COMPUTER PROGRAMMING FOR GIS

CODING WITH C(HIKONDI)

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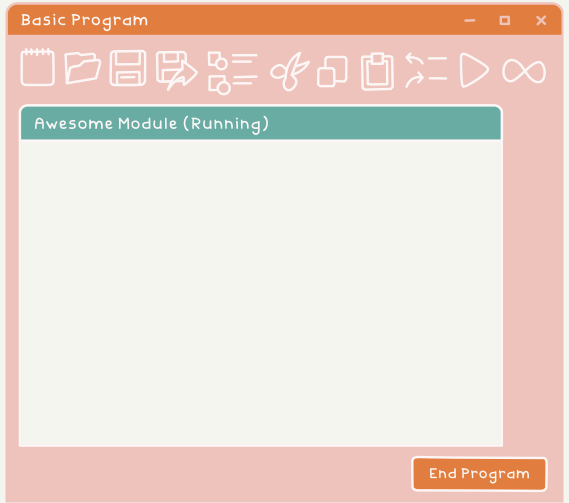

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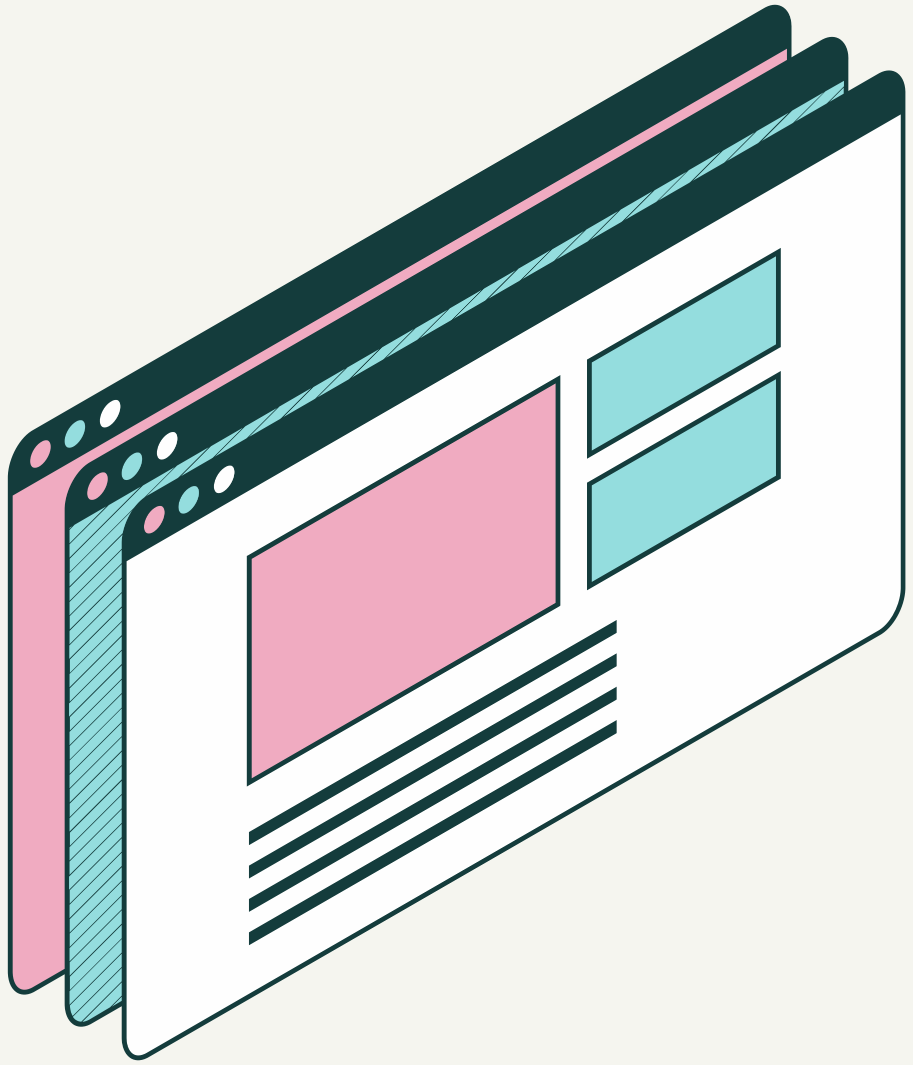

PRESENTATION

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PROGRAMMING LANGUAGES

Python

- General purpose
- Very popular
- Object oriented programming
- Interpreted
- High-level language

C

- General purpose
- Very popular
- Procedural oriented programming
- Compiled
- Low-level language

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OBJECT ORIENTED PROGRAMMING (OOP)

PYTHON, JAVA, C++, RUBY

- Common programming approach
- Grouping into classes and objects
- Modular units (code blocks)

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FEATURES OF OBJECT ORIENTED PROGRAMMING

ENCAPSULATION

Helps to minimze number of parameters by grouping variables & functions together.

