Swinburne University of Technology

Faculty of Science, Engineering and Technology

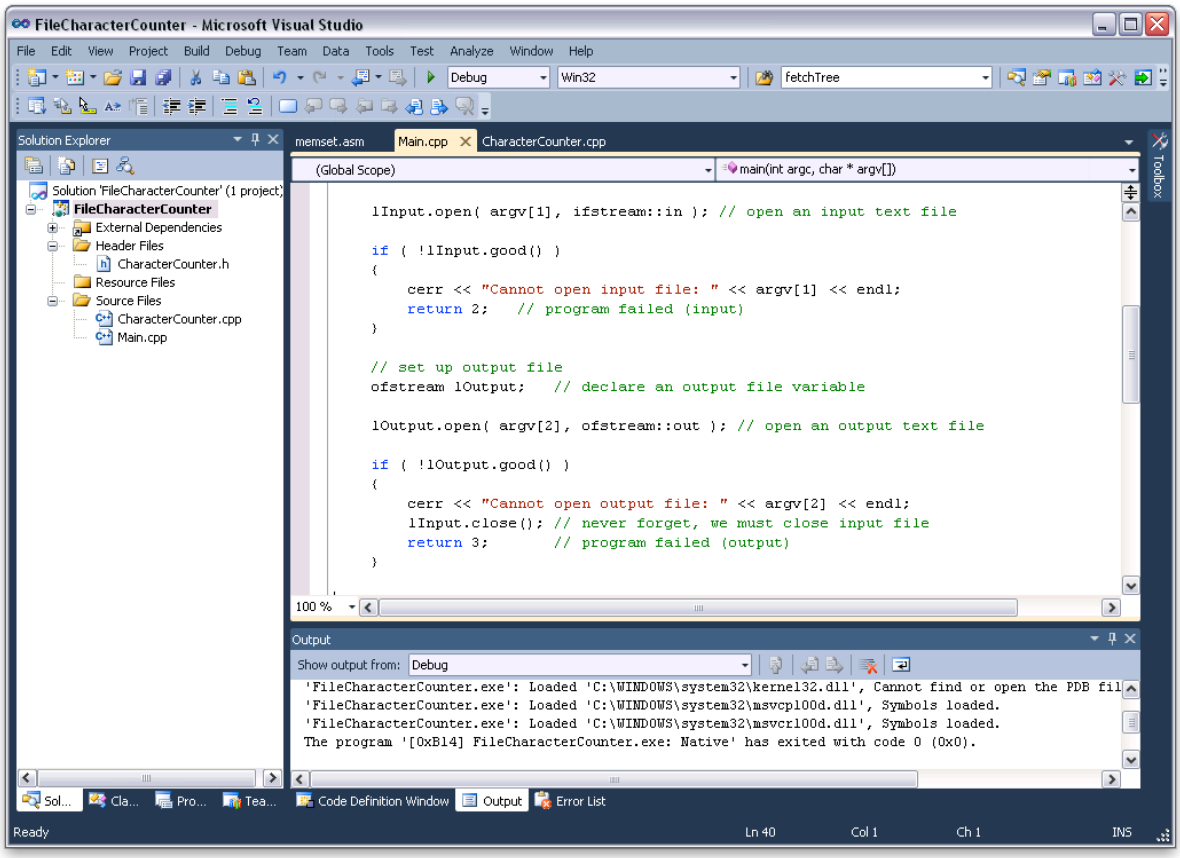
LABORATORY COVER SHEET

Subject Code:	COS30008
Subject Title:	Data Structures and Patterns
Lab number and title:	4, File I/O
Lecturer:	Dr. Markus Lumpe

