Course: ENSF 614–Fall2021

Lab #: Lab 3

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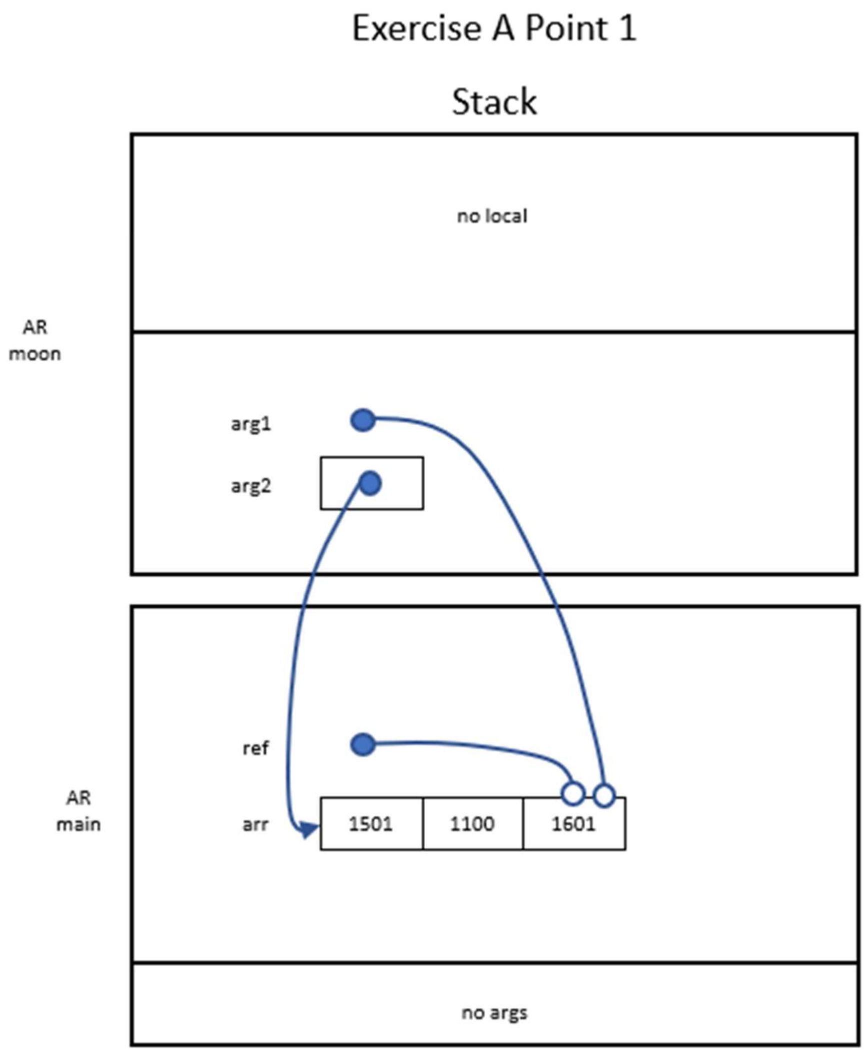
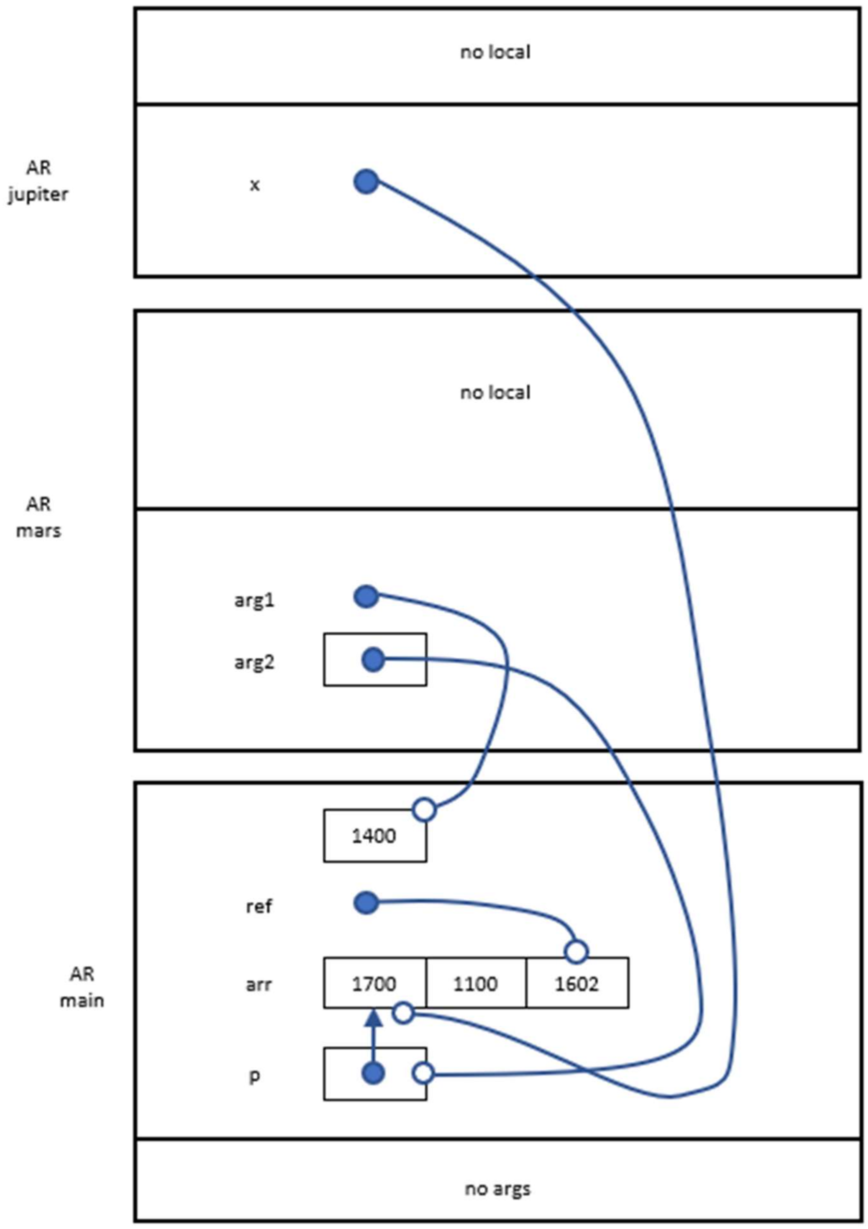
Submission Date: 2021-10-04