ABSTRACTION

Hides complexity by showing essentials. Reduces the impact of change.

INHERITANCE

Eliminates redundant code.

POLYMORPHISM

Easy to adjust.

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PROCEDURAL ORIENTED PROGRAMMING

C, PASCAL, FORTRAN

- Set of ordered steps to reach a certain state
- Not about whether there are objects or classes
- Data can easily be accessed

KEY DIFFERENCES IN CODING

Commands	Python	C
Display output	print( )	printf ( );
Comments	#	// or /*
Assigning variables	=	=
Display integer	type(int)	scanf("%d" &b)

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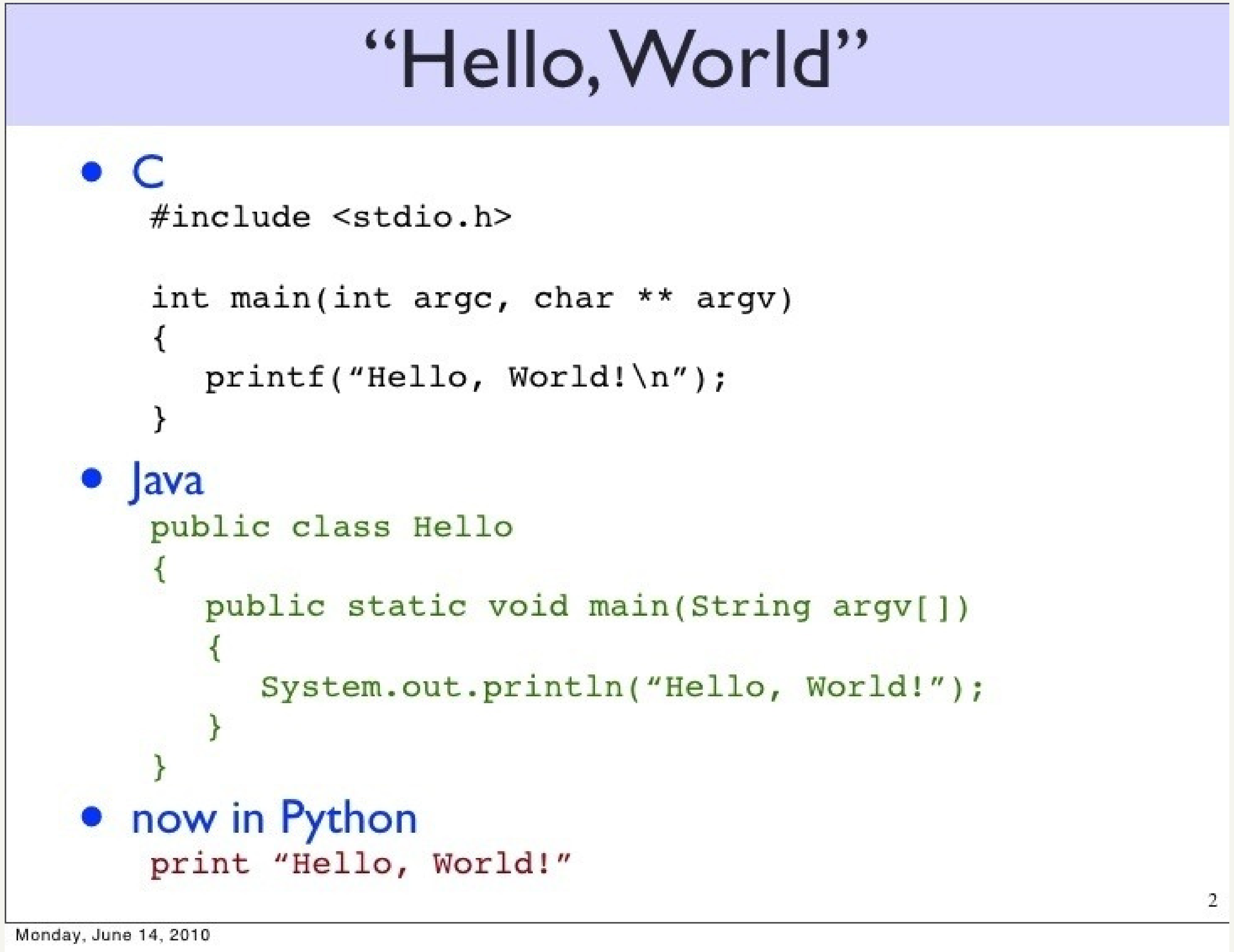
EXAMPLE



