**INSTRUCTIONS TO STUDENTS.**

* This exam counts for 30% of your final mark in this course.
* Appropriate coding style and documentation are expected.
* It is imperative that you name your files exactly as requested. Attach all (and only) the requested files to your email to handin at the end of the exam.

### Julia Sets

You will recall that the Mandelbrot Set consists of the set of points, c, in the Argand (Complex) Plane, whose orbits under the iterative formula, *z* ← *z*2+*c* never reach a magnitude greater than 2.0, where *z* starts at 0+0*i*. The algorithm for Julia Sets is very similar in that the orbits are also considered under the iterative formula, *z* ← *z*2+*c*, however c remains fixed over the entire map while,

-2.0 <= Re(*z*) <= 2.0 and -2.0 <= Im(*z*) <= 2.0

With Julia Sets it is sufficient to keep the maximum number of iterations reasonable (anywhere from 64 to 256 is plenty). Assigning a colour to a point is similar to the Mandelbrot algorithm. If z does not reach a magnitude of 2 within the allotted number of iterations, colour the point Black, otherwise use the number of iterations to index your palette.

**Task**. You are to adapt your Mandelbrot project to produce a sequence of 100 jpg frames displaying the sequence of Julia Set images with c ranging from (0.0,0.0) to your specially chosen target below.



**Note**. To make it easy for me to mount your video, please name your frames with your last name. For example, Max should name his images, moros\_0.jpg, moros\_1.jpg, and so on. Go to the URL,

<http://darcy.rsgc.on.ca/ICS3M/Exams/ICS3M06Julia.html>

to view two sample videos.

 **Attach all images and all the necessary files for me to recompile and run your application.** Documenting the c value for the respective frames allows you to revisit specific coordinates of interest for still images at a later date. To do so, add Java statements similar to,

g.setColor(Color.WHITE);

cString = "c["+zoomLevel+"]=("+df.format(reC)+", "+df.format(imC)+")";

g.drawString(cString,5,HEIGHT-5);

where df is an object declared once as,

java.text.DecimalFormat df = new java.text.DecimalFormat("##.###");

Sample Julia images appear below.

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| 2005Julia_1Figure 1. c = 0.38-0.35i; ITERATIONS: 127 | 2005Julia_2Figure 2. c = -0.123+0.745i; ITERATIONS: 127 |
| 2005Julia_3Figure 3. c = -0.6672+0.459i; ITERATIONS: 31 | 2005Julia_4Figure 4. c = -0.765+0.003i; ITERATIONS: 31 |