```java
/* Chapter No. 08 - Project No. 06
    File Name:          Chapter08Project06.java
    Programmer:         Andrew Caldwell
    Date Last Modified: Feb. 6, 2014

    Problem Statement:
                Implement classes from 8.5

    Overall Plan
    * make a coordinate system that can hold the figures.
    * find an algorithm used to draw pixels
    * use algorithm in Screen class
    * just use the figures for holding their points

    Classes needed and Purpose
    main class - Chapter08Project06
    Figure - Abstract base class
    Rectangle - Figure subclass
    Triangle - Figure subclass
    Screen - grid
        Point - X,Y
        Frame - bounds and origin
*/


import java.io.*;

public class Chapter08Project06 {
        public static Frame DEFAULT_FRAME = new Frame(10,10,new Point(
10,10));

        public static void main(String[] args) {
                Screen s = new Screen(getTerminalFrame());
                Figure r = new Rectangle(s,DEFAULT_FRAME);
                Figure t = new Triangle(s,DEFAULT_FRAME);

                r.draw();
                r.center();
                t.draw();

                s.print();
        }

        public static Frame getTerminalFrame() {
                Frame terminalFrame = new Frame();

                BufferedReader input;
                Process process;
```

```
            String line;

            try {
                // get height
                String[] tputLines = {"/bin/bash","-c","tput lines"};
                        process = Runtime.getRuntime().exec(tputLines
);
                    input = new BufferedReader(new InputStreamReader(
process.getInputStream()));

                    if ((line = input.readLine()) != null) {
                        terminalFrame.setHeight(Integer.parseInt(line
));
                    } else {
                        throw new IOException();
                    }
                    input.close();

                    // get width
                    String[] tputCols = {"/bin/bash","-c","tput cols"
};
                    process = Runtime.getRuntime().exec(tputCols);
                    input = new BufferedReader(new InputStreamReader(
process.getInputStream()));

                    if ((line = input.readLine()) != null) {
                        terminalFrame.setWidth(Integer.parseInt(line)
);
                    } else {
                        throw new IOException();
                    }
                    input.close();

                } catch (IOException e) {
                        // 80,25
                        terminalFrame.setWidth(80);
                        terminalFrame.setHeight(25);
                }

                return terminalFrame;
        }
}
```

```
public abstract class Figure {
        private Screen _screen;
        private Frame _frame;
        void draw() {
                printClassAndCallingMethod();
        }
        void erase() {
                printClassAndCallingMethod();
        }
        void center() {
                erase();

                Point center = new Point(getScreen().getFrame().getWi
dth()/2,getScreen().getFrame().getHeight()/2);
                int xOffset = getFrame().getWidth()/2;
                int yOffset = getFrame().getHeight()/2;
                Point offsetOrigin = new Point(center.getX() - xOffse
t, center.getY() - yOffset);
                Frame centeredFrame = new Frame(getFrame().getWidth()
,getFrame().getHeight(),offsetOrigin);
                setFrame(centeredFrame);

                draw();
        }
        public void printClassAndCallingMethod() {
                Exception e = new Exception();
                e.fillInStackTrace();
                System.out.println(getClass().getName() + ": " + e.ge
tStackTrace()[1].getMethodName());
        }

        public Point[] getCorners() {
                Point[] array = {upperLeft(),upperRight(),lowerRight(
),lowerLeft()};
                return array;
        }