“Hello, World”

- C

```
#include <stdio.h>

int main(int argc, char ** argv)
{
   printf(“Hello, World!\n”);
}
```

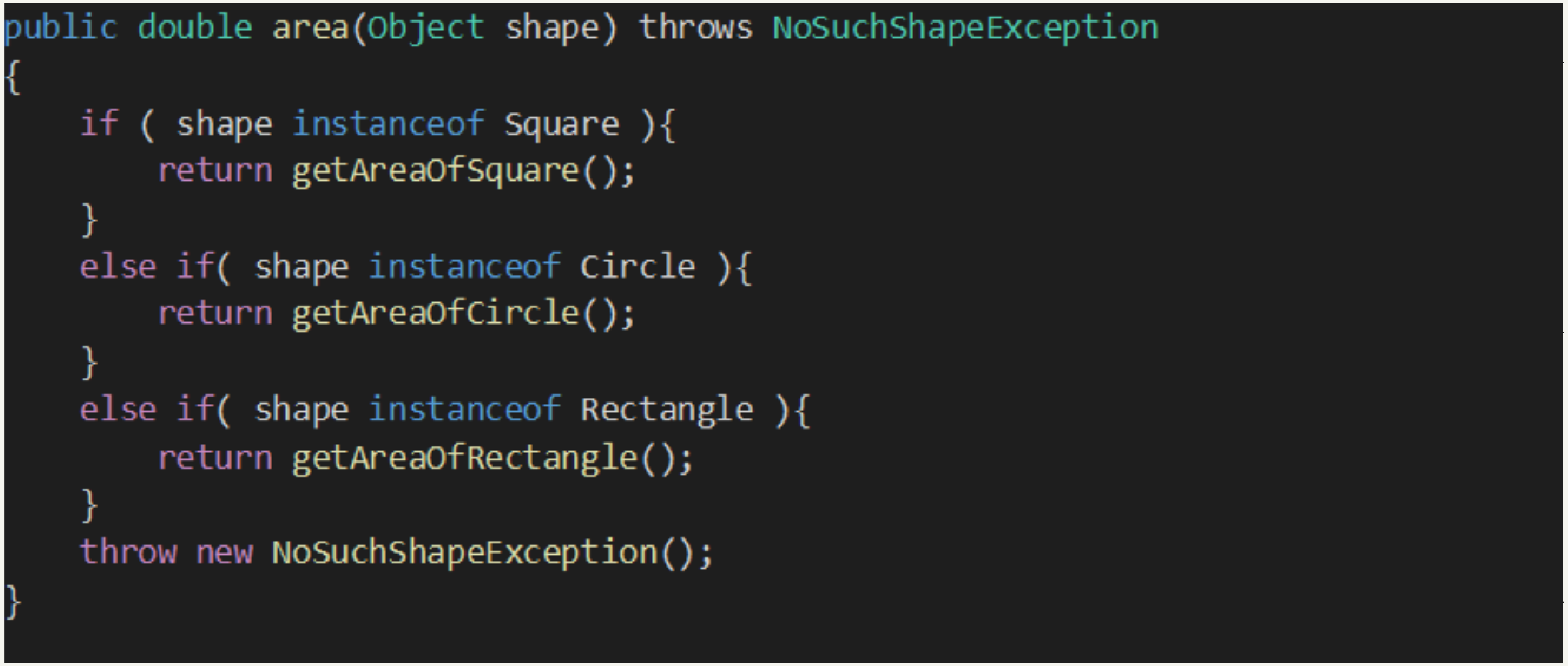
- Java

```
public class Hello
{
   public static void main(String argv[])
   {
      System.out.println(“Hello, World!”);
   }
}
```

