Assignment ArtCollage

This assignment you will create a collage of images.

Refer to our Programming Assignments FAQ for instructions on how to install VSCode, how to use the command line and how to submit your assignments.

Overview

The goal of this assignment is to perform several operations on digital images.

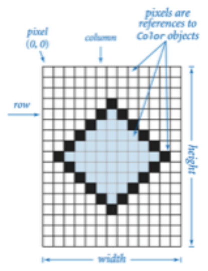
Your cellphone are computers with lenses and light-sensitive devices capable of capturing images in digital form, and your computer has photo-editing software that allows you to process those images. You can crop them, enlarge and reduce them, adjust the contrast, brighten or darken them, remove redeye, and a myriad of other operations. Many such operations are easy to implement, given a simple data type that captures the idea of a digital image.

Digital Image

A digital image is a rectangular grid of pixels (picture elements), where the color of each pixel is individually defined.

An image can be represented as a 2D array where each array cell has a color.

Color is a sensation in the eye from electromagnetic radiation. Since we want to view and manipulate color images on our computers, color is a widely used abstraction in computer graphics, and Java provides a Color data Type.

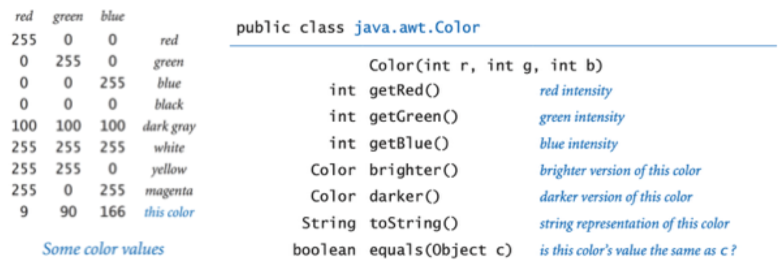


Color

To present color values, Color uses the RGB color model that represent the intensity of the red, green, and blue components of the color. Other color values are obtained by mixing red, green, and blue components. That is, the data-type values of Color are three integer values.

```
// The Color data type has a constructor that
// takes three integer arguments.
Color bookBlue = new Color(9, 90, 166);
System.out.printf("Green component %d", bookBlue.getGreen());
```

The API for Color contains several constructors and methods; three of the methods enables the programmer to retrieve the Color components intensity separately (see far right).



red	green	blue	
255	0	0	*red*
0	255	0	*green*
0	0	255	*blue*
0	0	0	*black*
100	100	100	*dark gray*
255	255	255	*white*
255	255	0	*yellow*
255	0	255	*magenta*
9	90	166	*this color*

Some color values

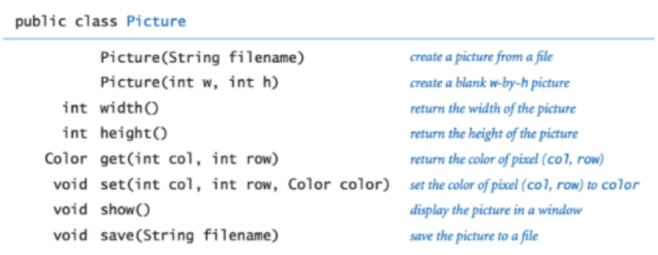
`public class java.awt.Color`

	`Color(int r, int g, int b)`	
`int`	`getRed()`	*red intensity*
`int`	`getGreen()`	*green intensity*
`int`	`getBlue()`	*blue intensity*
`Color`	`brighter()`	*brighter version of this color*
`Color`	`darker()`	*darker version of this color*
`String`	`toString()`	*string representation of this color*
`boolean`	`equals(Object c)`	*is this color's value the same as c ?*

Picture

The Picture class from the Introduction to Computer Science book is a data type for digital images whose definition follows from the digital image abstraction (see Digital Image above). The set of values is a two-dimension array of Color values, and the operations is what you would expect (see right).