        public Point upperLeft() {
                return getFrame().getOrigin();
        }
        public Point upperRight() {
                return new Point(getFrame().getOrigin().getX() + getF
rame().getWidth(), getFrame().getOrigin().getY());
        }
        public Point lowerLeft() {
                return new Point(getFrame().getOrigin().getX(), getFr
ame().getOrigin().getY() + getFrame().getHeight());
        }
        public Point lowerRight() {
                return new Point(upperRight().getX(),lowerLeft().getY
());
        }


        // boiler
```

```
	public void setFrame(Frame frame) {
		_frame = frame;
	}
	public Frame getFrame() {
		return _frame;
	}
	public void setScreen(Screen screen) {
		_screen = screen;
	}
	public Screen getScreen() {
		return _screen;
	}

}
```

```
public class Frame {
	private int _width;
	private int _height;
	private Point _origin;

	Frame() {
		this(0,0);
	}
	Frame(int width, int height) {
		this(width,height,new Point(0,0));
	}
	Frame(int width, int height, Point origin) {
		setWidth(width);
		setHeight(height);
		setOrigin(origin);
	}
	Frame(Frame frame) {
		setWidth(frame.getWidth());
		setHeight(frame.getHeight());
		setOrigin(frame.getOrigin());
	}

	public boolean inBounds(Point point) {
		boolean xInBounds = (point.getX() < getOrigin().getX(
) + getWidth());
		boolean yInBounds = (point.getY() < getOrigin().getY(
) + getHeight());
		return xInBounds && yInBounds;
	}

	// Boiler
	public int getWidth() {
		return _width;
	}
	public int getHeight() {
		return _height;
	}
	public Point getOrigin() {
		return _origin.copy();
	}
	public void setWidth(int width) {
		if (width < 0)
			throw new IllegalArgumentException("Negative "
 + width + "width.");
		_width = width;
	}
	public void setHeight(int height) {
		if (height < 0)
			throw new IllegalArgumentException("Negative "
 + height + "height.");
		_height = height;
	}
	public void setOrigin(Point origin) {
		_origin = origin;
	}
	public Frame copy() {
		return new Frame(getWidth(),getHeight(),getOrigin());
	}
	@Override
	public String toString() {
		return "<" + getWidth() + "," + getHeight() + "," + g
etOrigin() + ">";
	}

}
```

```
public class Point {
	int _x;
	int _y;
	Point(Point point) {
		this(point.getX(), point.getY());
	}
	Point(int x, int y) {
		setX(x);
		setY(y);
	}

	// getters
	public int getX() {
```

```
                return _x;
        }
        public int getY() {
                return _y;
        }

        // setters
        public void setX(int x) {
                if (x < 0)
                        throw new IllegalArgumentException("Negative "
 + x + " x.");
                _x = x;
        }
        public void setY(int y) {
                if (y < 0)
                        throw new IllegalArgumentException("Negative "
 + y + " y.");
                _y = y;
        }
        // Object
        @Override
        public String toString() {
                return "(" + this.getX() + "," + this.getY() + ")";
        }

        @Override
        public boolean equals(Object o) {
                if (o == null) {
                        return false;
                }
                else if (o.getClass() != this.getClass()) {
                        return false;
                }
                else  {
                        Point p = (Point)o;
                        boolean xIsEqual = this.getX() == p.getX();
                        boolean yIsEqual = this.getY() == p.getY();
                        return xIsEqual && yIsEqual;
                }
        }
        public Point copy() {
                return new Point(this);
        }
}
```

```
public class Rectangle extends Figure {
        Rectangle(Screen screen,Frame frame) {
                setScreen(screen);
                setFrame(frame);
        }
        @Override
        void draw() {
                // Naaaaaants ingonyama bagithi Baba!
                // Sithi uhm ingonyama!
                // It's the Cirrrrcle of Life!