- now in Python

```
print “Hello, World!”
```

EXAMPLE OF OOP VS. POP



```
public double area(Object shape) throws NoSuchShapeException
{
    if ( shape instanceof Square ){
        return getAreaOfSquare();
    }
    else if( shape instanceof Circle ){
        return getAreaOfCircle();
    }
    else if( shape instanceof Rectangle ){
        return getAreaOfRectangle();
    }
    throw new NoSuchShapeException();
}
```

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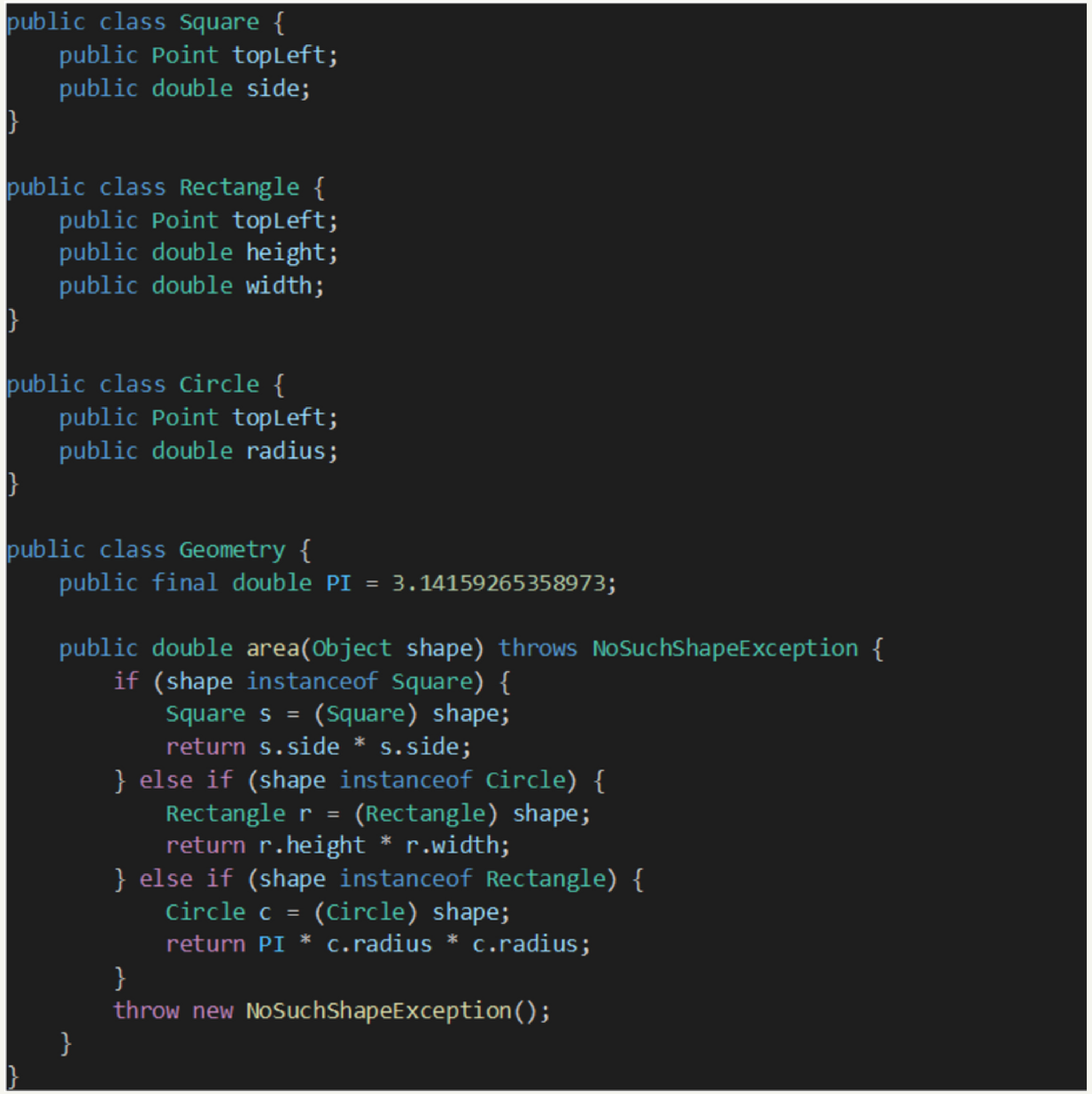
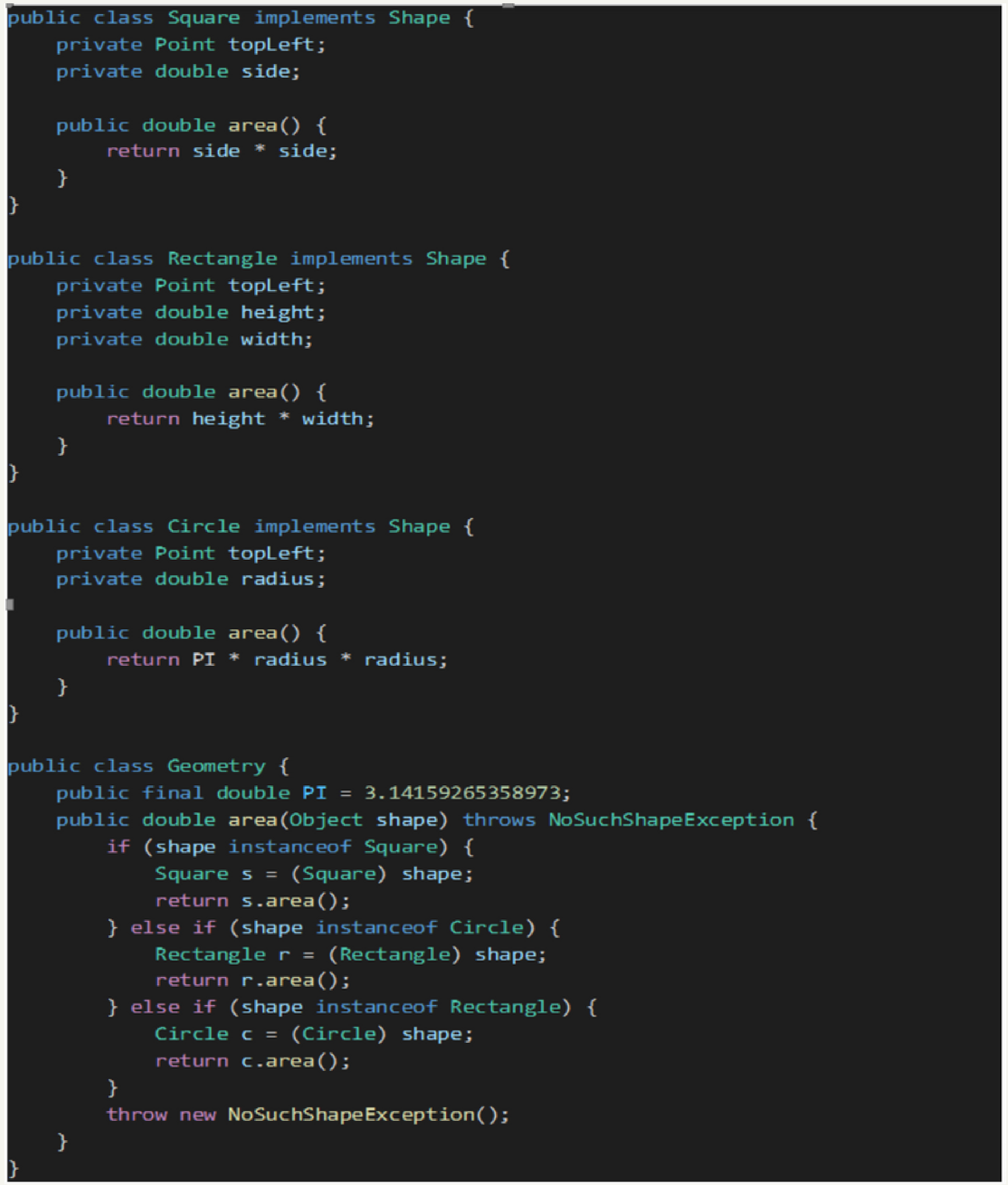
PROCEDURAL ORIENTED



```
public class Square {
    public Point topLeft;
    public double side;
}

public class Rectangle {
    public Point topLeft;
    public double height;
    public double width;
}

public class Circle {
    public Point topLeft;
    public double radius;
}

public class Geometry {
    public final double PI = 3.141592653589793;

    public double area(Object shape) throws NoSuchShapeException {
        if (shape instanceof Square) {
            Square s = (Square) shape;
            return s.side * s.side;
        } else if (shape instanceof Circle) {
            Rectangle r = (Rectangle) shape;
            return r.height * r.width;
        } else if (shape instanceof Rectangle) {
            Circle c = (Circle) shape;
            return PI * c.radius * c.radius;
        }
        throw new NoSuchShapeException();
    }
}
```

