```
/*****************************************************/
/* Andrew Robinson                                   */
/* Math 371                                          */
/* Fall 2017                                         */
/*                                                   */
/* Source at: https://github.com/SirArkimedes/MATH371 */
/*****************************************************/

// Imports
using System;

// Declare the project's namespace...
namespace Project1
{

  // Declare a struct for easy reuse later in the course...
  struct ProgramDescriptions
  {
    // Accepts a string that is displayed with the standard information.
    public static void displayClassInformation(string programName)
    {
      Console.WriteLine("Math 371");
      Console.WriteLine("Fall 2017");
      Console.WriteLine(programName);
      Console.WriteLine("Andrew Robinson");
      Console.WriteLine();
    }

    // Accepts the purpose string to display in informative label.
    public static void displayPurpose(string purpose)
    {
      Console.WriteLine("Purpose:");
      Console.WriteLine(purpose);
      Console.WriteLine();
    }
  }

  // Declare a struct that represents a function in form ax + by = r
  struct Function
  {
    public double a;
    public double b;
    public double r;
  }

  // Declare the class that Main() enters into.
  class MainClass
  {
    // Declare the loop control for running again.
    static bool wantsToRunProcessAgain = true;

    // Main() -> The console enters into here...
    public static void Main(string[] args)
    {
      // Call the struct declared above and pass the necessary information.
      ProgramDescriptions.displayClassInformation("Linear System Solver");

      string purpose = "Upon input of a, b, c, d, r, and s, the solution to " +
          " the system of equations ax + by = r, cx + dy = s is produced.";
      ProgramDescriptions.displayPurpose(purpose);
```

```
61
62          while (wantsToRunProcessAgain)
63          {
64            // Declare function to be added to later...
65            Function f1, f2;
66
67            // Begin user input
68            userInput('a', out f1.a);
69            userInput('b', out f1.b);
70            userInput('r', out f1.r);
71
72            userInput('c', out f2.a);
73            userInput('d', out f2.b);
74            userInput('s', out f2.r);
75
76            // Attempt to solve.
77            double x, y;
78            string output = solve(f1, f2, out x, out y);
79
80            Console.WriteLine("{0}x + {1}y = {2}", f1.a, f1.b, f1.r);
81            Console.WriteLine("{0}x + {1}y = {2}", f2.a, f2.b, f2.r);
82            if (output == "success")
83            {
84              Console.WriteLine("x = {0:0.0000}", x);
85              Console.WriteLine("y = {0:0.0000}", y);
86              Console.WriteLine();
87            }
88            else
89            {
90              // Not a success; output the string that was received.
91              Console.WriteLine(output);
92              Console.WriteLine();
93            }
94
95            // Prompt for running again.
96            Console.WriteLine("Run with new equations? y/n");
97            string response = Console.ReadLine();
98            if (response != "y")
99            {
100             wantsToRunProcessAgain = false;
101           }
102
103           Console.WriteLine();
104         }
105       }
106
107       // Prompt for user input for passed variable name and
108       // assign the integerToSet if successful.
109       static void userInput(char variable, out double doubleToSet)
110       {
111         // Prompt to enter the value for passed variable
112         Console.Write("Input value for {0}: ", variable);
113
114         // Check to see if the input can be a double, assign to doubleToSet if so.
115         if (!double.TryParse(Console.ReadLine(), out doubleToSet))
116         {
117           // The integer can't be parsed. Retry.
118           Console.WriteLine("Invalid input for `{0}`! Retrying...", variable);
119           Console.WriteLine();
120           userInput(variable, out doubleToSet); // Takes advantage of recursion.
```

```
121         }
122       }
123
124       // Solve the system. Assign the x and y that was passed. Return string of success or not.
125       static string solve(Function f1, Function f2, out double x, out double y)
126       {
127         if (!Equals(f1.a * f2.b, f2.a * f1.b))
128         {
129           y = (f1.a * f2.r - f2.a * f1.r) / (f1.a * f2.b - f2.a * f1.b);
130
131           if (Equals(f1.a, 0.0)) // Prevent divide by 0.
