one against the other: And if King Edward
be as true and just
As I am subtle, false, and treacherous,
This day should Clarence closely be mew'd up, About a
prophecy, which says, that G
Of Edward's heirs the murderer shall be.
Dive, thoughts, down to my soul: here Clarence comes.

Brother, good day: what means this armed guard That waits
upon your Grace?
```
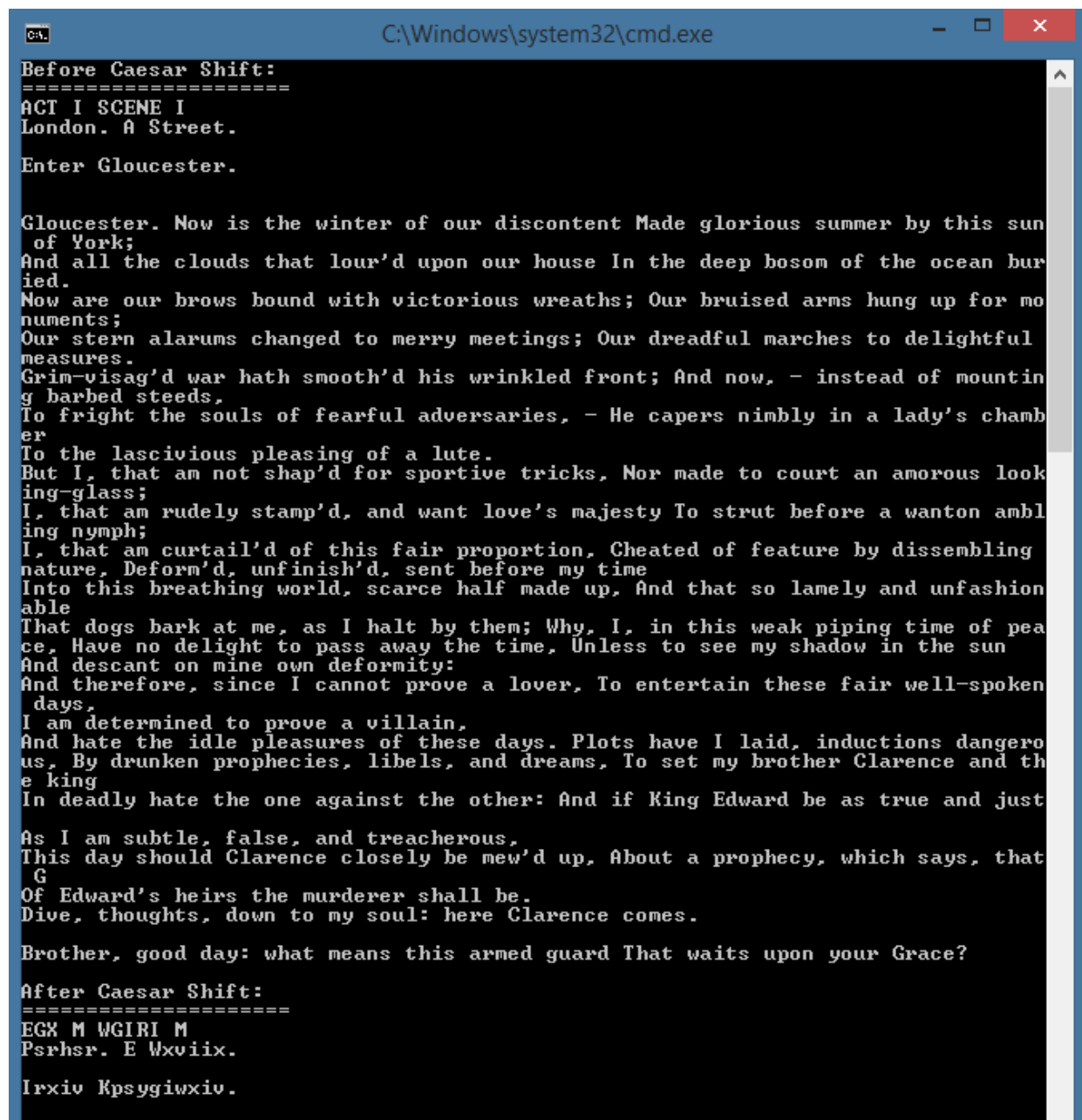
Console Output Screenshot:

```
C:\Windows\system32\cmd.exe

Before Caesar Shift:
======================
ACT I SCENE I
London. A Street.

Enter Gloucester.


