Course: ENSF 614 – Fall 2023
Lab #: Lab 3
Instructor: Moussavi
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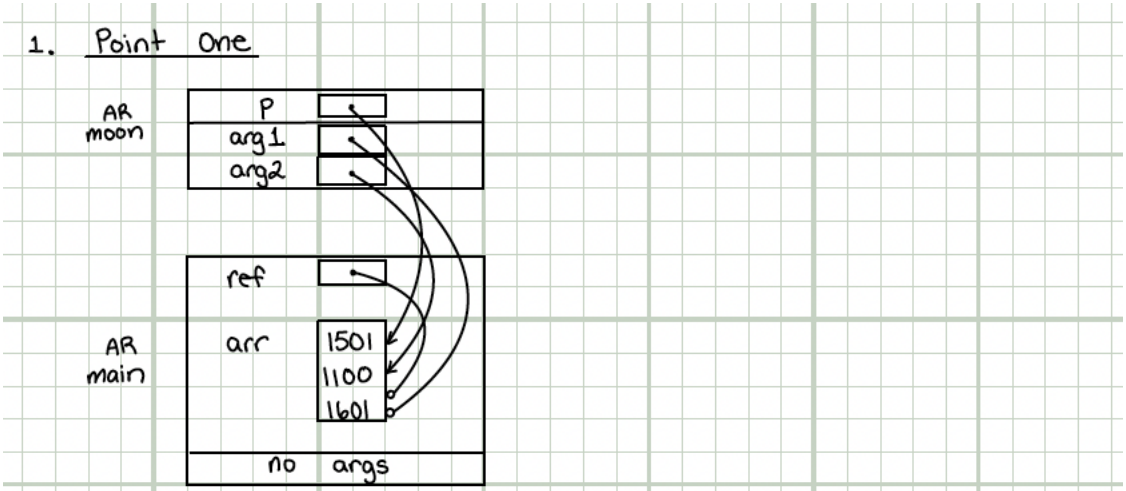
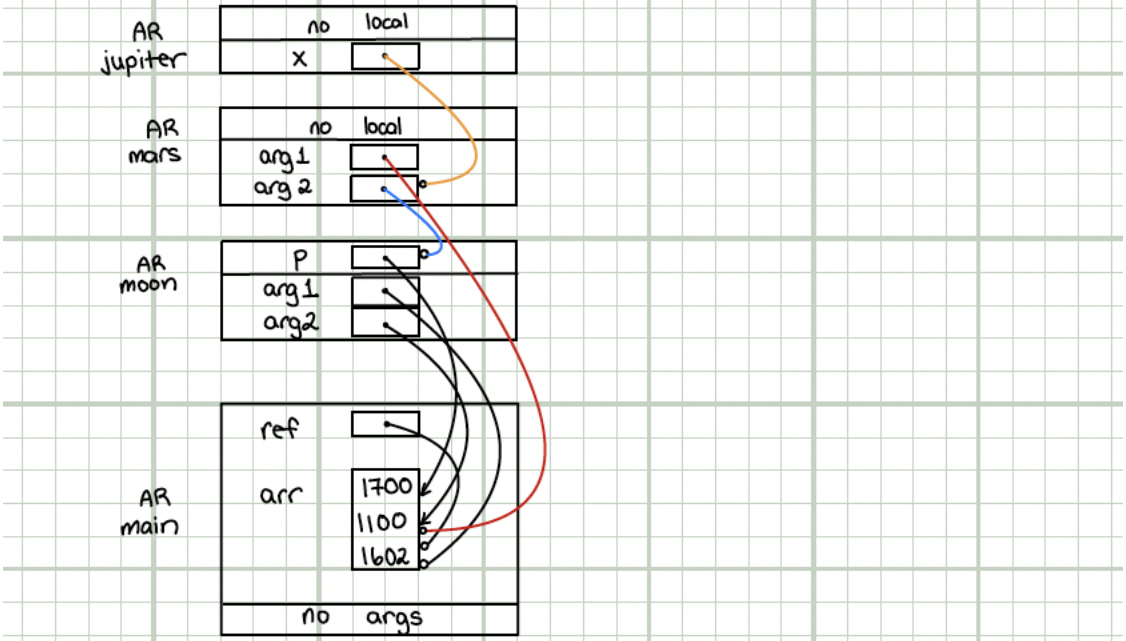
Submission Date: October 13th, 2023