Exercise A

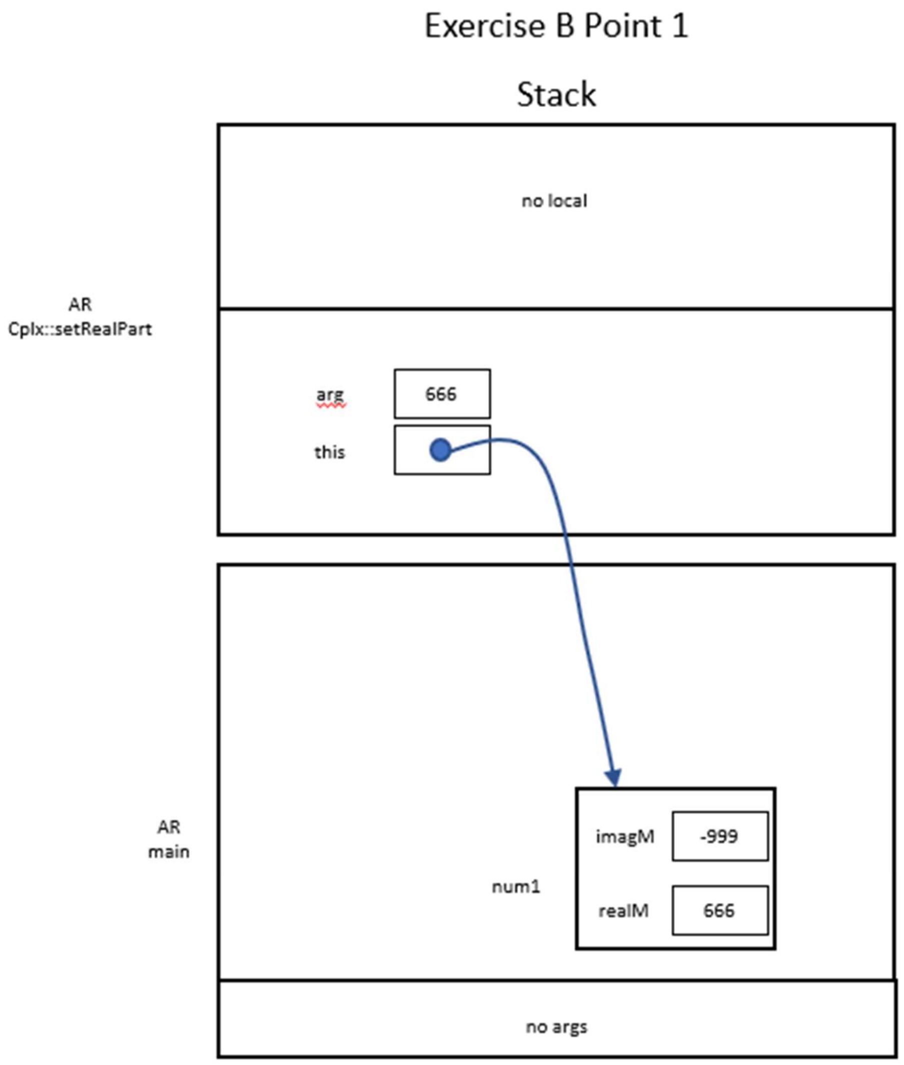

Exercise A Point 1
Stack
no local
AR
moon
arg1
arg2
AR
main
ref
arr
1501
1100
1601
no args