Gloucester. Now is the winter of our discontent Made glorious summer by this sun
 of York;
And all the clouds that lour'd upon our house In the deep bosom of the ocean bur
ied.
Now are our brows bound with victorious wreaths; Our bruised arms hung up for mo
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Our stern alarums changed to merry meetings; Our dreadful marches to delightful
measures.
Grim-visag'd war hath smooth'd his wrinkled front; And now, - instead of mountin
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To fright the souls of fearful adversaries, - He capers nimbly in a lady's chamb
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To the lascivious pleasing of a lute.
But I, that am not shap'd for sportive tricks, Nor made to court an amorous look
ing-glass;
I, that am rudely stamp'd, and want love's majesty To strut before a wanton ambl
ing nymph;
I, that am curtail'd of this fair proportion, Cheated of feature by dissembling
nature, Deform'd, unfinish'd, sent before my time
Into this breathing world, scarce half made up, And that so lamely and unfashion
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That dogs bark at me, as I halt by them; Why, I, in this weak piping time of pea
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And descant on mine own deformity:
And therefore, since I cannot prove a lover, To entertain these fair well-spoken
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I am determined to prove a villain,
And hate the idle pleasures of these days. Plots have I laid, inductions dangero
us, By drunken prophecies, libels, and dreams, To set my brother Clarence and th
e king
In deadly hate the one against the other: And if King Edward be as true and just

As I am subtle, false, and treacherous,
This day should Clarence closely be mew'd up, About a prophecy, which says, that
 G
Of Edward's heirs the murderer shall be.
Dive, thoughts, down to my soul: here Clarence comes.

Brother, good day: what means this armed guard That waits upon your Grace?

After Caesar Shift:
======================
EGX M WGIRI M
Psrhsr. E Wxviix.

Irxiv Kpsygiwxiv.
```
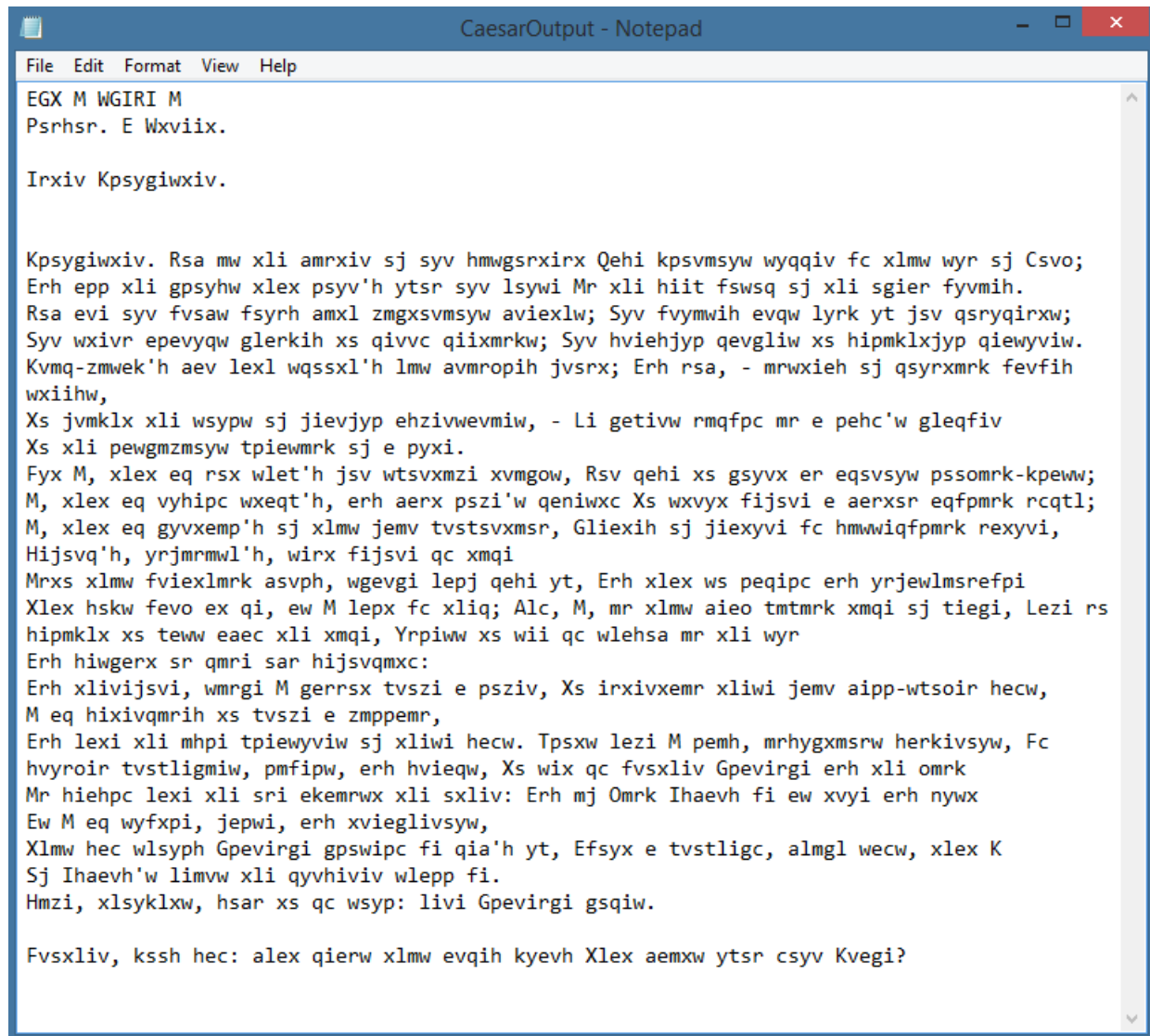
```
After Caesar Shift:
=====================
EGX M WGIRI M
Psrhsr. E Wxviix.