                getScreen().addLine(upperLeft(),upperRight());
                getScreen().addLine(upperRight(),lowerRight());
                getScreen().addLine(lowerRight(),lowerLeft());
                getScreen().addLine(lowerLeft(),upperLeft());
        }
        @Override
        void erase() {
                getScreen().removeLine(upperLeft(),upperRight());
                getScreen().removeLine(upperRight(),lowerRight());
                getScreen().removeLine(lowerRight(),lowerLeft());
                getScreen().removeLine(lowerLeft(),upperLeft());
        }
}
```

```
import java.util.Arrays;
public class Screen {
        private boolean[][] _grid;
        private Frame _frame;

        Screen(Frame frame) {
                setFrame(frame);
        }

        private void plot(int x,int y) {
                _grid[x][y] = true;
        }
        private void free(int x,int y) {
                _grid[x][y] = false;
        }
        public void print() {
                for (int y = 0;y < getFrame().getHeight();y++) {
                        for (int x = 0;x < getFrame().getWidth();x++)
 {
                                boolean isFilled = _grid[x][y];
                                String s = (isFilled)?"*":" ";
                                System.out.print(s);
```

```
				}
				System.out.println();
			}
		}
		public void addLine(Point pointA, Point pointB) {
			if (!(getFrame().inBounds(pointA) || getFrame().inBou
nds(pointB))) {
				throw new IllegalArgumentException("Line out
of bounds");
			}

			int x0 = pointA.getX();
			int y0 = pointA.getY();
			int x1 = pointB.getX();
			int y1 = pointB.getY();

			// Bresenham's line algorithm
			int deltaX = Math.abs(x0 - x1);
			int deltaY = Math.abs(y0 - y1);
			int stepX = x0<x1 ? 1 : -1;
			int stepY = y0<y1 ? 1 : -1;
			int error = ((deltaX>deltaY)?deltaX:-deltaY)/2;
			int deltaError;

			for (;;) {
				plot(x0,y0);
				if (x0 == x1 && y0 == y1)
					break;
				deltaError = error;
				if (deltaError > -deltaX) {
					error -= deltaY;
					x0 += stepX;
				}
				if (deltaError < deltaY) {
					error += deltaX;
					y0 += stepY;
				}
			}
		}
		public void removeLine(Point pointA, Point pointB) {
			if (!(getFrame().inBounds(pointA) || getFrame().inBou
nds(pointB))) {
				throw new IllegalArgumentException("Line out
of bounds");
			}

			int x0 = pointA.getX();
			int y0 = pointA.getY();
			int x1 = pointB.getX();
			int y1 = pointB.getY();
```

```
                // Bresenham's line algorithm
                int deltaX = Math.abs(x0 - x1);
                int deltaY = Math.abs(y0 - y1);
                int stepX = x0<x1 ? 1 : -1;
                int stepY = y0<y1 ? 1 : -1;
                int error = ((deltaX>deltaY)?deltaX:-deltaY)/2;
                int deltaError;

                for (;;) {
                        free(x0,y0);
                        if (x0 == x1 && y0 == y1)
                                break;
                        deltaError = error;
