

CS 2100: Data Structures, Spring 2016

Homework 2

This is a homework you must complete individually. Please email your solutions to both the instructor and the grader by Sunday, January 31 at 11:59pm.

If you wish to hand in a paper copy of problem 1, that is fine, but be sure to get it to me by the start of class on Monday morning; I will not accept any paper copies once class has begun.

1. (a) Fill in the diagram below to represent the underlying memory configuration that is present after the following commands are executed:

```
int a(52);
int b(22);
int c(a);
int &m(a);
int *x(&b);
```

memory contents	memory address
	281
	282
	283
	284
	285
	286
	287
	288
	289
	290

- (b) Now use the diagram below to update the memory configuration from part (a) after the following 5 commands are executed.

```
m = 3;
int *y = new int(13);
x = y;
int d = (*x) + 2;
a = 6;
```

memory contents	memory address
	281
	282
	283
	284
	285
	286
	287
	288
	289
	290
	291
	292

2. Write a class `Rational` for performing arithmetic with fractions. Use integers to represent the (private) variables numerator and denominator. Provide a constructor function that enables an object of this class to be initialized, and which should contain default values in case no input is provided. The constructor should also guarantee that the fraction is stored in reduced form, so that (for example) the inputs 2 and 4, for the fraction $\frac{2}{4}$, will be stored with numerator 1 and denominator 2.

Also provide public functions for the following operations:

- Addition of two rational numbers, where the result should be stored in reduced form
- Subtraction of two rational numbers, where the result should be stored in reduced form
- Multiplication of two rational numbers, where the result should be stored in reduced form
- Division of two rational numbers, where the result should be stored in reduced form
- Printing rational numbers (using `cout`) in the form of a/b where a is the numerator and b is the denominator
- Printing rational numbers in floating point format.

You must also write a main file which tests each of your functions. Please submit your class file and test file separately for grading.