Irxiv Kpsygiwxiv.


Kpsygiwxiv. Rsa mw xli amrxiv sj syv hmwgsrxirx Qehi kpsvmsyw wyqqiv fc xlmw wyr
 sj Csvo;
Erh epp xli gpsyhw xlex psyv'h ytsr syv lsywi Mr xli hiit fswsq sj xli sgier fyv
mih.
Rsa evi syv fvsaw fsyrh amxl zmgxsvmsyw aviexlw; Syv fvymwih evqw lyrk yt jsv qs
ryqirxw;
Syv wxivr epevyqw glerkih xs qivvc qiixmrkw; Syv hviehjyp qevgliw xs hipmklxjyp
qiewyviw.
Kvmq-zmwek'h aev lexl wqssxl'h lmw avmropih jvsrx; Erh rsa, - mrwxieh sj qsyrxmr
k fevfih wxiihw,
Xs jvmklx xli wsypw sj jievjyp ehzivwevmiw, - Li getivw rmqfpc mr e pehc'w gleqf
iv
Xs xli pewgmzmsyw tpiewmrk sj e pyxi.
Fyx M, xlex eq rsx wlet'h jsv wtsvxmzi xvmgow, Rsv qehi xs gsyvx er eqsvsyw psss
mrk-kpeww;
M, xlex eq vyhipc wxeqt'h, erh aerx pszi'w qeniwxc Xs wxvyx fijsvi e aerxsr eqfp
mrk rcqtl;
M, xlex eq gyvxemp'h sj xlmw jemv tvstsvxmsr, Gliexih sj jiexyvi fc hmwwiqfpmrk
rexyvi, Hijsvq'h, yrjmrmwl'h, wirx fijsvi qc xmqi
Mrxs xlmw fviexlmrk asvph, wgevgi lepj qehi yt, Erh xlex ws peqipc erh yrjewlmsr
efpi
Xlex hskw fevo ex qi, ew M lepx fc xliq; Alc, M, mr xlmw aieo tmtmrk xmqi sj tie
gi, Lezi rs hipmklx xs teww eac xli xmqi, Yrpiww xs wii qc wlehsa mr xli wyr
Erh hiwgerx sr qmri sar hijsvqmxc:
Erh xlivijsvi, wmrgi M gerrsx tvszi e psziv, Xs irxivxemr xliwi jemv aipp-wtsoir
 hecw,
M eq hixivqmrih xs tvszi e zmppemr,
Erh lexi xli mhpi tpiewyviw sj xliwi hecw. Tpsxw lezi M pemh, mrhygxmsrw herkivs
yw, Fc hvyroir tvstligmiw, pmfipw, erh hviequw, Xs wix qc fvsxliv Gpevirgi erh xl
i omrk
Mr hiehpc lexi xli sri ekemrwx xli sxliv: Erh mj Omrk Iheavh fi ew xvyi erh nywx
 
Ew M eq wyfxpi, jepwi, erh xvieglivsyw,
Xlmw hec wlsyph Gpevirgi gpswipc fi qia'h yt, Efsyx e tvstligc, almgl wecw, xlex
 K
Sj Iheavh'w limvw xli qyvhiviv wlepp fi.
Hmzi, xlsyklxw, hsar xs qc wsyp: livi Gpevirgi gsqiw.