                        if (deltaError > -deltaX) {
                                error -= deltaY;
                                x0 += stepX;
                        }
                        if (deltaError < deltaY) {
                                error += deltaX;
                                y0 += stepY;
                        }
                }
        }
        // boiler
        public boolean[][] getGrid() {
                boolean[][] publicGrid = new boolean[_grid.length][_g
rid[0].length];
                for (int x = 0;x < _grid.length; x++) {
                        for (int y = 0;y < _grid[0].length; y++) {
                                publicGrid[x][y] = _grid[x][y];
                        }
                }

                return publicGrid;
        }
        public Frame getFrame() {
                return _frame;
        }
        public void setFrame(Frame frame) {
                _frame = frame;
                if (_grid != null) {
                        boolean[][] newGrid = new boolean[frame.getWi
dth()][frame.getHeight()];
                        for (int x = 0;x < newGrid.length;x++) {
                                for (int y = 0;y < newGrid[x].length;
y++) {
                                        newGrid[x][y] = _grid[x][y];
                                }
                        }
                        _grid = newGrid;
                } else {
                        _grid = new boolean[frame.getWidth()][frame.g
etHeight()];
                }
        }

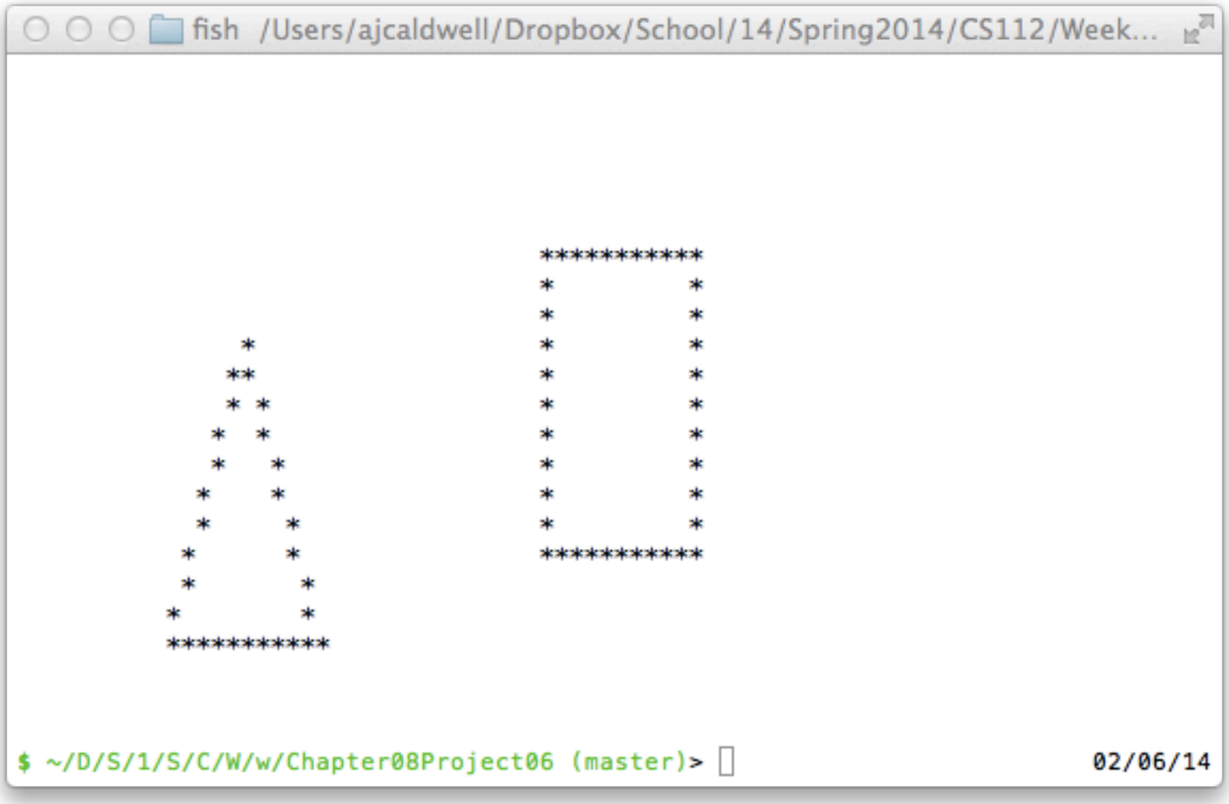
}
```

```
public class Triangle extends Figure {
        Triangle(Screen screen) {
                this(screen,new Frame());
        }
        Triangle(Screen screen, Frame frame) {
                setScreen(screen);
                setFrame(frame);
        }
        @Override
        void draw() {
                // Naaaaaants ingonyama bagithi Baba!
                // Sithi uhm ingonyama!
                // It's the Cirrrrcle of Life!

                getScreen().addLine(upperMiddle(),lowerRight());
                getScreen().addLine(lowerRight(),lowerLeft());
                getScreen().addLine(lowerLeft(),upperMiddle());
        }

        @Override
        void erase() {
                getScreen().removeLine(upperMiddle(),lowerRight());
                getScreen().removeLine(lowerRight(),lowerLeft());
                getScreen().removeLine(lowerLeft(),upperMiddle());
        }

        public Point upperMiddle() {
                return new Point(getFrame().getOrigin().getX() + getF
rame().getWidth()/2, getFrame().getOrigin().getY());
        }
}
```



```
fish  /Users/ajcaldwell/Dropbox/School/14/Spring2014/CS112/Week…
```

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              **                   *         *
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          ***********

$ ~/D/S/1/S/C/W/w/Chapter08Project06 (master)>                  02/06/14
```

Test