

CST238 Fall 2019

Homework 06 - Dynamic Arrays

Objectives:

- Use dynamic arrays to make programs more flexible
- Freeing dynamic memory when we're done with it

How to turn in: Submit two C++ files on iLearn

Q1. (15 points) Write a C++ program called hw6_1.cpp that performs the following operations:

1. Asks the user to specify the name of a file that contains rows of numbers. The format will be

$n \ m_1 \ m_2 \ m_3 \ \dots \ m_n$

where n is the number of elements in the list, followed by the list of elements, like this:

6 1 7 8 9 6 9

1 1

2. Reads in the file and stores in a dynamic array
3. Calls a function to determine whether or not the array is a palindrome (same forward and backward)
4. If it is a palindrome, print out that fact and the array
5. If it is not a palindrome
 - a. Create a new array of double the size
 - b. Copy the contents of the old array into the new array
 - c. "Mirror" the contents of the old array into the new array
 - d. Print out the new palindrome
6. Deallocate the storage of all arrays when appropriate, and announce that you are freeing memory each time

The following shows a sample run of your program:

Enter a filename: fl

Line 1 is NOT a palindrome: 1 7 8 9 6 9

Line 1 made into a palindrome:

Freeing up the old array!

1 7 8 9 6 9 9 6 9 8 7 1

Freeing up the array!

Line 2 is a palindrome of 1 numbers: 1

Freeing up the array!

Line 3 is a palindrome of 3 numbers: 1 5 1

Freeing up the array!

Line 4 is a palindrome of 4 numbers: 1 4 4 1

Freeing up the array!

Line 5 is NOT a palindrome: 1 4

Line 5 made into a palindrome:

Freeing up the old array!

1 4 4 1

Freeing up the array!

You will need at least three functions:

```
void printArray(int * a, int size);
bool isPalindrome(int * a, int size);
int * makePalindrome(int * a, int & size);
```

Q2. (15 points) Write a C++ program called hw6_2.cpp that calculates GPAs based on user input. Calculating GPA involves determining the total number of classes taken, then for each class, how many credits and what the grade was. Then, for each class:

1. Convert the grade to a number of grade points (e.g., A == 4.0, A- = 3.67, B+ == 3.33, etc.)
2. Multiply the grade points by the number of credits for that class
3. Sum up all of the grade points for all classes
4. Sum up all of the credits for all classes
5. Divide the total grade points by the total credits to calculate the GPA

For example, let's say you took four classes and received the following grades:

Course	Credits	Letter Grade	Grade Point Value	Grade Points
CST100	4	A-	3.67	14.68
CST101	3	B+	3.33	9.99
ENG100	3	C	2.0	6.0
UBW101	2	F	0.0	0.0

To calculate your GPA, we sum the credits (12) and the grade points (30.67), then divide the grade points by the credits (30.67/12), and get $2.555\overline{83}$.

The homework must use a class called GpaCalculator, declared as follows, along with a helper function and data for converting letter grades to grade points:

```
// ---- NO NEED TO CHANGE THIS CODE ----
const int SIZE = 12;
const string GRADES [SIZE] = {"A", "A-", "B+", "B", "B-", "C+", "C", "C-", "D+", "D", "D-", "F"};
const double GRADEPOINTS [SIZE] = {4.0, 3.67, 3.33, 3.0, 2.67, 2.33, 2.0, 1.67, 1.33, 1, 0.67, 0};
double getGradePoints(string grade) {
    for (int i = 0; i < SIZE; i++) {
        if(GRADES[i] == grade) {
            return GRADEPOINTS[i];
        }
    }
    return 0;
}
// -----
```

```

class GpaCalculator {
public:
    GpaCalculator();
    GpaCalculator(int courseCount);
    void addCourse(int credits, string grade);
    int getCourseCount() const { return myCourseCount; };
    double getTotalGradePoints() const;
    int getTotalCredits() const;
    double getGpa() const;
    ~GpaCalculator();
private:
    int myCourseCount;
    int myCoursesEntered = 0;
    int * myCredits;
    double * myGradePoints;
};

```

Here's a sample run of the program:

```

./main
Enter number of courses: 4
Enter number of credits for course 1: 4
Enter grade for course 1: A-

Enter number of credits for course 2: 3
Enter grade for course 2: B+

Enter number of credits for course 3: 3
Enter grade for course 3: C

Enter number of credits for course 4: 2
Enter grade for course 4: F

You earned 30.67 grade points over 12 credits
Your GPA is: 2.55583

Deleting credits dynamic array
Deleting grade points dynamic array

```