Fvsxliv, kssh hec: alex qierw xlmw evqih kyevh Xlex aemxw ytsr csyv Kvegi?

Character Frequency Counter (before, after)
A: 129, 25
B: 29, 0
C: 37, 28
D: 77, 0
E: 162, 129
F: 32, 29
G: 29, 37
H: 75, 77
I: 87, 162
J: 2, 32
K: 10, 29
L: 58, 75
M: 50, 87
N: 95, 2
O: 113, 10
P: 27, 58
Q: 0, 50
R: 99, 95
S: 106, 113
T: 124, 27
U: 61, 0
V: 13, 99
W: 25, 106
X: 0, 124
Y: 28, 61
Z: 0, 13
Press any key to continue . . . . _
```

CaesarOutput.txt Screenshot:

```
CaesarOutput - Notepad                                    _  □  ×

File  Edit  Format  View  Help

EGX M WGIRI M
Psrhsr. E Wxviix.

Irxiv Kpsygiwxiv.


Kpsygiwxiv. Rsa mw xli amrxiv sj syv hmwgsrxirx Qehi kpsvmsyw wyqqiv fc xlmw wyr sj Csvo;
Erh epp xli gpsyhw xlex psyv'h ytsr syv lsywi Mr xli hiit fswsq sj xli sgier fyvmih.
Rsa evi syv fvsaw fsyrh amxl zmgxsvmsyw aviexlw; Syv fvymwih evqw lyrk yt jsv qsryqirxw;
Syv wxivr epevyqw glerkih xs qivvc qiixmrkw; Syv hviehjyp qevgliw xs hipmklxjyp qiewyviw.
Kvmq-zmwek'h aev lexl wqssxl'h lmw avmropih jvsrx; Erh rsa, - mrwxieh sj qsyrxmrk fevfih
wxiihw,
Xs jvmklx xli wsypw sj jievjyp ehzivwevmiw, - Li getivw rmqfpc mr e pehc'w gleqfiv
Xs xli pewgmzmsyw tpiewmrk sj e pyxi.
Fyx M, xlex eq rsx wlet'h jsv wtsvxmzi xvmgow, Rsv qehi xs gsyvx er eqsvsyw pssomrk-kpeww;
M, xlex eq vyhipc wxeqt'h, erh aerx pszi'w qeniwxc Xs wxvyx fijsvi e aerxsr eqfpmrk rcqtl;
M, xlex eq gyvxemp'h sj xlmw jemv tvstsvxmsr, Gliexih sj jiexyvi fc hmwwiqfpmrk rexyvi,
Hijsvq'h, yrjmrmwl'h, wirx fijsvi qc xmqi
Mrxs xlmw fviexlmrk asvph, wgevgi lepj qehi yt, Erh xlex ws peqipc erh yrjewlmsrefpi
Xlex hskw fevo ex qi, ew M lepx fc xliq; Alc, M, mr xlmw aieo tmtmrk xmqi sj tiegi, Lezi rs
hipmklx xs tewe eaec xli xmqi, Yrpiww xs wii qc wlehsa mr xli wyr
Erh hiwgerx sr qmri sar hijsvqmxc:
Erh xlivijsvi, wmrgi M gerrsx tvszi e psziv, Xs irxivxemr xliwi jemv aipp-wtsoir hecw,
M eq hixivqmrih xs tvszi e zmppemr,
Erh lexi xli mhpi tpiewyviw sj xliwi hecw. Tpsxw lezi M pemh, mrhygxmsrw herkivsyw, Fc
hvyroir tvstligmiw, pmfipw, erh hvieqw, Xs wix qc fvsxliv Gpevirgi erh xli omrk
Mr hiehpc lexi xli sri ekemrwx xli sxliv: Erh mj Omrk Ihaevh fi ew xvyi erh nywx
Ew M eq wyfxpi, jepwi, erh xvieglivsyw,
Xlmw hec wlsyph Gpevirgi gpswipc fi qia'h yt, Efsyx e tvstligc, almgl wecw, xlex K
Sj Ihaevh'w limvw xli qyvhiviv wlepp fi.
Hmzi, xlsyklxw, hsar xs qc wsyp: livi Gpevirgi gsqiw.

Fvsxliv, kssh hec: alex qierw xlmw evqih kyevh Xlex aemxw ytsr csyv Kvegi?
```

This exercise requires approximately 110 lines of low-density C++ code.