Exercise A Point 2

Stack

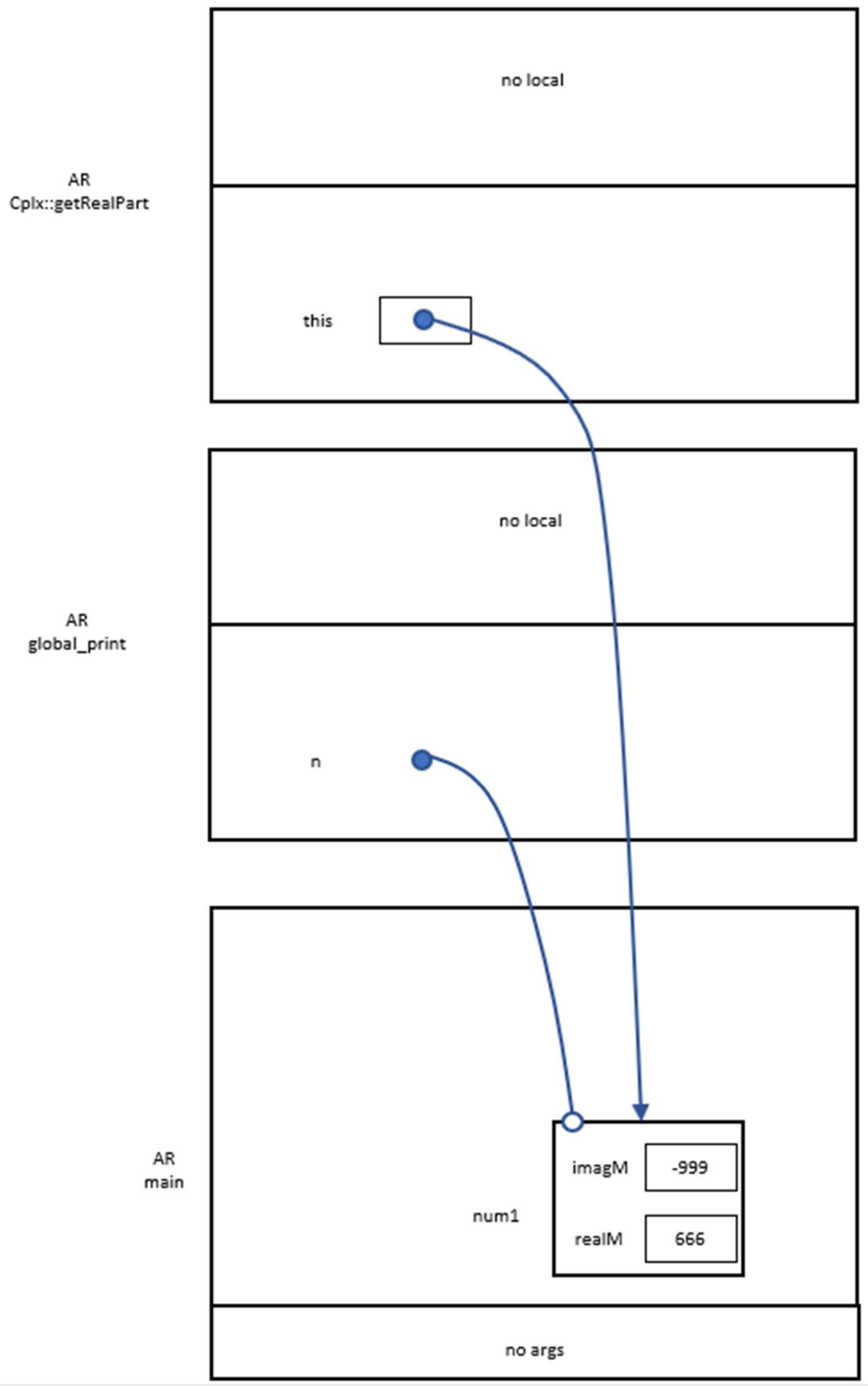


Exercise B

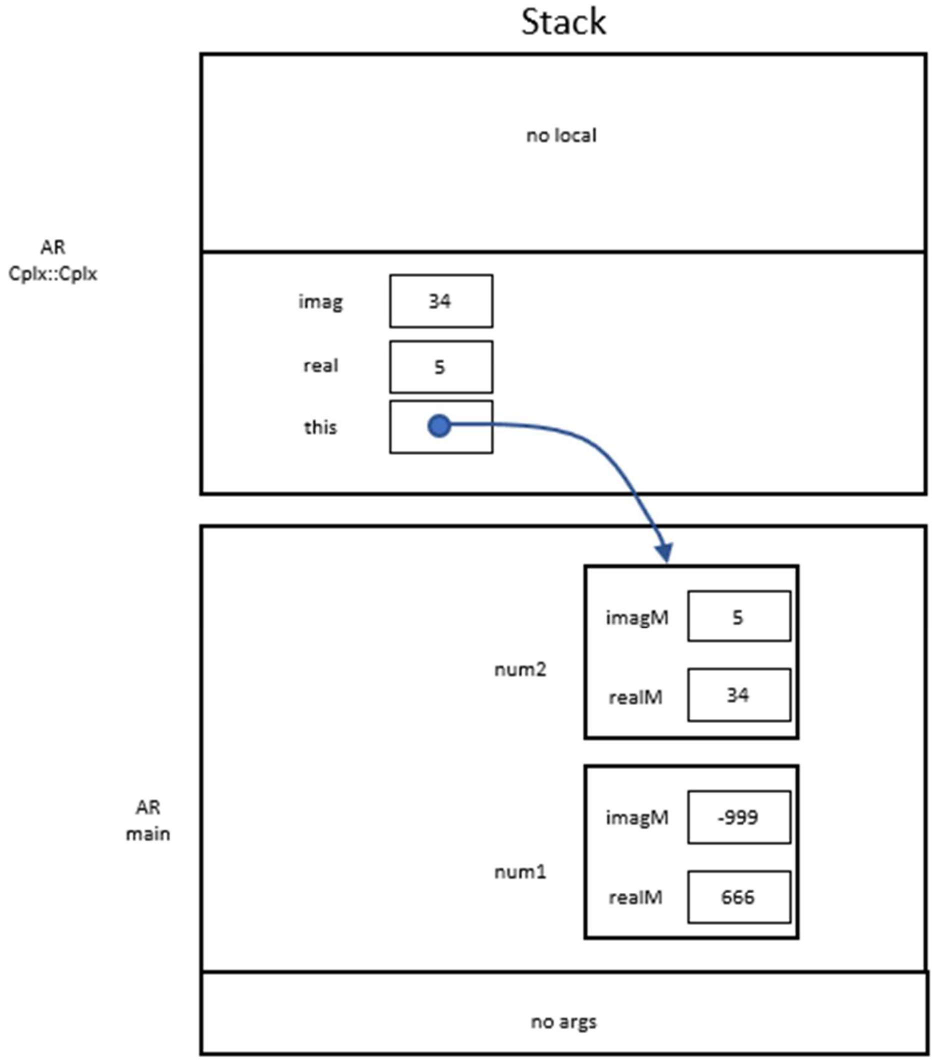

Exercise B Point 1
Stack
no local
AR
Cplx::setRealPart
arg
666
this
AR
main
num1
imagM
-999
realM
666
no args