By convention, (0,0) is the upper-leftmost pixel, so the image is laid as in the customary order for two-dimensional arrays. The supported file formats for the first constructor are PNG and JPEG formats.



public class Picture

	Picture(String filename)	create a picture from a file
	Picture(int w, int h)	create a blank w-by-h picture
int	width()	return the width of the picture
int	height()	return the height of the picture
Color	get(int col, int row)	return the color of pixel (col, row)
void	set(int col, int row, Color color)	set the color of pixel (col, row) to color
void	show()	display the picture in a window
void	save(String filename)	save the picture to a file

Implementation

Overview of Files:

- **Picture**, which is described above (from CS111). **Do not edit this class.**
- **Collage**, which contains some provided methods in addition to annotated method signatures for all the methods you are expected to fill in. You will write your solutions in this file, and it is the file which will be submitted for grading.
- **Driver**, which you can run to test any of your methods interactively. Feel free to edit this class, as it is provided only to help you test. It is not submitted and it is not used to grade your code.
- **StdIn**, which is used by the driver. **Do not edit this class.**
- Multiple jpeg files that can be read by the driver as test cases. They are not submitted.

Methods to be implemented by you in Collage.java:

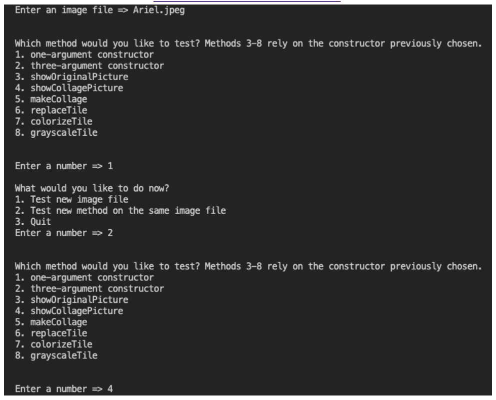
Collage keeps at all times two digital images as Pictures:

- **original picture**, which is the image from the input file without modification. Do not modify this image.
- **collage picture**, which is the image you will perform operations on.
  - You are going to manipulate this image as if it is made up of tiles. The image has *collageDimension* x *collageDimension* tiles.
  - Each tile is made of *tileDimension* x *tileDimension* pixels.

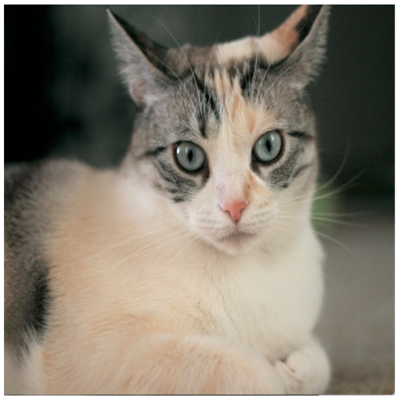
1. **one-argument constructor**
   - set default values of collage dimension to 4 and tile dimension to 150.
   - initializes original picture with the filename image.
   - initializes collage picture as a Picture of tileDimension*collageDimension x tileDimension*collageDimension where each pixel is black.
   - update collagePicture to be a scaled version of original.
2. **three-arguments constructor**

   - set default values of collage dimension and tile dimension to argument values.
   - initializes original picture with the filename image.
   - initializes collage picture as a Picture of tileDimension*collageDimension x tileDimension*collageDimension, where each pixel is black.
   - update collage picture to be a scaled version of original picture.

3. **scale**
   - used in both constructors.
   - changes the size of a picture to fit into another.
   - how to scale? see the code here.



```
Enter an image file => Ariel.jpeg


Which method would you like to test? Methods 3-8 rely on the constructor previously chosen.
1. one-argument constructor
2. three-argument constructor
3. showOriginalPicture
4. showCollagePicture
5. makeCollage
6. replaceTile
7. colorizeTile
8. grayscaleTile


Enter a number => 1

What would you like to do now?
1. Test new image file
2. Test new method on the same image file
3. Quit
Enter a number => 2


Which method would you like to test? Methods 3-8 rely on the constructor previously chosen.
1. one-argument constructor
2. three-argument constructor
3. showOriginalPicture
4. showCollagePicture
5. makeCollage
6. replaceTile
7. colorizeTile
8. grayscaleTile


Enter a number => 4
```

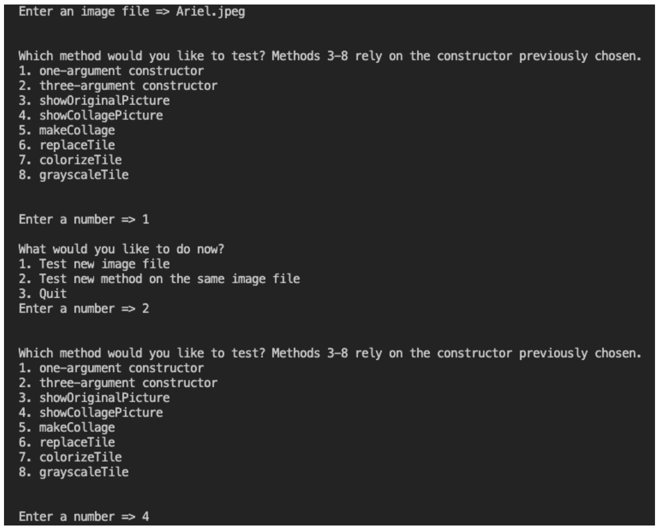


The original image (Ariel.jpeg) has 1536 rows x 1819 columns. The collage image that results from the one-argument constructor (on the left) has 600 rows by 600 columns.