132           {
133             x = 0.0;
134           }
135           else
136           {
137             x = (f1.r - f1.b * y) / f1.a;
138           }
139
140           return "success";
141         }
142         else if ((Equals(f1.a, 0.0) && Equals(f1.b, 0.0) && !Equals(f1.r, 0.0)) || // 0x + 0y = 3 ↵
           is false.
143                  (Equals(f2.a, 0.0) && Equals(f2.b, 0.0) && !Equals(f2.r, 0.0)))
144         {
145           // Assign because they have to be.
146           x = double.MaxValue;
147           y = double.MaxValue;
148           return "No solution!";
149         }
150         else if ((Equals(f1.a, 0.0) && Equals(f1.b, 0.0) && Equals(f1.r, 0.0)) ||
151                  (Equals(f2.a, 0.0) && Equals(f2.b, 0.0) && Equals(f2.r, 0.0)) ||
152                  // If the equations are multiples of each other.
153                  (Equals(f1.a / f2.a, f1.b / f2.b) && Equals(f1.a / f2.a, f1.r / f2.r)))
154         {
155           // Assign because they have to be.
156           x = double.MaxValue;
157           y = double.MaxValue;
158           return "Infinitely many solutions!";
159         }
160         else // Catch the remaining cases as these can't be combined in the ORs.
161         {
162           // Assign because they have to be.
163           x = double.MaxValue;
164           y = double.MaxValue;
165           return "No solution!";
166         }
167       }
168
169     }
170   }
171
172   // PROGRAM OUTPUT FOR GIVEN SYSTEMS:
173   /*
174   Math 371
175   Fall 2017
176   Linear System Solver
177   Andrew Robinson
178
179   Purpose:
```

```
180  Upon input of a, b, c, d, r, and s, the solution to  the system of equations ax + by = r, cx + ↵
      dy = s is produced.
181
182  Input value for a: 2
183  Input value for b: 3
184  Input value for r: 8
185  Input value for c: 5
186  Input value for d: -4
187  Input value for s: 9
188  2x + 3y = 8
189  5x + -4y = 9
190  x = 2.5652
191  y = 0.9565
192
193  Run with new equations? y/n
194  y
195
196  Input value for a: 2
197  Input value for b: -5
198  Input value for r: 8
199  Input value for c: -4
200  Input value for d: 10
201  Input value for s: 9
202  2x + -5y = 8
203  -4x + 10y = 9
204  No solution!
205
206  Run with new equations? y/n
207  y
208
209  Input value for a: 2
210  Input value for b: -5
211  Input value for r: 8
212  Input value for c: -4
213  Input value for d: 10
214  Input value for s: -16
215  2x + -5y = 8
216  -4x + 10y = -16
217  Infinitely many solutions!
218
219  Run with new equations? y/n
220  y
221
222  Input value for a: 2
223  Input value for b: 3
224  Input value for r: 8
225  Input value for c: 5
226  Input value for d: 0
227  Input value for s: 12
228  2x + 3y = 8
229  5x + 0y = 12
230  x = 2.4000
231  y = 1.0667
232
233  Run with new equations? y/n
234  y
235
236  Input value for a: 2
237  Input value for b: 3
238  Input value for r: 8
```

```
239  Input value for c: 0
240  Input value for d: 5
241  Input value for s: 12
242  2x + 3y = 8
243  0x + 5y = 12
244  x = 0.4000
245  y = 2.4000
246
247  Run with new equations? y/n
248  y
249
250  Input value for a: 0
251  Input value for b: 0
252  Input value for r: 0
253  Input value for c: 2
254  Input value for d: -3
255  Input value for s: 5
256  0x + 0y = 0
257  2x + -3y = 5
258  Infinitely many solutions!
259
260  Run with new equations? y/n
261  y
262
263  Input value for a: 4
264  Input value for b: 5
265  Input value for r: 8
266  Input value for c: 0
267  Input value for d: 0
268  Input value for s: 3
269  4x + 5y = 8
270  0x + 0y = 3
271  No solution!
272
273  Run with new equations? y/n
274  n
275
276
277  Press any key to continue...
278
279  */
280
```