Exercise B Point 2

Stack

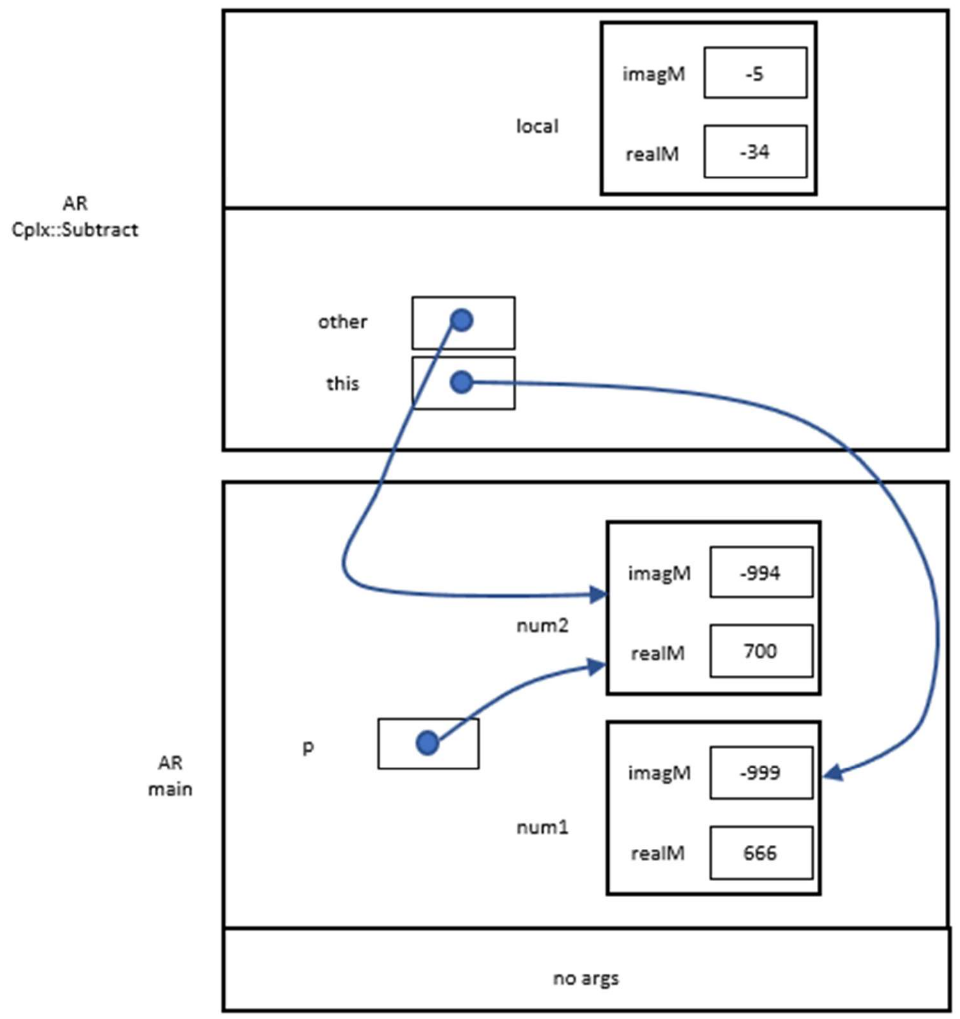


Exercise B Point 3



Exercise B Point 4

Stack



Exercise C

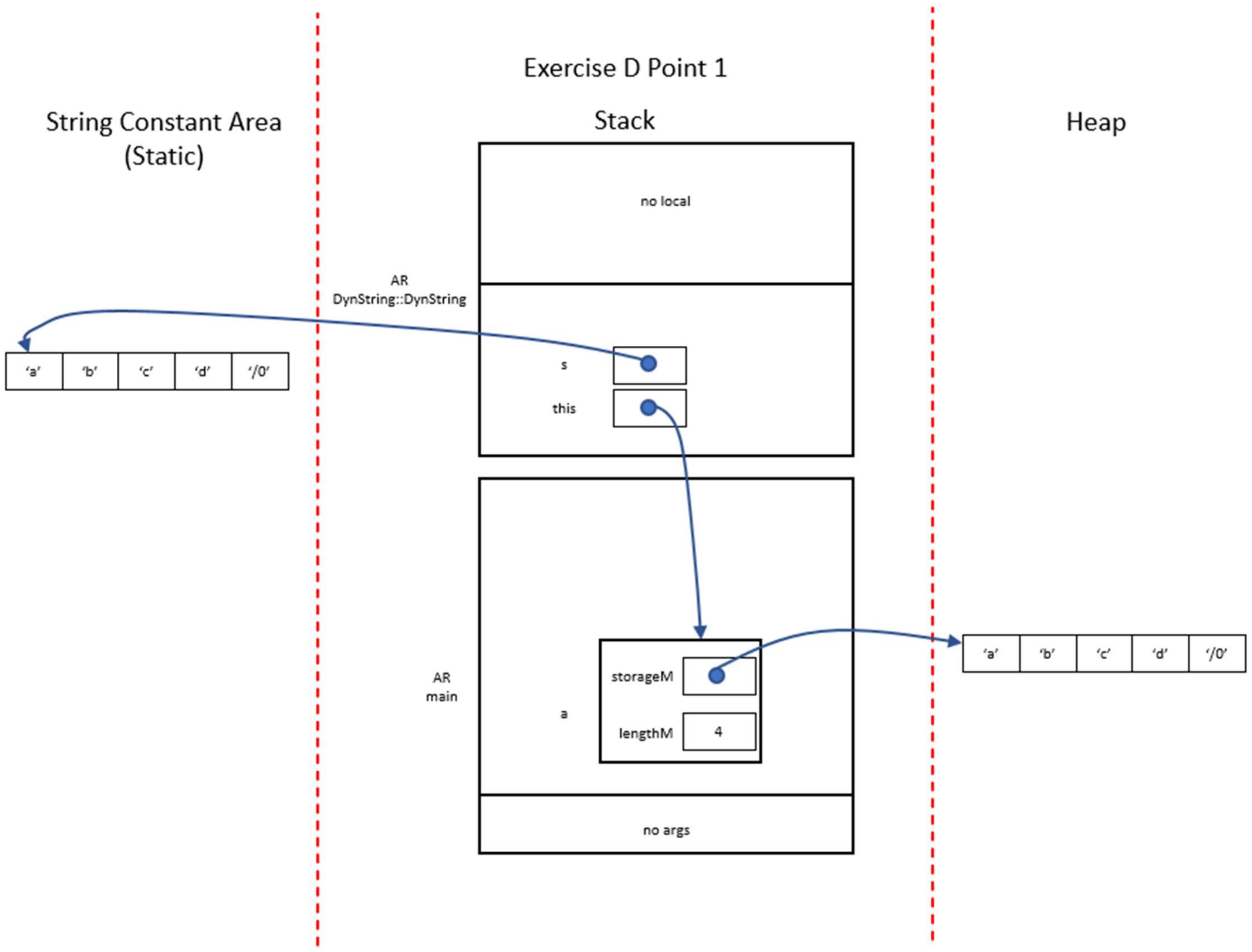
```
/*
* File Name: lab3Clock.h
* Lab # and Assignment #: Lab 3 Exercise C
* Lab section: 1
* Completed by: Graydon Hall and Jared Kraus
* Submission Date: 2021-10-04
*/


#ifndef lab3_exe_C_Clock
#define lab3_exe_C_Clock
/* This class definition represents a clock that shows hours,
* Minutes, and Seconds.
*/

class Clock{
    public:
        Clock();
        // PROMISES: initializes the values of hours, minutes, and seconds, all to 0

        Clock(int seconds);
        //PROMISES: receives integer argument in seconds, uses it to set clock time in
        // hours, minutes, and seconds

        Clock(int hours, int minutes, int seconds);
        // PROMIESES: initializes hours, minutes, and seconds for clock based on user provi
ded arguments

        int get_hour () const;
        // PROMISES: return hour value for clock

        int get_minute () const;
        // PROMISES: return minute value for clock

        int get_second () const;
        // PROMISES: return second value for clock

        void set_hour (int arg);
        // PROMISES: set a new value for hour with the value of arg

        void set_minute (int arg);
        // PROMISES: set a new value for minute with the value of arg

        void set_second (int arg);
        // PROMISES: set a new value for second with the value of arg

        void increment ();
        // PROMISES: increments the value of the clock’s time by one second.
        void decrement ();
        // PROMISES: decrements the value of the clock’s time by one second.

        void add_seconds (int second);
        // PROMISES: adds the value of given seconds to the value of the current time
        // REQUIRES: a positive integer argument in seconds



    private:
        int hour; // hours on the clock
        int minute;  // minutes on the clock
        int second;  // seconds on the clock

        int hms_to_sec();
        // PROMISES: returns the total value of data members in a Clock object,
        // in seconds.

        void sec_to_hms(int n);
        // PROMISES:  receives an argument n in seconds, and sets the values
        // for the Clock data members, second, minute, and hour, based on this argument.



};

#endif
```