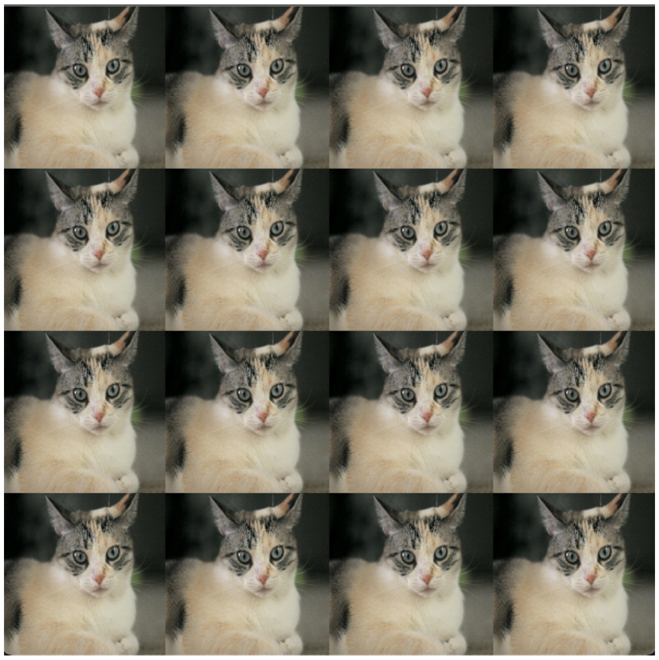
The scaling method made the original image smaller to fit into the collage picture size.

4. **makeCollage**
   - make a tile of *tileDimension* x *tileDimension* pixels by scaling down the original picture.

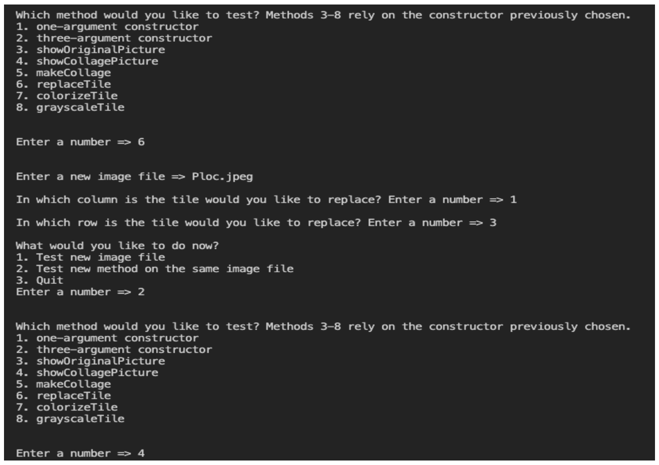
  - update the collage picture to be a collage of these tiles. Meaning, each tile is repeated in the image.
  - the collage picture will have *collageDimension* x *collageDimension* tiles.



