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| **AP® Computer Science A** | **Major Lab 05a2** |
| **The Rational Class Program II** | **80 & 100 Point Versions** |
| **Assignment Purpose:**  The primary purpose of this lab is to demonstrate knowledge of creating a Rational class with object methods, instantiate multiple objects of the created class, and then call the object methods from a class outside the Rational class. | |

This lab assignment continues the **Rational** class that was started with the **Lab05a1** assignment. Now comes the time to add, subtract, multiply and divide fractions with your **Rational** class. For this assignment you will need to complete the **Rational** class.

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| **Lab05a2vst**  **Student Version** | **Do not copy this file,**  **which is provided.** |
| // Lab05a2vst.java // The Rational Class Program II // This is the student starting version of the Lab05a2 assignment.  import java.util.Scanner;  public class Lab05a2vst {  public static void main (String[] args)  {  Scanner keyboard = new Scanner(System.in);  System.out.print("\nEnter the 1st numerator ----> ");  int num1 = keyboard.nextInt();  System.out.print("\nEnter the 1st denominator --> ");  int den1 = keyboard.nextInt();  System.out.print("\nEnter the 2nd numerator ----> ");  int num2 = keyboard.nextInt();  System.out.print("\nEnter the 2nd denominator --> ");  int den2 = keyboard.nextInt();  System.out.println();   Rational r1 = new Rational(num1,den1);  Rational r2 = new Rational(num2,den2);  Rational r3 = new Rational();   r3.showMultiply(r1,r2); // required for 80-points  r3.showDivide(r1,r2); // required for 80-points  r3.showAdd(r1,r2); // required for 100-points  r3.showSubtract(r1,r2); // required for 100-points  } } | |

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| class Rational {  private int num;   private int den;    // Required for 80-points  public Rational()  {  }   // Required for 80-points  public Rational(int n, int d)  {  }    // Required for 80-points  public String getRational()   {   return " ";  }   // Required for 80-points  private int getGCF(int n1,int n2)  {  return 0;  }   // Required for 80-points  public String getReduced()  {  return " ";  }   // Required for 80-points  public void showMultiply(Rational r1, Rational r2)  {   }    // Required for 80-points  public void showDivide(Rational r1, Rational r2)  {   }    // Required for 100-points  public void showAdd(Rational r1, Rational r2)  {   }   // Required for 100-points  public void showSubtract(Rational r1, Rational r2)  {   } } |

**80 Point Version Specifics**

For the 80-point version you need to write two **Rational** constructor methods and also methods, **getRational**, **getGCF** and **getReduced**. The last three methods were already written for Lab05a1. Completely new for **Lab05a2** are methods **showMultiply** and **showDivide**. Make sure your outputs match those shown below.

**80 Point Version Outputs**

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|   ----jGRASP exec: java Lab05a2v80   Enter the 1st numerator ----> 20   Enter the 1st denominator --> 24   Enter the 2nd numerator ----> 9   Enter the 2nd denominator --> 15   20/24 \* 9/15 = 1/2   20/24 / 9/15 = 25/18 |

**100 Point Version Specifics**

The 100-point version completes the **Rational** class with methods **showAdd** and **showSubtract**. The result of computing the four binary operations, add, subtract multiply amid divide also need to be displayed after being reduced to the smallest fractions.

It is important that fraction reduction happens at the end of the computation when the product, quotient, sum or difference have already been computed. It is possible otherwise to end up with a final answer that is not completely reduced. Consider the following examples:

**Computation with reduction performed after the add computation:**

6/8 + 6/8 = 12/8 which then reduces to 3/2

**Computation with reduction performed before the add computation:**

6/8 reduces to 3/4 and 3/4 + 3/4 adds to 6/4, which is not totally reduced.

**100 Point Version Output**

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|   ----jGRASP exec: java Lab05a2v100   Enter the 1st numerator ----> 20   Enter the 1st denominator --> 24   Enter the 2nd numerator ----> 9   Enter the 2nd denominator --> 15   20/24 \* 9/15 = 1/2   20/24 / 9/15 = 25/18   20/24 + 9/15 = 43/30  20/24 - 9/15 = 7/30 |