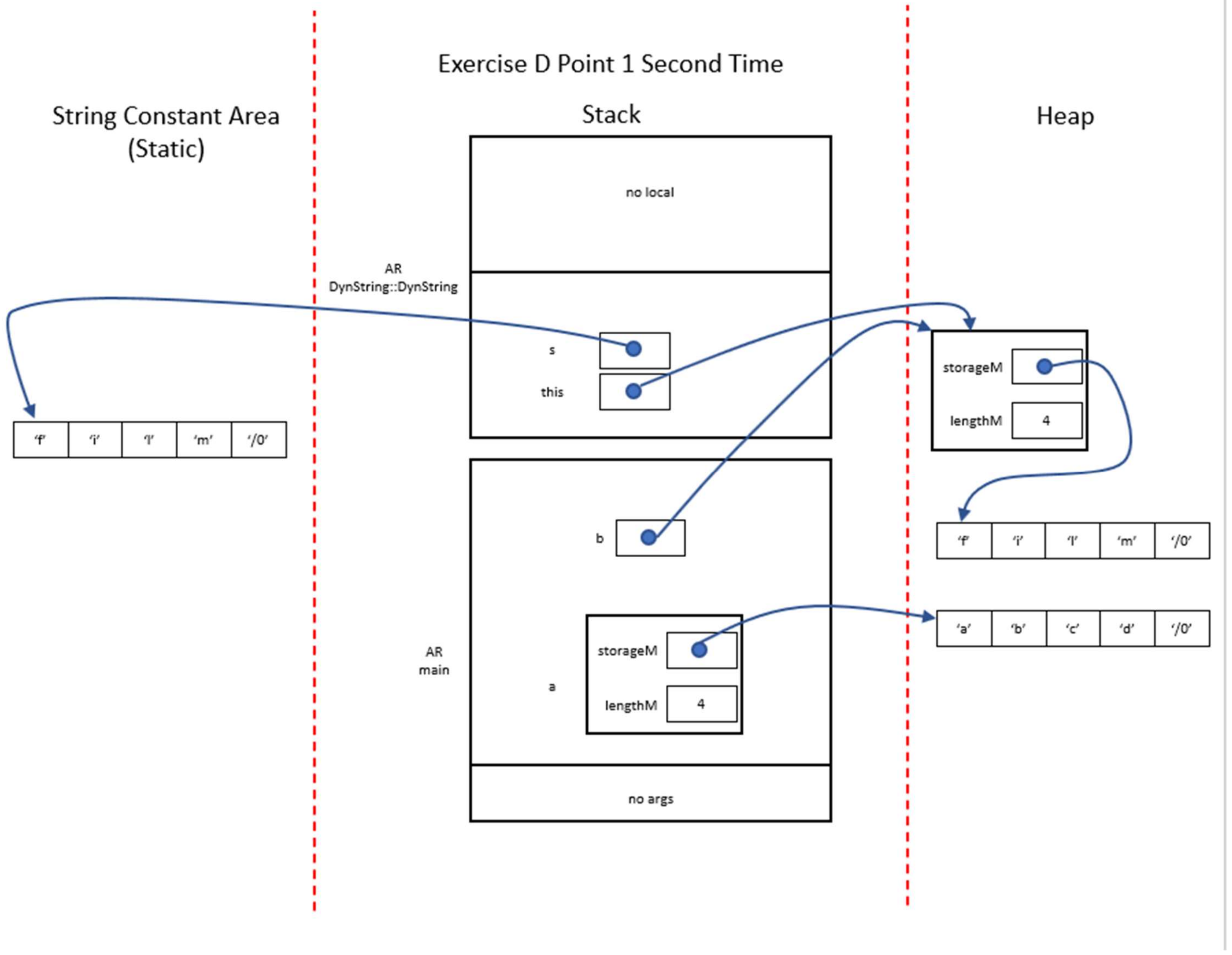
```
/*
* File Name: lab3Clock.cpp
* Lab # and Assignment #: Lab 3 Exercise C
* Lab section: 1
* Completed by: Graydon Hall and Jared Kraus
* Submission Date: 2021-10-04
*/
#include <iostream>
#include <iomanip>
using std::cout;
using std::endl;
using std::setw;
using std::setfill;


#include "lab3Clock.h"

void print(const Clock& t);


// Start GH Code
```

```cpp
Clock::Clock(){
    hour=0;
    minute=0;
    second=0;
}

Clock::Clock(int seconds)
{
    // set values for hour minute second based on seconds argument
    sec_to_hms(seconds);
}


Clock::Clock(int hours, int minutes, int seconds)
{
    if(hours < 0 || hours > 23 || minutes < 0
    || minutes > 59 || seconds < 0 || seconds > 59){
        hour=0;
        minute=0;
        second=0;
    }
    else {
        hour = hours;
        minute = minutes;
        second = seconds;
    }
}

int Clock::get_hour () const {
    return hour;
}

int Clock::get_minute () const {
    return minute;
}


int Clock::get_second () const {
    return second;
}

void Clock::set_hour (int arg){
    if(arg>=0 && arg <=23){
        hour=arg;
    }
}

void Clock::set_minute (int arg){
    if(arg>=0 && arg <=59){
        minute=arg;
    }
}

void Clock::set_second (int arg){
    if(arg>=0 && arg <=59){
        second=arg;
    }
}

void Clock::increment (){
    if(second==59){
        if(minute==59){
            if(hour==23){
                hour=0;
                minute=0;
                second=0;
            }else{
                hour++;
                minute=0;
                second=0;
            }
        }else{
            minute++;
            second=0;
        }

    } else{
        second++;
    }
}

void Clock::decrement (){
    if(second==0){
        if(minute==0){
            if(hour==0){
                hour=23;
                minute=59;
                second=59;
            }else{
                hour--;
                minute=59;
                second=59;
            }
        }else{
            minute--;
            second=59;
        }

    } else{
        second--;
```