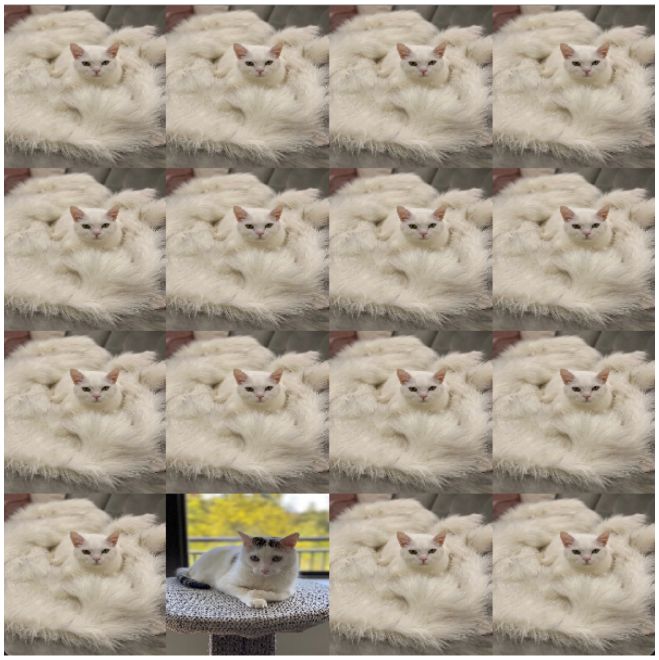
```
Enter an image file => Ariel.jpeg


Which method would you like to test? Methods 3-8 rely on the constructor previously chosen.
1. one-argument constructor
2. three-argument constructor
3. showOriginalPicture
4. showCollagePicture
5. makeCollage
6. replaceTile
7. colorizeTile
8. grayscaleTile


Enter a number => 1

What would you like to do now?
1. Test new image file
2. Test new method on the same image file
3. Quit
Enter a number => 2


Which method would you like to test? Methods 3-8 rely on the constructor previously chosen.
1. one-argument constructor
2. three-argument constructor
3. showOriginalPicture
4. showCollagePicture
5. makeCollage
6. replaceTile
7. colorizeTile
8. grayscaleTile


Enter a number => 4
```



5. **replaceTile**
   - replaces a tile on the collage picture with another image.

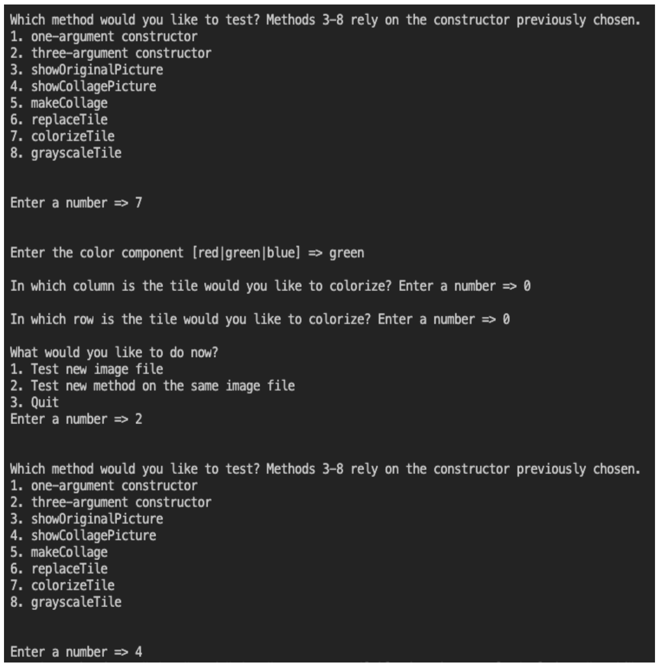


```
Which method would you like to test? Methods 3-8 rely on the constructor previously chosen.
1. one-argument constructor
2. three-argument constructor
3. showOriginalPicture
4. showCollagePicture
5. makeCollage
6. replaceTile
7. colorizeTile
8. grayscaleTile


Enter a number => 6


Enter a new image file => Ploc.jpeg

In which column is the tile would you like to replace? Enter a number => 1

In which row is the tile would you like to replace? Enter a number => 3

What would you like to do now?
1. Test new image file
2. Test new method on the same image file
3. Quit
Enter a number => 2


Which method would you like to test? Methods 3-8 rely on the constructor previously chosen.
1. one-argument constructor
2. three-argument constructor
3. showOriginalPicture
4. showCollagePicture
5. makeCollage
6. replaceTile
7. colorizeTile
8. grayscaleTile


Enter a number => 4
```