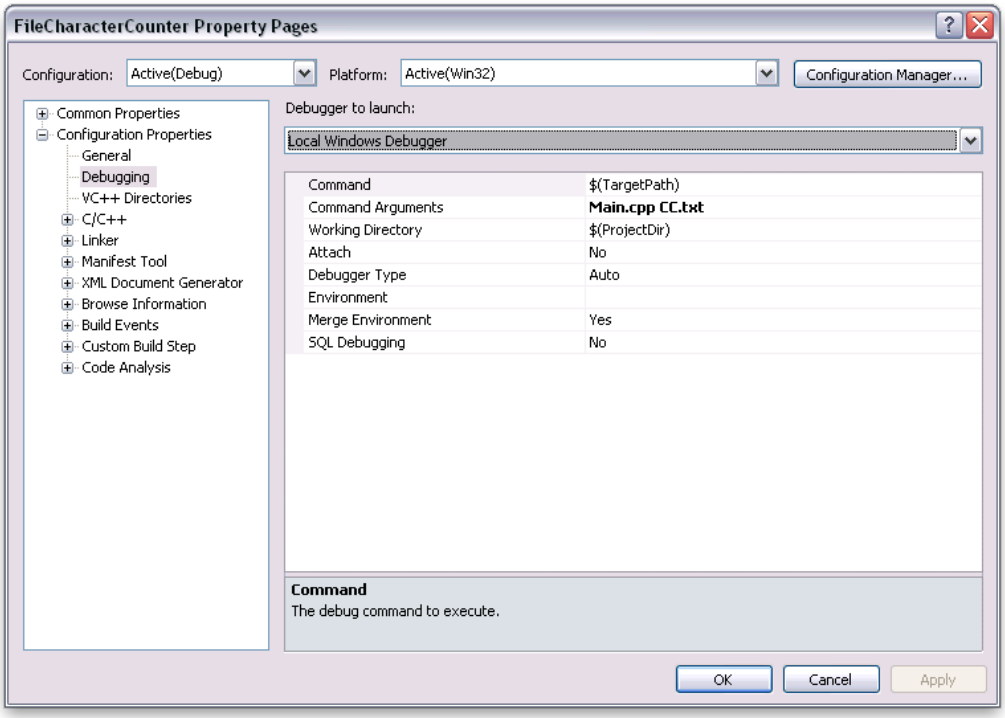
Figure 1: Julius Caesar Bust Vatican Museum.

Problem 1

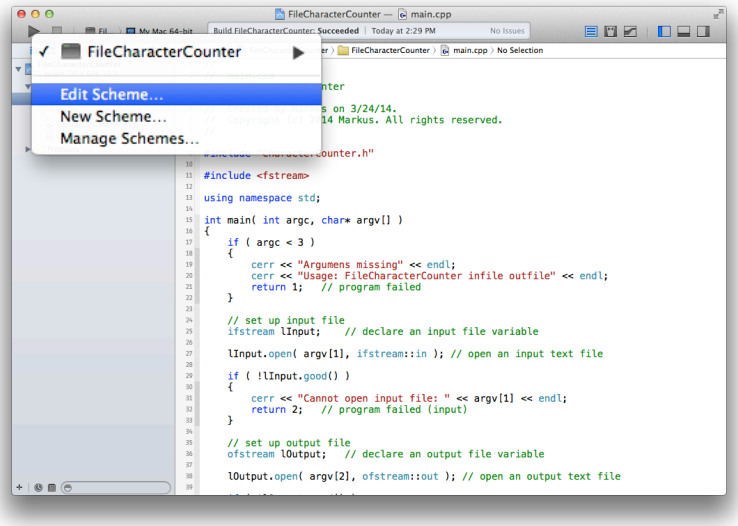
Consider the program `CharacterCounter` that we developed in the tutorial 1. Modify the solution so that the resulting program uses file input and output streams.

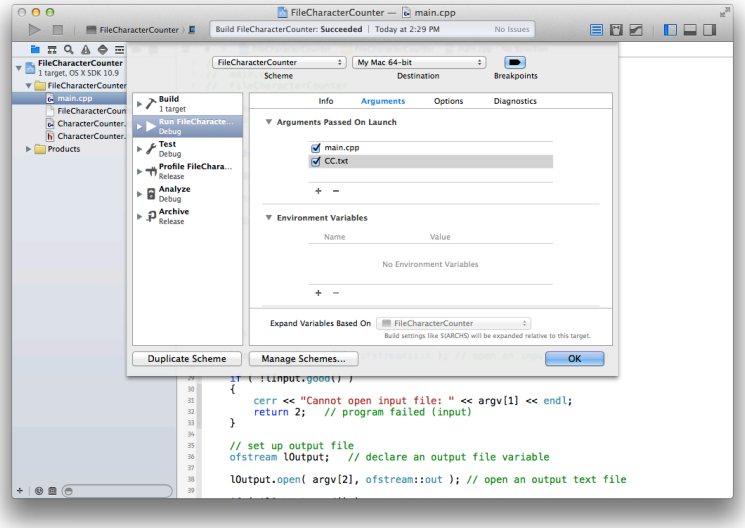


Add command line arguments VS:

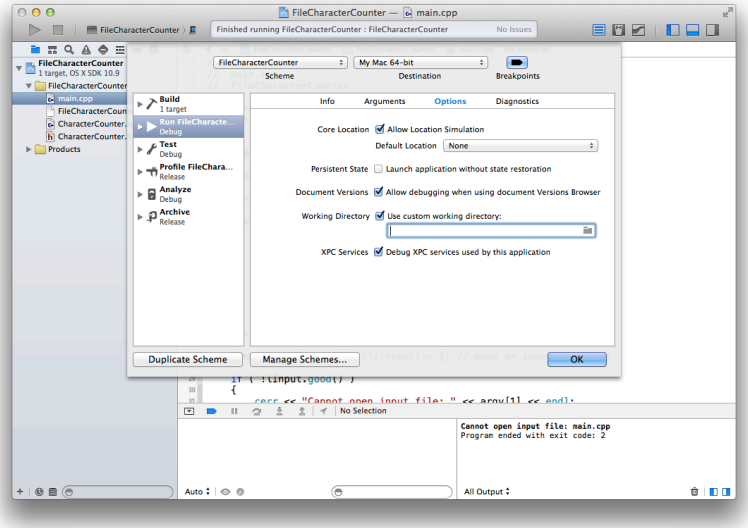


Parameter setting in Xcode:





Choose Working Directory:



Problem 2

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.