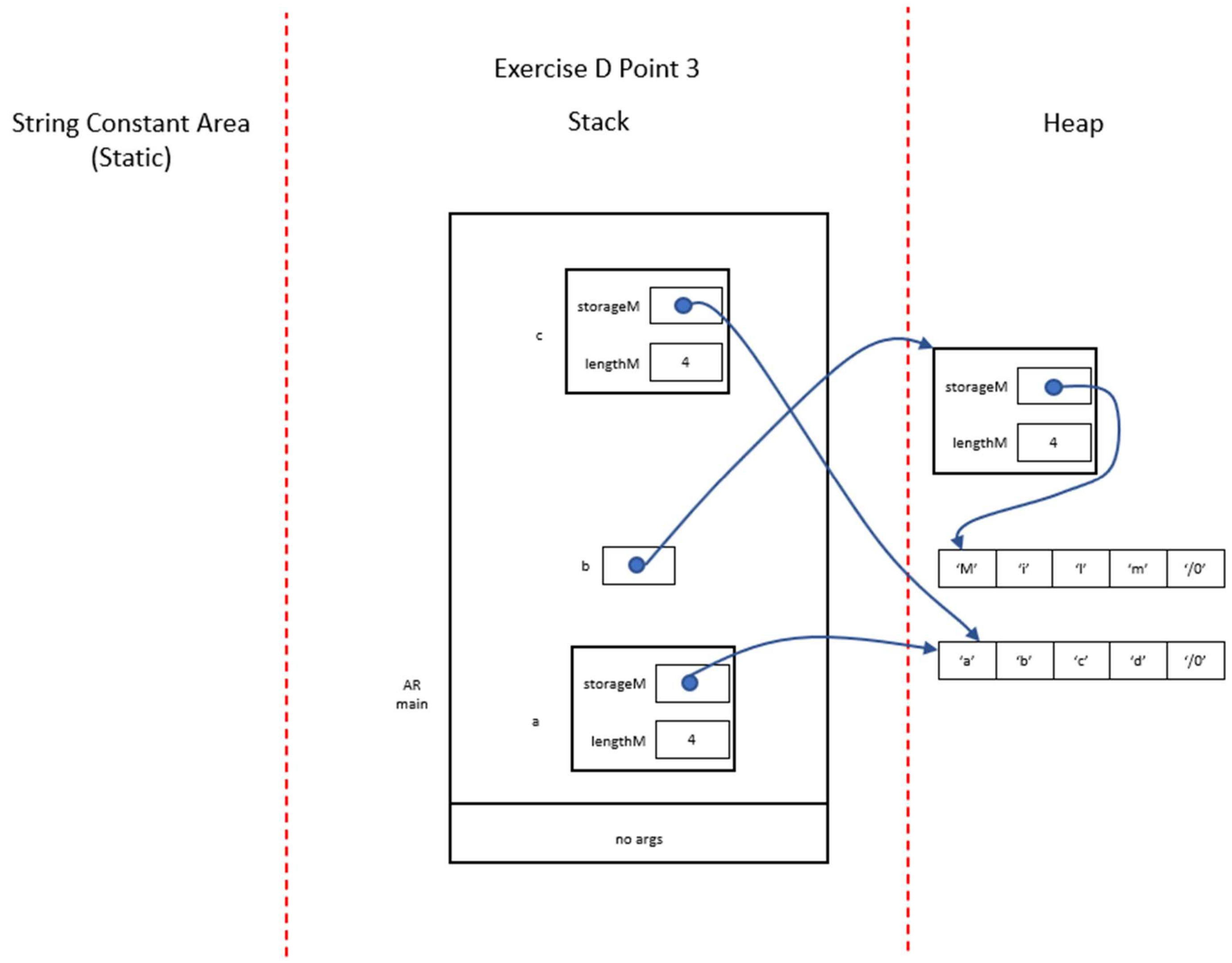
```cpp
    }
}

// maybe find more efficient way to do this later
void Clock::add_seconds(int seconds){
    if(seconds>0){
        for (int i = 0; i < seconds; i++) {
            increment();
        }
    }
}

int Clock::hms_to_sec(){
    int total_seconds;
    total_seconds = hour*3600+minute*60+second;
}

void Clock::sec_to_hms(int n){

    if(n<0){
        n=0;
    }

    int full_hours = n/3600;
    int remaining_secs = n - full_hours*3600;

    while(full_hours>23){
        full_hours = full_hours - 24;
    }

    int full_minutes = remaining_secs/60;
    remaining_secs = remaining_secs - full_minutes*60;

    hour = full_hours;
    minute = full_minutes;
    second = remaining_secs;

}
```