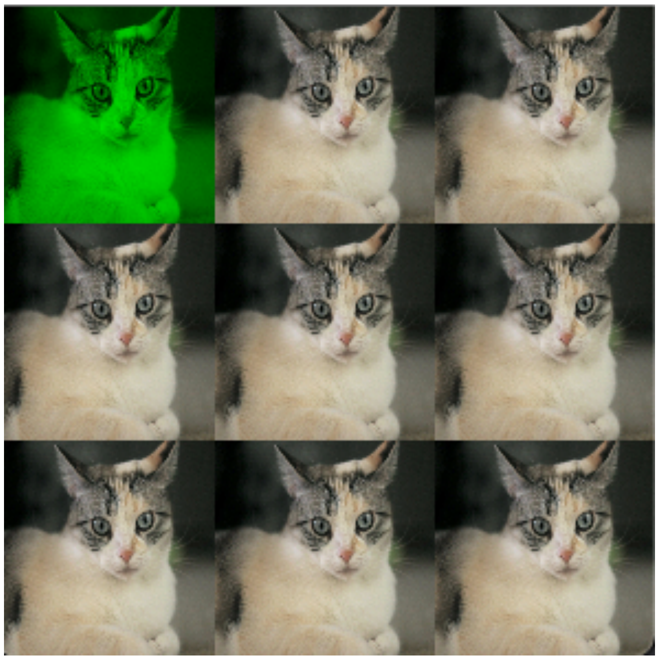


6. **colorizeTile**
   - colorizes a tile in the collage picture using red, green, or blue component.
   - to colorize a tile “green” do for every pixel:
     1. get the pixel’s color’s green intensity.
     2. update/set the pixel with only it’s green component.

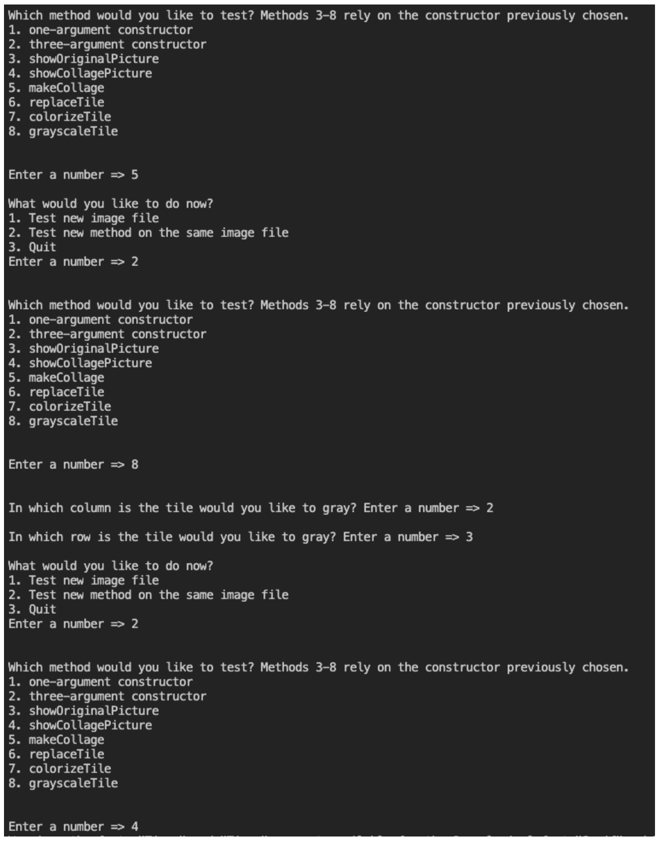
```
Color color = picture.get(col, row);

int g = color.getGreen();

color.set(col, row, new Color(0, g, 0));
```



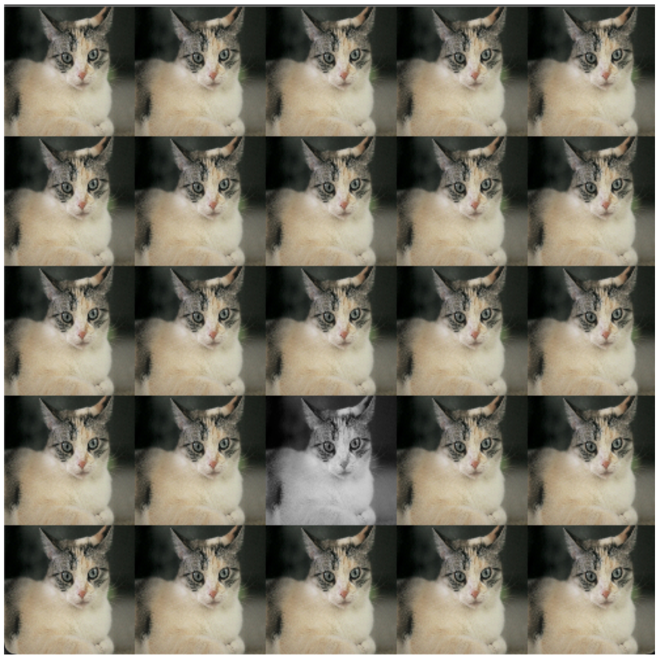
```
Which method would you like to test? Methods 3-8 rely on the constructor previously chosen.
1. one-argument constructor
2. three-argument constructor
3. showOriginalPicture
4. showCollagePicture
5. makeCollage
6. replaceTile
7. colorizeTile
8. grayscaleTile


Enter a number => 7


Enter the color component [red|green|blue] => green

In which column is the tile would you like to colorize? Enter a number => 0

In which row is the tile would you like to colorize? Enter a number => 0

What would you like to do now?
1. Test new image file
2. Test new method on the same image file
3. Quit
Enter a number => 2


Which method would you like to test? Methods 3-8 rely on the constructor previously chosen.
1. one-argument constructor
2. three-argument constructor
3. showOriginalPicture
4. showCollagePicture
5. makeCollage
6. replaceTile
7. colorizeTile
8. grayscaleTile


Enter a number => 4
```