The class `CaesarCipher` is specified as follows:

```
#pragma once

#include <ostream>

class CaesarChipher
{
private:
  int fOffset;
  unsigned int fCharacterFrequenciesBefore[26];
  unsigned int fCharacterFrequenciesAfter[26];

public:
  CaesarChipher( int aOffset = 4 );

  char operator[]( char aCharacter );

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

The class `CaesarCipher` defines an indexer that implements the Caesar cipher. We can vary the offset by changing its default value. In addition, `CaesarCipher` records the character frequencies before and after the encoding. The constructor has to initialize all data members with sensible or required values.

The index operator is the heart of the class `CaesarCipher`. It performs the encoding. We only wish to change letters. All other characters remain the same. In addition, we wish to preserve upper case and lower case. Here are some example scenarios:

- `aCharacter == 'a'`: result `'e'`
- `aCharacter == 'M'`: result `'Q'`
- `aCharacter == ','`: result `','`
- `aCharacter == '8'`: result `'8'`

To achieve this behavior, you need to follow the following steps:

1. Set result to `aCharacter`.
2. If result is a letter continue with 3. Otherwise, go to 11.
3. Record if result is lower case.
4. If result is lower case, then convert result to upper case.
5. Make result an index between 0 and 25. (letter 'A' should yield 0, letter 'Z' gives 25)
6. Count result in before frequencies.
7. Apply Caesar rule to result.
8. Count result in after frequencies.
9. Make result a letter between 'A' and 'Z'.
10. If `aCharacter` was lower case, then make result lower case.
11. Return result.

You need to map this pseudo code to proper C++ code.

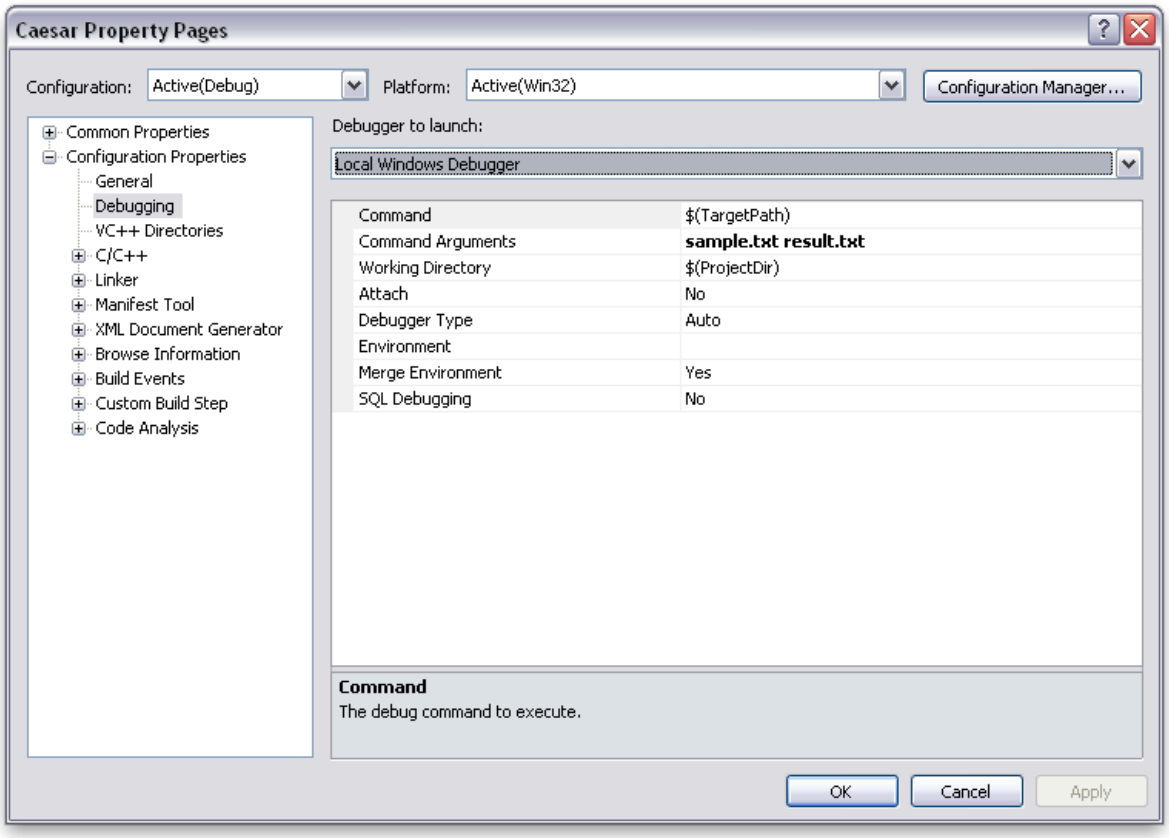
In addition, you need to define a `main` function that opens the input and output files (based on the given command line arguments), defines a variable of type `Caesar`, invokes the method `shiftByFour`, and prints the character statistics to `cout`.

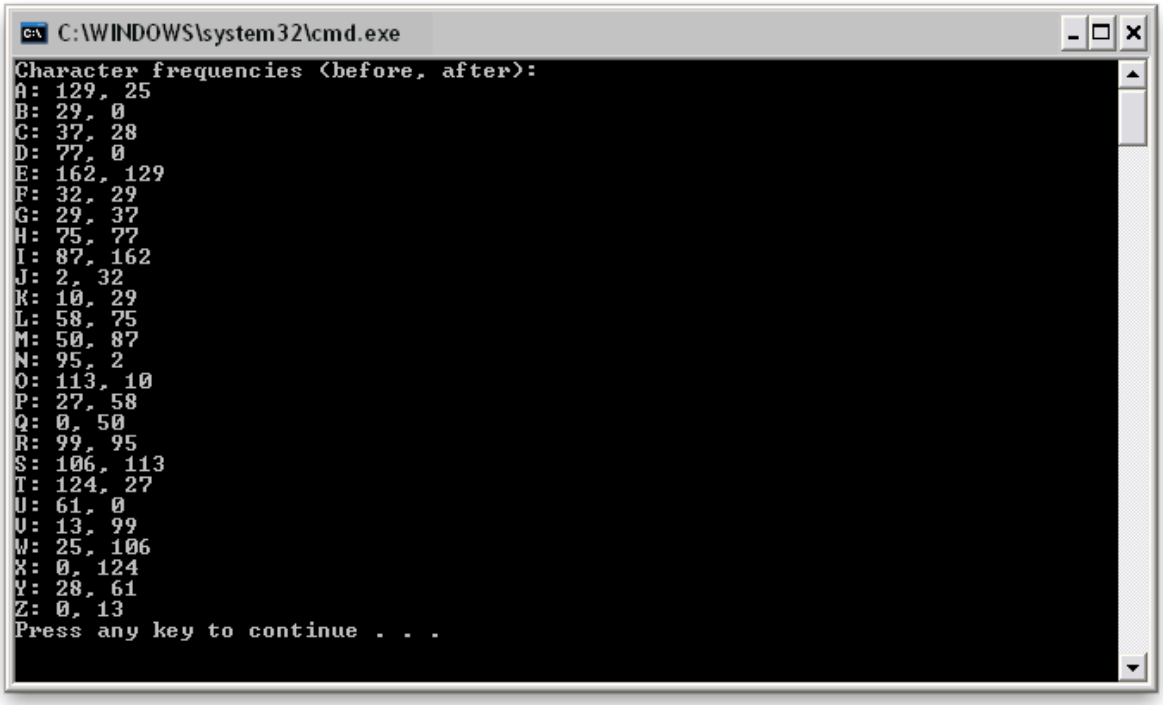
In the main function, use the following code to run the Caesar cipher:

```
CaesarCipher lScrambler;
int lCharacter;

while( (lCharacter = lInput.get()) > 0 )
{
    lOutput.put( lScrambler[lCharacter] );
}

cout << lScrambler;
```

Here we use raw input and output. We do not want to skip characters. However, even though we use raw, that is binary I/O, we still read and write text files.

Running the program (Start Without Debugging) produces an output similar to the following sample:





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

Sample.txt:

```
                    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?
```

Result.txt:

```
                    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 teww 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?
```