

# CSC 1300 LAB 11

## AIR POLLUTION IN FACTORIES



### CONCEPTS

- Array of pointers
- Skill of being able to take another person's code, understand it, and add to it.

### DIRECTIONS

You work for the Environmental Protection Agency as an environmental engineer. The agency has asked you to investigate THREE factories to see if they are following the National Ambient Air Quality Standards (NAAQS). You will write a program to find out which of the three factories are not complying with the Clean Air Act concerning the following pollutants: carbon monoxide, nitrogen dioxide, and ozone concentrations. You will also determine which factory has had the highest amounts of these pollutants in the last user-determined amount of years.

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### FILES

The lab assignment consists of three files. Two are source files and one header file:

- pollution.h (provided)
- pollution.cpp (contains the main function and it is completely provided for you)
- functions.cpp (this is the file you have to create and the description of all the functions are in this document)

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### GLOBAL CONSTANTS

Constant variables are created in the header file for the legal limit of each of the three air pollutants.

CO = carbon monoxide, NO<sub>2</sub> = nitrogen dioxide, and O<sub>3</sub> = Ozone. There is also a constant for the number of factories (SIZE).

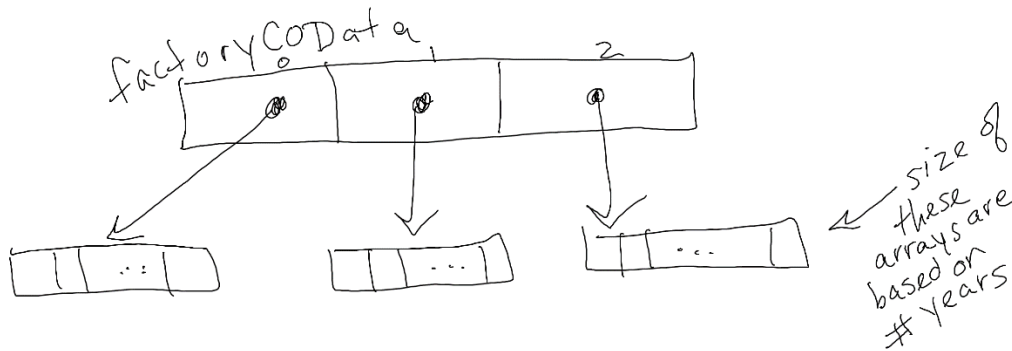
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## ARRAYS

The program uses the following arrays:

- factoryNames – string array defined using SIZE
- factoryCODData – this array will hold the memory addresses of multiple arrays which hold carbon monoxide data for each factory. This is an array of pointers to floats and should be defined with SIZE elements. An example of a definition of this array is below.

```
float* factoryCODData[SIZE];
```



- factoryNO2Data – same as factoryCODData above, except holds nitrogen dioxide data
- factoryO3Data – same as factoryCODData above, except holds ozone data

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## ENTERFACTORYNAMES FUNCTION

A string array should be passed to this function. The function should ask the user for the name of each factory and read the name in to the array that was passed to this function.

Name of FACTORY 1: Garbage Pail Kids

Name of FACTORY 2: Amazon

Name of FACTORY 3: Crayola

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## MAKEARRAY FUNCTION

The size of the array (number of years) should be passed to this function. The function should dynamically allocate a new array of floats of this size and then return a pointer to this array.

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## ENTERCODATA FUNCTION

A pointer to a float array and the number of years should be passed to this function. The function should allow the user to enter in the average level per hour (in parts per million) of carbon monoxide for each year.

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## ENTERNO2DATA FUNCTION

A pointer to a float array and the number of years should be passed to this function. The function should allow the user to enter in the average level per hour (in parts per million) of carbon monoxide for each year.

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## ENTERO3DATA FUNCTION

A pointer to a float array and the number of years should be passed to this function. The function should allow the user to enter in the average level per 8 hours (in parts per billion) of ozone for each year.

## PRINTOVLIMIT FUNCTION

This function should be passed the factoryNames array, the data array (array of pointers), the number of years, and the limit. The function should use loops to go through each factory & each year to find which (if any) factories go over the limit for the particular air pollution. If all factories stayed under the limits, you should print "Yay! There are no factories over the limit!!"

```
FACTORIES over the CARBON MONOXIDE pollutant level (35):
Garbage Pail Kids
```

```
FACTORIES over the NITROGEN DIOXIDE pollutant level (100):
Amazon
```

```
FACTORIES over the OZONE pollutant level (0.07):
Amazon
Crayola
-----
```

## GETLARGEST FUNCTION

This function should be passed the factoryNames array, the data array (array of pointers), the number of years, and then three reference parameters representing the largest float amount, largest amount factory name, and largest amount year subscript (an integer). This function should go through each factory and each year to find the factory, amount, and year of the factory with the largest amount for a particular air pollution.

## WHAT TO TURN IN

Zip pollution.cpp, functions.cpp, & pollution.h and upload to the lab submission folder in ilearn.