Part A

1. Point One

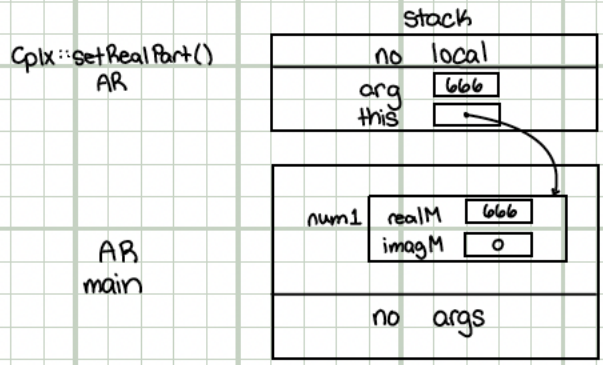


Point Two

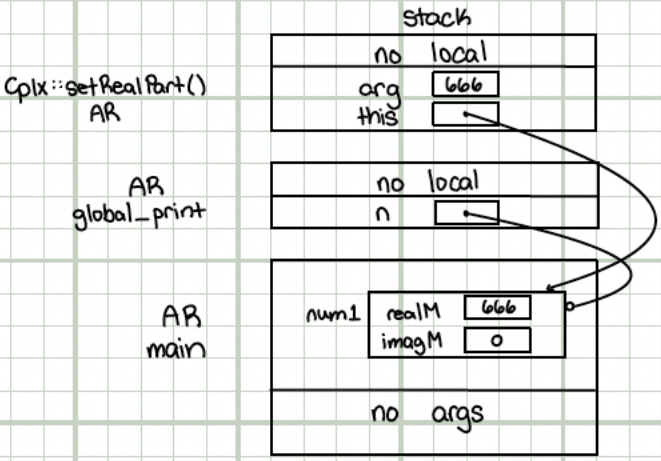


Part B

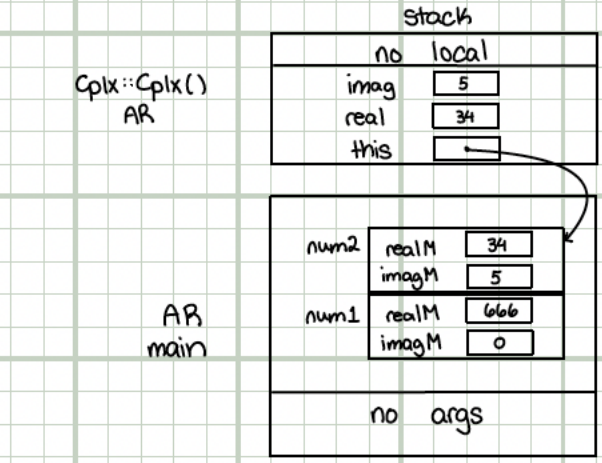
2. Point One



Point Two



Point Three



Part C

lab3Clock.h

```
#ifndef LAB3CLOCK_H
#define LAB3CLOCK_H

class Clock {
public:
    Clock();
    Clock(int s);
    Clock(int h, int m, int s);

    void set_hour(int h);
    void set_minute(int m);
    void set_second(int s);

    int get_hour() const;
    int get_minute() const;
    int get_second() const;

    void increment();
    void decrement();

    int hms_to_sec() const;
    void sec_to_hms(int totalSeconds);
    void add_seconds(int secondsToAdd);

private:
    int hour;
    int minute;
    int second;
};

#endif
```

lab3Clock.cpp

```cpp
#include "lab3Clock.h"

// Default Constructor

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

// Used for seconds

Clock::Clock(int s) {
    if (s < 0) {
        hour = 0;
        minute = 0;
        second = 0;
    } else {
        hour = s / 3600;
        minute = (s % 3600) / 60;
        second = (s % 3600) % 60;
    }
}

// Used for all variables in clock

Clock::Clock(int h, int m, int s) {
    if (h < 0 || h > 23 || m < 0 || m > 59 || s < 0 || s > 59) {
        hour = 0;
        minute = 0;
        second = 0;
    } else {
        hour = h;
        minute = m;
        second = s;
```

```
    }
}

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

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

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

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

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

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

void Clock::increment() {
    second++;
    if (second >= 60) {
        second = 0;
```

```
        minute++;
        if (minute >= 60) {
            minute = 0;
            hour++;
            if (hour >= 24) {
                hour = 0;
            }
        }
    }
}

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

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

void Clock::sec_to_hms(int totalSeconds) {
    hour = totalSeconds / 3600;
    minute = (totalSeconds % 3600) / 60;
    second = totalSeconds % 60;
}

void Clock::add_seconds(int secondsToAdd) {
```

```
    if (secondsToAdd > 0) {
        int totalSeconds = hms_to_sec();
        totalSeconds += secondsToAdd;
        sec_to_hms(totalSeconds);
    }
}
```

