**DMA and operator overload review**

Workshop 8.2

(reference removed to make operator++(int) it possible to have do the addition after the line it is in)

(added operator+)

In this workshop, you are to create a class that encapsulates string

**LEARNING OUTCOMES**

Upon successful completion of this workshop, you will have demonstrated the abilities to

Dynamic Memory Management

Operator overloading

**SUBMISSION POLICY**

The “in-lab” section is to be completed **during your assigned lab section**. It is to be completed and submitted by the end of the workshop. If you do not attend the workshop, you can submit the “in-lab” section along with your “at-home” section (a 20% late deduction will be assessed). The “at-home” portion of the lab is **due the day before your next scheduled workshop**

All your work (all the files you create or modify) must contain your name, Seneca email and student number.

You are responsible to regularly backup your work.

**In lab:**

Download or clone workshop 8 from <https://github.com/Seneca-244200/OOP-Workshop8>

**String class:**

#ifndef SICT\_STRING\_H\_

#define SICT\_STRING\_H\_

#include <iostream>

const int ExpansionSize = 500;

namespace sict{

class String{

char\* data\_;

int memSize\_;

int len\_;

void deallocate();

void allocate(int size);

void init(const char\* str, int memSize);

public:

void resize(int newsize);

int memSize()const;

String();

String(const char\* str, int memsize = 500);

String(const String& S);

String& operator=(const String& S);

virtual ~String();

int length()const;

operator const char\*()const;

// IO

std::istream& read(std::istream& istr = std::cin);

// operators

String& operator+=(const char\* str);

String& operator+=(String& s);

String operator+(const String& s)const;

String& operator++();

String operator++(int);

char& operator[](int index);

};

std::ostream& operator<<(std::ostream& ostr, const String &s);

std::istream& operator>>(std::istream& ostr, String &s);

}

#endif

In String.cpp;  
Complete the code of the class named **String** that encapsulates a string.

**void deallocate();**

Deletes the dynamic array of characters pointed by data\_ and sets the pointer and the memSize attribute to nullptr and zero.

1. Deallocate memory pointed data\_
2. Set the data\_ attribute to null pointer
3. Set the memSize\_ attribute to zero

**void allocate(int memsize);**

Deallocates the memory allocated by data\_ and then allocates memsize memory and updates the memsize\_ member variable.

1. Make sure memory pointed by data\_ is deallocated.
2. Allocate memsize bytes and make data\_ point to it
3. Set memsize\_ attribute to memsize arg value;

**void init(const char\* str, int memSize);**

This function is to avoid having the same code in the constructors, so make sure you understand that “init” can only be called when either the object is just created (in a constructor) or the object is in a safe empty state.

Init allocates memSize memory if memSize is big enough to hold the c-string pointed by str, otherwise it will reset the memSize argument to the length of the str + 1 and then does the allocation.

Afterwards it will copy the str into the newly allocated memory.

Init also makes sure memSize\_ and len\_ member variable have accurate values.

1. Set the data\_ attribute to null
2. if memsize is smaller than the length of the string, we will set the memsize arg to the length of the string + 1
3. allocate memsize bytes pointed by data
4. copy str to data\_
5. set len\_ to the proper value;

**void resize(int newsize);**

Resizes the memory pointed by data\_ keeping the c-string inside data\_ intact.

1. allocate memsize bytes pointed by a temp char pointer
2. if data\_ is not null copies the string pointed by data\_ pointer character by character into the newly allocated memory up to the length of the string in data\_ or memsize-1; whichever comes first.
3. Null terminates the string pointed by temp.
4. Deallocates old memory pointed by data\_
5. Makes data\_ point to where temp is pointing. (copies the address kept in temp into data\_)
6. Updates memSize\_ and len\_ the their new values.

**String();**

No argument constructor sets the data\_ attribute to nullptr and other member variables to zero (puts the object in a safe empty state).

**String(const char\* str, int memsize = 500);**

Initializes the object using str and memsize values through the **init** function.

**String(const String& S);**

Initializes the object using S.data\_ and S.memSize\_ values through the **init** function.

**String& operator=(const String& S);**

If the object is not set to itself **(this != &S)**, First it will deallocate the already existing memory and then Initializes the object using S.data\_ and S.memSize\_ values through the **init** function.

Afterwards, it will return the reference of the current String object.

**virtual ~String();**

Deallocates the memory pointed by data\_.

**int length()const;**

Returns len\_

**operator const char\*()const;**

When casted to a **const char\*** this object returns the address kept in **data\_** member variable.

String& operator+=(const char\* str);

If the size of the allocated memory permits, this operator overload concatenates the c-string **str** to the end of **data\_** cstring. If the memSize is less than the sum of length of two strings +1, then it will resize itself to the exact same size (the sum of two +1) and then does the Concatenation.

At the end it will return the reference of the current String object.

1. Keep the length of the **str** c-string in a temp variable
2. If the sum of two lengths + 1 is greater that **memSize\_** resize the memory to the sum of two lengths +1
3. Concatenate the **str**  argument to the end of **data\_**  using ***strcat.***
4. Update **len\_** to the new length.
5. Return the reference of the current String object.

String operator+(const String& s)const;

Using a temp String it reuses operator += not to change the current object.

String& operator+=(String& s);

Reuses the **operator+=(const char\* str)**  passing **s.data\_** as the **str**  argument.

String& operator++();  
Adds a space before the string.

Callenge! Let me see how you do this…

String operator++(int);  
Adds a space after the string.

Use **operator+=**  and add a space.

Pseudo:

1. Make a copy of the current (\*this) object.
2. Add a space
3. Return the copy instead of \*this.

**char& operator[](int idx);**

Returns the reference of the character of the data\_ array sitting at the **idx** index. If the index is out of the range of the length of the string, this operator should resize the object to idx + ExpansionSize. ExpansionSize is the constant integer defined in String.h

**operator int()const;**

When casted to an integer, the length of the **data\_** c-string is returned.

**std::istream& read(std::istream& istr = std::cin);**

This is probably the most complicated part of this class.

Instead of getting the string using getline or cin>>, this function gets the string character by character and if the number of characters reaches the memSize\_ value, it will resize the object to memSize\_ + ExpansionSize.

All the characters are copies into **data\_** string until **‘\n’** is reached. At this point a NULL is copied to the data\_ c-string to null-terminate the array.

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**SUBMISSION**

To test and demonstrate execution of your program use w8\_in\_lab.cpp.

If not on matrix already, upload **String.h , String.cpp** and **w8\_in\_lab.cpp** to your matrix account. Compile and run your code and make sure everything works properly.

Then run the following script from your account:

**Section SCC and SDD:  
~fardad.soleimanloo/submit w8\_at\_home <ENTER>**

and follow the instructions.