## SAMPLE OUTPUT

```
-----
Name of FACTORY 1:  Nestle
```

```
Name of FACTORY 2:  Ficosa
```

```
Name of FACTORY 3:  Russel Stover
```

```
How many years of data do you have?
```

```
5
```

```
Please enter data for each factory.
-----
```

```
FACTORY:  Nestle
```

```
Carbon Monoxide (CO) average level per hour (in parts per million)
```

```
YEAR 1:  38
```

```
YEAR 2:  23
```

```
YEAR 3:  88
```

```
YEAR 4:  22
```

```
YEAR 5:  9
```

```
Nitrogen Dioxide (NO2) average level per hour (in parts per billion)
```

```
YEAR 1:  33
```

```
YEAR 2:  21
```

```
YEAR 3:  23
```

```
YEAR 4:  12
```

YEAR 5: 34

Ozone (O3) average level per 8 hours (in parts per million)

YEAR 1: .03  
YEAR 2: .02  
YEAR 3: .004  
YEAR 4: .002  
YEAR 5: .083

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FACTORY: Ficosa

Carbon Monoxide (CO) average level per hour (in parts per million)

YEAR 1: 12  
YEAR 2: 33  
YEAR 3: 53  
YEAR 4: 1  
YEAR 5: 2

Nitrogen Dioxide (NO2) average level per hour (in parts per billion)

YEAR 1: 398  
YEAR 2: 888  
YEAR 3: 342  
YEAR 4: 222  
YEAR 5: 321

Ozone (O3) average level per 8 hours (in parts per million)

YEAR 1: 1  
YEAR 2: 1.4  
YEAR 3: 1.6  
YEAR 4: .93  
YEAR 5: .03

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FACTORY: Russel Stover

Carbon Monoxide (CO) average level per hour (in parts per million)

YEAR 1: 44  
YEAR 2: 32  
YEAR 3: 95  
YEAR 4: 83  
YEAR 5: 3

Nitrogen Dioxide (NO2) average level per hour (in parts per billion)

YEAR 1: 294  
YEAR 2: 399  
YEAR 3: 233  
YEAR 4: 12  
YEAR 5: 123

Ozone (O3) average level per 8 hours (in parts per million)

YEAR 1: .03  
YEAR 2: .02  
YEAR 3: .005  
YEAR 4: .029  
YEAR 5: .033

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FACTORIES over the CARBON MONOXIDE pollutant level (35):

Nestle

Ficosa

Russel Stover

FACTORIES over the NITROGEN DIOXIDE pollutant level (100):

Ficosa

Russel Stover

FACTORIES over the OZONE pollutant level (0.07):

Nestle

Ficosa

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The Russel Stover factory produced the most carbon monoxide pollution with 95 parts per million in year 3.

The Ficosa factory produced the most nitrogen dioxide pollution with 888 parts per million in year 2.

The Ficosa factory produced the most ozone pollution with 1.6 parts per million in year 3.

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## SAMPLE OUTPUT

```
C:\Windows\System32\cmd.exe
C:\Users\acrockett\Desktop\CSC\CSC2100-002\PROGRAMS\PROGRAM 4>g++ program4.cpp
C:\Users\acrockett\Desktop\CSC\CSC2100-002\PROGRAMS\PROGRAM 4>a

-----

Name of FACTORY 1:  Garbage Pail Kids
Name of FACTORY 2:  Amazon
Name of FACTORY 3:  Crayola
How many years of data do you have?
2

Please enter data for each factory.
-----

FACTORY:  Garbage Pail Kids
Carbon Monoxide (CO) average level per hour (in parts per million)
    YEAR 1:  38
    YEAR 2:  50

Nitrogen Dioxide (NO2) average level per hour (in parts per billion)
    YEAR 1:  93
    YEAR 2:  91

Ozone (O3) average level per 8 hours (in parts per million)
    YEAR 1:  .01
    YEAR 2:  .03
-----
```

FACTORY: Amazon

Carbon Monoxide (CO) average level per hour (in parts per million)

YEAR 1: 31

YEAR 2: 24

Nitrogen Dioxide (NO2) average level per hour (in parts per billion)

YEAR 1: 160

YEAR 2: 120

Ozone (O3) average level per 8 hours (in parts per million)

YEAR 1: 1.2

YEAR 2: 1.8

FACTORY: Crayola

Carbon Monoxide (CO) average level per hour (in parts per million)

YEAR 1: 31

YEAR 2: 27

Nitrogen Dioxide (NO2) average level per hour (in parts per billion)

YEAR 1: 94

YEAR 2: 91

Ozone (O3) average level per 8 hours (in parts per million)

YEAR 1: 1.9

YEAR 2: 2.6

FACTORIES over the CARBON MONOXIDE pollutant level (35):

Garbage Pail Kids

^  
FACTORIES over the NITROGEN DIOXIDE pollutant level (100):

Amazon

FACTORIES over the OZONE pollutant level (0.07):

Amazon

Crayola

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The Garbage Pail Kids factory produced the most carbon monoxide pollution with 50 parts per million in year 2.

The Amazon factory produced the most nitrogen dioxide pollution with 160 parts per million in year 1.

The Crayola factory produced the most ozone pollution with 2.6 parts per million in year 2.

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C:\Users\acrockett\Desktop\CSC\CSC2100-002\PROGRAMS\PROGRAM 4>