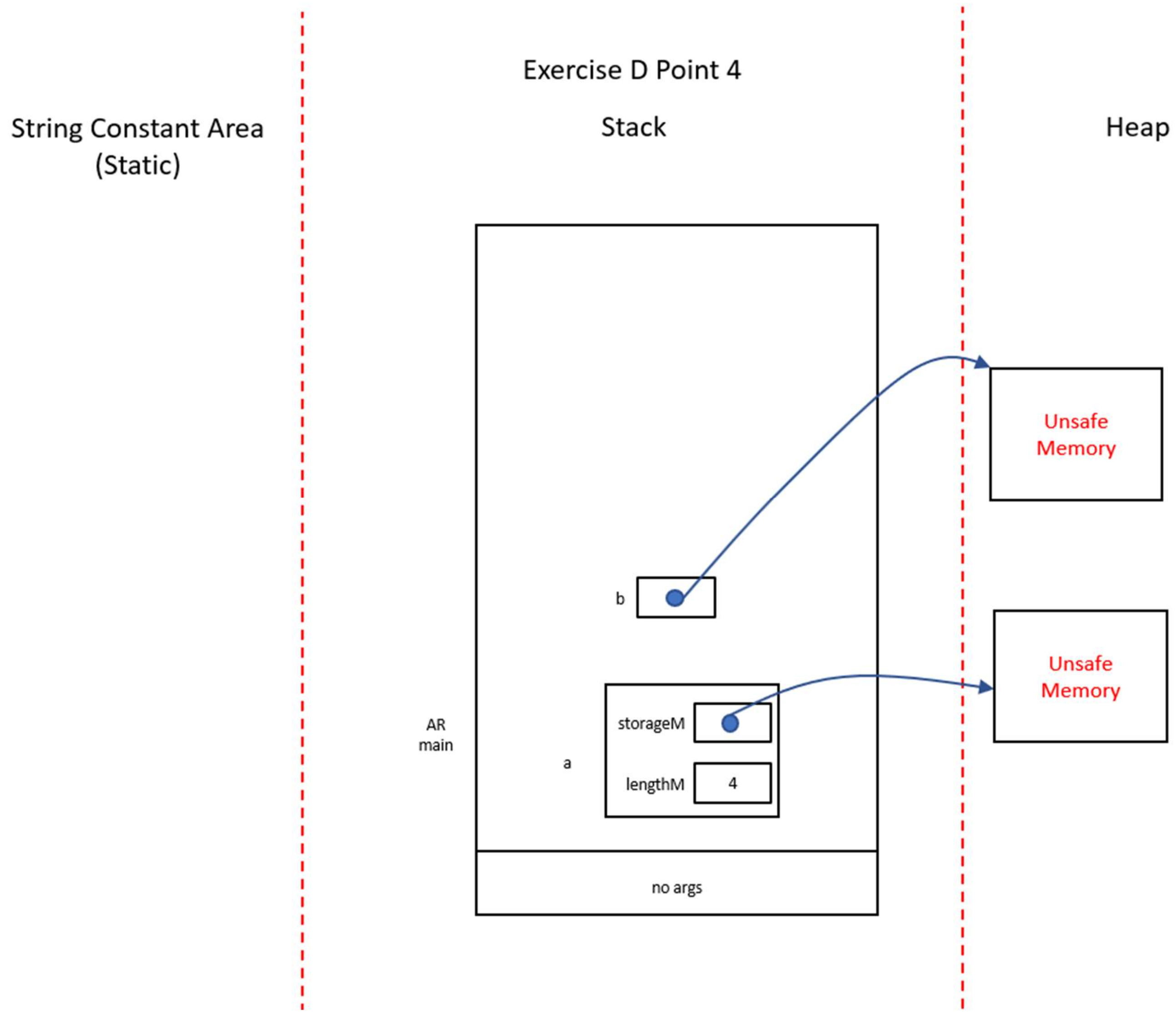
Exercise D – Part 1 – Step 1




Exercise D Point 1 Second Time
String Constant Area (Static)
Stack
Heap
no local
AR DynString::DynString
s
this
'f' 'i' 'l' 'm' '/0'
storageM
lengthM
4
'f' 'i' 'l' 'm' '/0'
b
'a' 'b' 'c' 'd' '/0'
AR main
a
storageM
lengthM
4
no args

Exercise D Point 3




Exercise D Point 4
String Constant Area (Static)
Stack
Heap
Unsafe Memory
b
Unsafe Memory
storageM
AR main
a
lengthM
4
no args

Exercise D – Part 1 – Step 2

1. At point four in the main function, how many times the constructor of class DynString is called?

By the time we get to point 4, the main constructor will have been called 2 times. One time each for the variables a, and b.

2. At point four how many times the destructor of the class DynString is called?

By the time we get to point 4, the destructor will have been called twice. First it is called for c, since the variable c ceases to exist outside of the curly braces it was created in. The second time the destructor is called is during is when the "delete b" line of code is executed.

