Alexandria University
Faculty of Engineering
Computer and Systems Engineering Dept.

CSE272: Programming 2
Programming Assignment 1
Spring 2017
Due date: 19 March 2017

Vector Based Drawing Application

Objectives

Upon completion of this assignment, you will be able to:

- Design an object oriented model for geometric shapes
- Draw a UML class diagram that represents your model
- Apply the OOP concepts of inheritance and polymorphism to your design
- Create an advanced GUI with 2D Graphics capabilities
- Enable dynamic extensions to your applications

Part 1: Geometric Shapes Data Model

Description:

Geometric shapes belong to different groups (ex: Elliptical Shapes, Polygons, Sectors…etc). Members of these different groups are related to each other in the sense that they share common properties. In order to be able to implement an efficient and object oriented drawing application. It is essential to design a model that takes these relations into consideration.

Tasks:

1- Design an object oriented model that covers the following geometric shapes: Line Segment, Circle, Ellipse, Triangle, Rectangle and Square.
2- Draw a UML Class diagram that represents your model, showing all the classes, attributes and methods.
3- Apply the concepts of inheritance and polymorphism to your design.

```java
package eg.edu.alexu.cse.oop.draw;

public interface Shape{
	/* set position */
	public void setPosition(java.awt.Point position);
	public java.awt.Point getPosition();

	/* update shape specific properties (e.g., radius) */
	public void setProperties(java.util.Map<String, Double> properties);
	public java.util.Map<String, Double> getProperties();

	/* colorize */
	public void setColor(java.awt.Color color);
	public java.awt.Color getColor();
	public void setFillColor(java.awt.Color color);
	public java.awt.Color getFillColor();

	/* redraw the shape on the canvas */
	public void draw(java.awt.Graphics canvas);

	/* create a deep clone of the shape */
	public Object clone() throws CloneNotSupportedException;
}
```

```java
package eg.edu.alexu.cse.oop.draw;

public interface DrawingEngine {
	/* manage shapes objects */
	public void addShape(Shape shape);
	public void removeShape(Shape shape);

	/* return the created shapes objects */
	public Shape[] getShapes();
	/* redraw all shapes on the canvas */
	public void refresh(java.awt.Graphics canvas);

	/* return the classes (types) of supported shapes that can
	 * be dynamically loaded at runtime (see Part 3) */
	public java.util.List<Class<? extends Shape>> getSupportedShapes();
	/* add to the supported shapes the new shape class (see Part 3) */
	public void installPluginShape (Class<? extends Shape> shapeClass);

	/* limited to 20 steps. Only consider in undo & redo
	 * these actions: addShape, removeShape*/
	public void undo();
	public void redo();
}
```

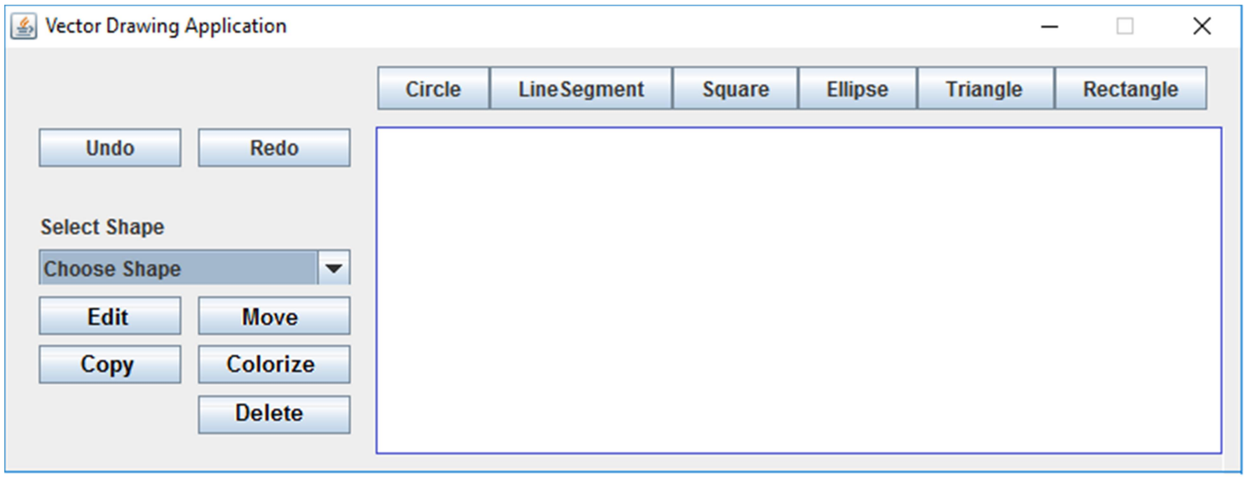
Part 2: Drawing and Painting Application

Description:

Drawing and painting applications are very popular and have a huge user base. They generally offer a big number of features that includes but is not limited to: Drawing, Coloring, and Resizing. They also include a number of built in, and possibly extensible set of geometric shapes, and classically, they allow the user to undo or redo any instructions so as to make the application more usable

Tasks:

1- Implement your design from part 1 in Java.
2- Design and implement a GUI that allows the drawing functionalities for the user on all the shapes defined in part 1.
3- There is no need to use the cursor in drawing. Just use a set of buttons to select the shape. Upon pressing the button, a dialog box appears to enter the properties of the shape such as: position, radius, length, …, etc.



4- In order to support the operations of edit, move, copy, colorize and delete a shape, there should be a way to select the shape. Add a drop-down menu that shows all the drawn shapes. You can use any arbitrary names for the drawn shapes (For example: circle01, square_04, …, etc). That way, the user can select a shape then applies an operation on it.
5- Implement your application such that it would allow the user to undo or redo any action performed.

Part 3: Dynamic Application Extensions and plug-ins

Description:

The concept of dynamic class loading is widely spread in computer applications. It is an option that allows the user to extend application features at runtime. This can be easily done by the dynamic class loading capabilities that OOP languages offer.

Tasks:

1- Create a new kind of the Shapes rather than the ones at Part 1 (e.g. Trapezoid, Star, Diamond, …, etc.)
2- Compile the class of the new kind as a class library (i.e. Jar file).
3- Provide an option in the GUI of your application that allows installing new shape. The user will see a dialog that allows him to enter:
    a. The fully qualified name of the shape class, and
    b. The path of the class library file (i.e. Jar file).
4- On installing and loading the class library file, the new shape should be appended to the available list of shapes in the application (use your method ***addNewSupportedShape***). The GUI will ask the engine to get its currently supported list of shapes using the method ***getSupportedShapes***, and add a new button for drawing the new shape

Deliverables

- Due date: Week #6, starting at 19 March 2017
- You should work in groups of four.
- The implementation for the given interfaces (DO NOT change anything to it).
- Develop this assignment in Java (**Hint**: Part 3 needs ***Reflection*** feature support).
- A self executable Jar: The program should be executable by simply double clicking the icon (not from the IDE), provided that you have a running JRE.
- A jar file contains your new plugin shape (Part 3).
- You should deliver your source code using your git repository.
- You are free to use any graphics libraries (Swing, AWT or SWT).
- You should deliver a report that contains the required UML diagram, describes your design thoroughly, and contains snapshots of your GUI and a user guide that explains how to use your application. Any design decisions that you have made should be listed clearly.
- Any cheating discovered will be penalized by zero in all year work marks for parties involved, so delivering nothing is so much better than delivering a copy.