

**Due:** 11:59 pm on October 10 (Late submissions are *not* accepted.)

### Program Purpose

Read a text file and output:

- The alphabetic character(s) that appear most frequently in the file (note: for all counts, ignore the character's case. e.g. treat 'a' and 'A' as the same character)
- The alphabetic character(s) that appear least frequently in the file
- A list of the characters and their frequencies, sorted from most frequent to least frequent. Characters that appear with the same frequency should be sorted alphabetically
- A bar chart displaying the frequencies of each character with the bars displaying with asterisk. The horizontal axis should be the characters from a-z with a space between each character

### Example input/output pairs

#### Input file contents:

The quick brown fox jumps over the lazy dog.

#### Program's corresponding output:

Highest frequency character (appeared 4 times in the file): o

Lowest frequency characters (appeared 1 time in the file): a, b, c, d, f, g, i, j, k, l, m, n, p, q, s, v, w, x, y, and z

o: 4  
e: 3  
h: 2  
r: 2  
t: 2  
u: 2  
a: 1  
b: 1  
c: 1  
d: 1  
f: 1  
g: 1  
i: 1  
j: 1  
k: 1  
l: 1  
m: 1  
n: 1  
p: 1  
q: 1  
s: 1  
v: 1  
w: 1  
x: 1  
y: 1  
z: 1

```

4          *
3      *          *
2      *      *      *      *
1 **** * * * * * * * * * * * * * *
  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

```

### Specifications

- All output should be directed to the standard output device using `cout`.
- Output formatting should match the example above and the sample output files given for the tests provided. Note the proper use of singular and plural (character/ characters, time/times) and use of commas and “and” when listing characters.
- Your main function’s signature should be: `main(int argc, char * argv[])`
- Your program will be run with the program name followed by the name of the input file your file should open and read (`argv[1]`). For example, if one types  
`./program3 test1-input.txt`  
at the command prompt, `program3` should open `test1-input.txt` from the current directory, read all of the text in the file, and produce output to the standard output device (using `cout`)
- Your main function must be implemented in `program3.cpp`
- Place the function prototypes for all functions you write to call in your main in `program3functions.h`
- Place the function implementations for all functions you write to call in your main in `program3functions.cpp`
- The only header files that may be included in your code are: `iostream`, `fstream`, `iomanip`, `cmath`, `cctype`, and `program3functions.h`
- You will submit a zip file (only a zip file will be accepted) containing `program3.cpp`, `program3functions.h`, and `program3functions.cpp`

### Testing

Text files containing sample input and the corresponding expected output for `program3` are also attached to the assignment. A makefile has been included to run your program with the sample input and compare the results to the expected output. In order to use the makefile, ensure that your `program3functions.h`, `program3functions.cpp`, and `program3.cpp` files and all of the files attached to the assignment (`checkit.cpp`, `correct-test1.txt`, `correct-test2.txt`, `makefile`, `test1-input.txt`, `test2-input.txt`) are in the same directory. Your program will be graded using this same method with different input/output file pairs.

To run the included tests on your program, type:

```
make program3test1
make program3test2
```

Note: Differences in capitalization or spacing (including extra whitespace at the end of the output) and prompts for input will cause the provided tests to fail. End your last output statement with `endl`. The tests will display your output up to the first character that doesn’t match the expected output. You can view your full output in the `student-test#.txt` file and compare it to the corresponding expected output in the `correct-test#.txt` file.

**Grade Breakdown**

Clean compile and link of program3.cpp: 1 point

Correctly displays highest frequency characters for instructor tests: 1 point

Correctly displays lowest frequency characters for instructor tests: 1 point

Correctly displays character frequencies for instructor tests: 3 points

Correctly displays bar chart for instructor tests: 2 points