3. Overall how many times in total the destructor of the class DynString will be called in this program?

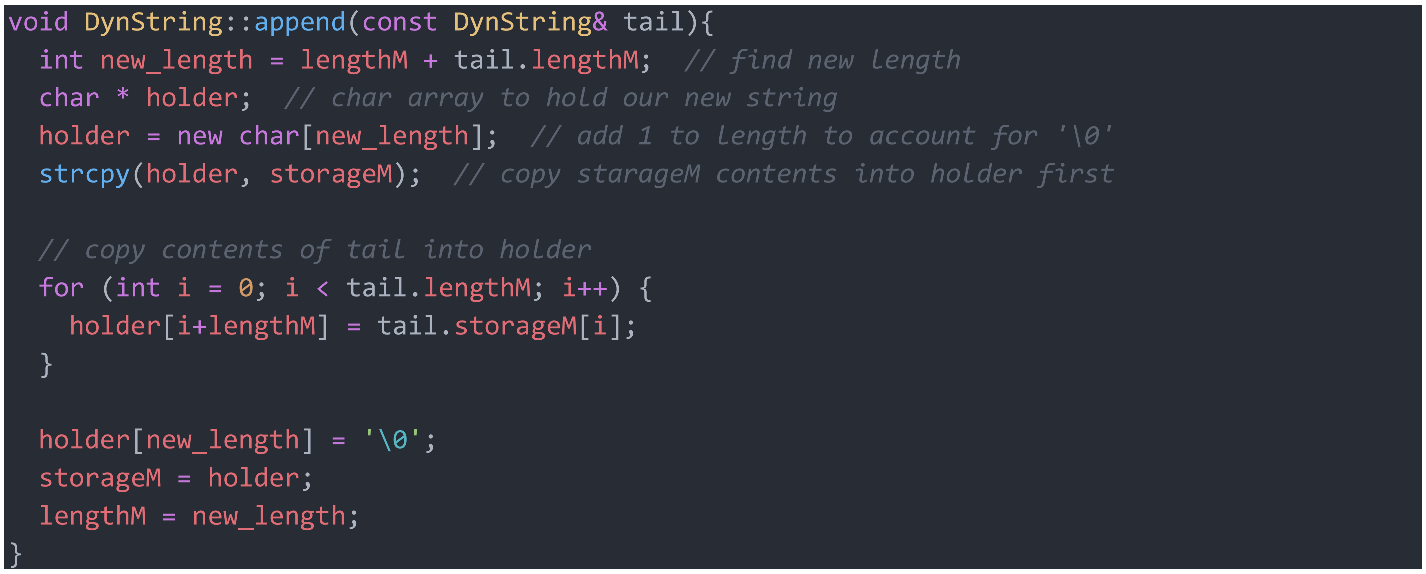
By the time we get to the end of the program, the destructor of DynString is called 3 times, once for a, b, and c each.

4. Answer the question that is noted in the main function: What is going wrong after you press the return key in the main function?

- In this program, the variable `c` is set equal to the variable `a` within an extra pair of curly braces, so the destructor is called for `c` after the program exits these extra curly braces (since `c` goes out of scope).
- In the destructor for the `DynString` class, the allocated space for `storageM` is freed through the line `delete [] storageM;` but the pointer pointing to that spot is still pointing there.
- Since `c` was set equal to `a`, their `storageM` pointer pointed to the same location in heap memory.
- Therefore, when the destructor for `a` is called again at the end of the main function, and we try to de-allocate the memory for `storageM` that was already de-allocated, we get an error.
- A way to solve this would be adding `storageM = nullptr` within the destructor for the `DynString` class.

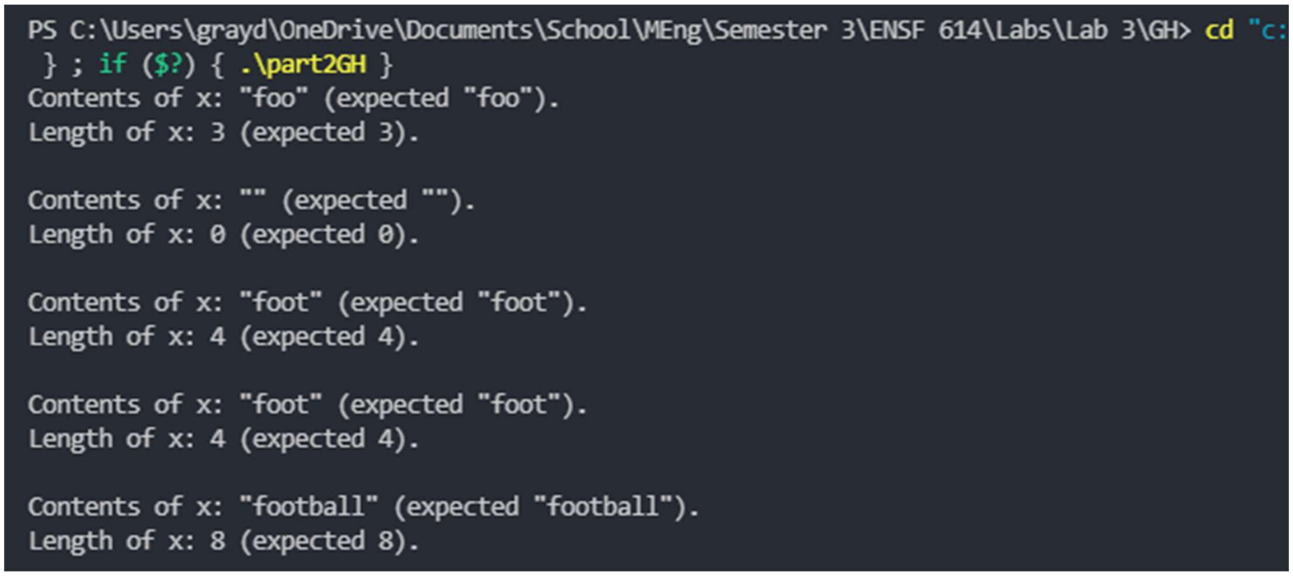
Exercise D – Part 2

Here is a copy of our append function



```
void DynString::append(const DynString& tail){
  int new_length = lengthM + tail.lengthM;  // find new length
  char * holder;  // char array to hold our new string
  holder = new char[new_length];  // add 1 to length to account for '\0'
  strcpy(holder, storageM);  // copy starageM contents into holder first

  // copy contents of tail into holder
  for (int i = 0; i < tail.lengthM; i++) {
    holder[i+lengthM] = tail.storageM[i];
  }

  holder[new_length] = '\0';
  storageM = holder;
  lengthM = new_length;
}
```

Program output:



```
PS C:\Users\grayd\OneDrive\Documents\School\MEng\Semester 3\ENSF 614\Labs\Lab 3\GH> cd "c:
 } ; if ($?) { .\part2GH }
Contents of x: "foo" (expected "foo").
Length of x: 3 (expected 3).

Contents of x: "" (expected "").
Length of x: 0 (expected 0).

Contents of x: "foot" (expected "foot").
Length of x: 4 (expected 4).

Contents of x: "foot" (expected "foot").
Length of x: 4 (expected 4).

Contents of x: "football" (expected "football").
Length of x: 8 (expected 8).
```