7. **grayscaleTile**
    - grayscale a tile of the collage picture.
    - update the pixel’s color of a tile to have the grayscale value computed by applying the toGray() method provide.



```
Which method would you like to test? Methods 3-8 rely on the constructor previously chosen.
1. one-argument constructor
2. three-argument constructor
3. showOriginalPicture
4. showCollagePicture
5. makeCollage
6. replaceTile
7. colorizeTile
8. grayscaleTile


Enter a number => 5

What would you like to do now?
1. Test new image file
2. Test new method on the same image file
3. Quit
Enter a number => 2


Which method would you like to test? Methods 3-8 rely on the constructor previously chosen.
1. one-argument constructor
2. three-argument constructor
3. showOriginalPicture
4. showCollagePicture
5. makeCollage
6. replaceTile
7. colorizeTile
8. grayscaleTile


Enter a number => 8


In which column is the tile would you like to gray? Enter a number => 2

In which row is the tile would you like to gray? Enter a number => 3

What would you like to do now?
1. Test new image file
2. Test new method on the same image file
3. Quit
Enter a number => 2


Which method would you like to test? Methods 3-8 rely on the constructor previously chosen.
1. one-argument constructor
2. three-argument constructor
3. showOriginalPicture
4. showCollagePicture
5. makeCollage
6. replaceTile
7. colorizeTile
8. grayscaleTile


Enter a number => 4
```



Implementation Notes

Update and submit the Collage.java file on Autolab.

Observe the following rules:

DO NOT use System.exit().
DO NOT add/rename the project or package statements.
DO NOT change the class name.
DO NOT add import statements other than the Color class already in the Collage.java file.

DO NOT change the headers of ANY of the given methods.
DO NOT add any new class fields.
You may USE any of the libraries provided in the zip file.

VSCode Extensions

You can install VSCode extension packs for Java. Take a look at this tutorial. We suggest:

- Extension Pack for Java
- Project Manager for Java
- Debugger for Java

Importing VSCode Project [how to video]

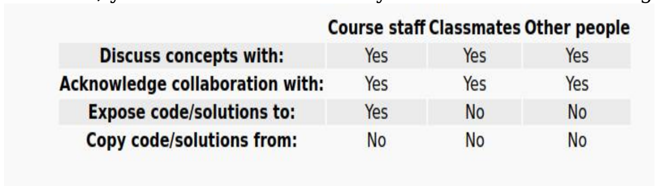
1. Download the zip file from Autolab Attachments.
2. Unzip the file by double clicking it.
3. Open VSCode
   - Import the folder to a workspace through **File > Open Folder**

Executing and Debugging

- You can run your program through VSCode or you can use the Terminal to compile and execute. We suggest running through VSCode because it will give you the option to debug.
- How to debug your code
- If you choose the Terminal, from ArtCollage directory/folder:
  - to compile: **javac -d bin src/art/*.java**
  - to execute: **java -cp bin art.Driver**

Before submission

- *Collaboration policy*. All assignments and exams are individual but we encourage collaboration with course staff and classmates. However, you must be careful how you collaborate. Use the guidelines bellow for reference:



	Course staff	Classmates	Other people
Discuss concepts with:	Yes	Yes	Yes
Acknowledge collaboration with:	Yes	Yes	Yes
Expose code/solutions to:	Yes	No	No
Copy code/solutions from:	No	No	No

- *Submitting the assignment*. Submit *Collage.java* via the web submission system called Autolab. To do this, click the *Assignments* link from the course website; click the *Submit* link for that assignment.

Getting help

If anything is unclear, don't hesitate to post a question on Piazza.

Uses libraries and content from Introduction to Computer Science book.