Output

```
(base) yajurvashisht@yajurs-macbook Lab 3 % g++ -o lab3exe_C lab3Clock.cpp
lab3exe_C.cpp

(base) yajurvashisht@yajurs-macbook Lab 3 % ./lab3exe_C

Object t1 is created. Expected time is: 00:00:00
00:00:00
Object t1 incremented by 86400 seconds. Expected time is: 00:00:00
00:00:00
Object t2 is created. Expected time is: 00:00:05
24:00:05
Object t2 decremented by 6 seconds. Expected time is: 23:59:59
23:59:59
After setting t1's hour to 21. Expected time is: 21:00:00
21:00:00
Setting t1's hour to 60 (invalid value). Expected time is: 21:00:00
21:00:00
Setting t2's minute to 20. Expected time is: 23:20:59
23:20:59
Setting t2's second to 50. Expected time is 23:20:50
23:20:50
Adding 2350 seconds to t2. Expected time is: 00:00:00
24:00:00
Adding 72000 seconds to t2. Expected time is: 20:00:00
44:00:00
Adding 216000 seconds to t2. Expected time is: 08:00:00
104:00:00
Object t3 is created. Expected time is: 00:00:00
00:00:00
Adding 1 second to clock t3. Expected time is: 00:00:01
00:00:01
After calling decrement for t3. Expected time is: 00:00:00
00:00:00
After incrementing t3 by 86400 seconds. Expected time is: 00:00:00
00:00:00
After decrementing t3 by 86401 seconds. Expected time is: 23:59:59
23:59:59
After decrementing t3 by 864010 seconds. Expected time is: 23:59:49
23:59:49
t4 is created with invalid value (25 for hour). Expected to show: 00:00:00
00:00:00
t5 is created with invalid value (-8 for minute). Expected to show: 00:00:00
00:00:00
t6 is created with invalid value (61 for second). Expected to show: 00:00:00
00:00:00
t7 is created with invalid value (negative value). Expected to show: 00:00:00
00:00:00
```

Part D

MyArray.cpp:

```
#include <iostream>
using namespace std;

#include "MyArray.h"
#include <cassert>
#include <algorithm>

MyArray::MyArray() : sizeM(0), storageM(nullptr) {}

MyArray::MyArray(const EType *builtin, int sizeA):sizeM(sizeA) {
   if (sizeM > 0) {
      storageM = new EType[sizeM];
      for (int i = 0; i < sizeM; ++i) {
         storageM[i] = builtin[i];
      }
   } else {
      storageM = nullptr;
   }
 }

MyArray::MyArray(const MyArray& source) : sizeM(source.sizeM) {
   if (sizeM > 0) {
      storageM = new EType[sizeM];
      for (int i = 0; i < sizeM; ++i) {
         storageM[i] = source.storageM[i];
      }
   } else {
      storageM = nullptr;
   }
}

MyArray& MyArray::operator =(const MyArray& rhs) {
   if (this != &rhs) {
      delete[] storageM;
```

```
        sizeM = rhs.sizeM;

        if (sizeM > 0) {
            storageM = new EType[sizeM];
            for (int i = 0; i < sizeM; ++i) {
                storageM[i] = rhs.storageM[i];
            }
        } else {
            storageM = nullptr;
        }
    }
    return *this;
}

MyArray::~MyArray() {
    delete[] storageM;
}

int MyArray::size() const {
    return sizeM;
}

EType MyArray::at(int i) const {
    if (i >= 0 && i < sizeM) {
        return storageM[i];
    } else {
        cout << "Not valid." << endl;
    }
}

void MyArray::set(int i, EType new_value) {
    if (i >= 0 && i < sizeM) {
        storageM[i] = new_value;
    } else {
        cout << "Not valid." << endl;
    }
```

```
}

void MyArray::resize(int new_size) {
    if (new_size == sizeM) {
        return;
    }

    EType* newStorage = new EType[new_size];

    int copySize = std::min(new_size, sizeM);

    for (int i = 0; i < copySize; ++i) {
        newStorage[i] = storageM[i];
    }

    delete[] storageM;

    sizeM = new_size;
    storageM = newStorage;
}
```

Output:

```
Elements of a:  0.5 1.5 2.5 3.5 4.5
(Expected:      0.5 1.5 2.5 3.5 4.5)

Elements of b after first resize:  10.5 11.5 12.5 13.5 14.5 15.5 16.5
(Expected:                         10.5 11.5 12.5 13.5 14.5 15.5 16.5)

Elements of b after second resize:  10.5 11.5 12.5
(Expected:                          10.5 11.5 12.5)

Elements of b after copy ctor check:  10.5 11.5 12.5
(Expected:                            10.5 11.5 12.5)

Elements of c after copy ctor check:  -1.5 11.5 12.5
(Expected:                            -1.5 11.5 12.5)

Elements of a after operator = check:  -10.5 1.5 2.5 3.5 4.5
(Expected:                             -10.5 1.5 2.5 3.5 4.5)

Elements of b after operator = check:  -11.5 1.5 2.5 3.5 4.5
(Expected:                             -11.5 1.5 2.5 3.5 4.5)

Elements of c after operator = check:  0.5 1.5 2.5 3.5 4.5
```

(Expected: 0.5 1.5 2.5 3.5 4.5)