OBJECT ORIENTED



```
public class Square implements Shape {
    private Point topLeft;
    private double side;

    public double area() {
        return side * side;
    }
}

public class Rectangle implements Shape {
    private Point topLeft;
    private double height;
    private double width;

    public double area() {
        return height * width;
    }
}

public class Circle implements Shape {
    private Point topLeft;
    private double radius;

    public double area() {
        return PI * radius * radius;
    }
}

public class Geometry {
    public final double PI = 3.141592653589793;
    public double area(Object shape) throws NoSuchShapeException {
        if (shape instanceof Square) {
            Square s = (Square) shape;
            return s.area();
        } else if (shape instanceof Circle) {
            Rectangle r = (Rectangle) shape;
            return r.area();
        } else if (shape instanceof Rectangle) {
            Circle c = (Circle) shape;
            return c.area();
        }
        throw new NoSuchShapeException();
    }
}
```

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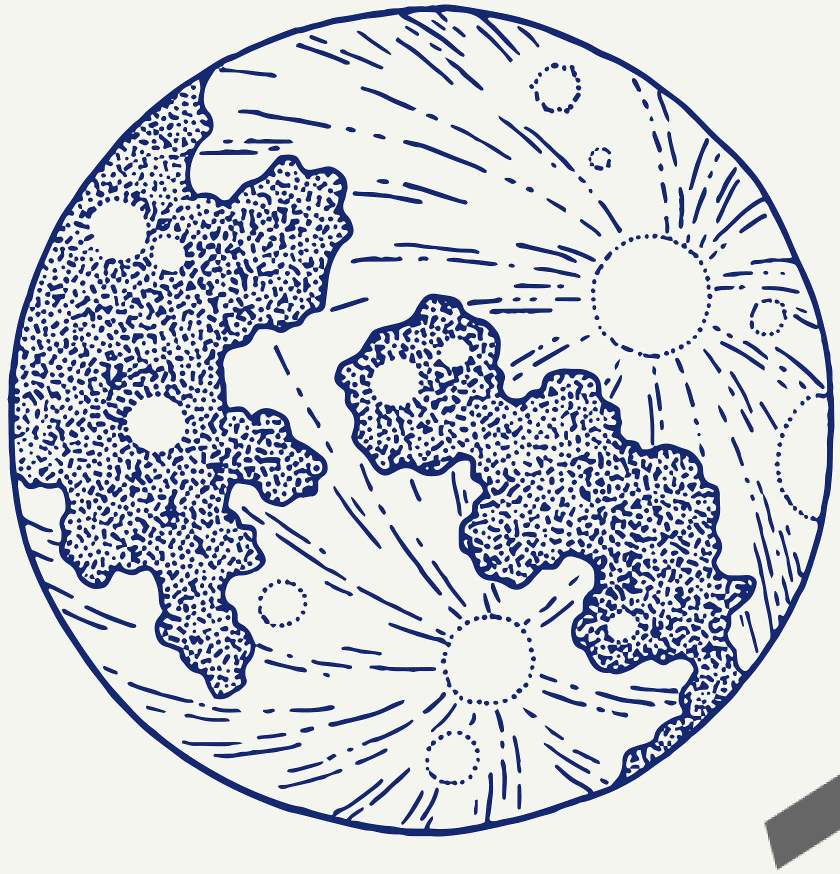
C & GIS

APPLICATIONS

- Not often used for analysis and modeling
- GRASS GIS - started in 1980s by US Army
- Geospatial Abstraction Database Library (GDAL)
- Einheitliche Datenbankschnittstelle (EDBS) Reader - Database for spatial data, written in C
- GIS Packages



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THANK YOU! QUESTIONS?

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SOURCES

https://realpython.com/python3-object-oriented-programming/
https://www.youtube.com/watch?v=pTB0EiLXUC8
https://www.programiz.com/python-programming/object-oriented-programming
https://junilearning.com/blog/guide/what-is-python-101-for-students/
https://medium.com/swlh/procedural-vs-object-oriented-coding-style-a25b0a78f01b
https://www.e-education.psu.edu/geog583/node/67
https://www.gislounge.com/open-source-gis-applications/#:~:text=Popular%20%E2%80%9CC%E2%80%9D%20based%20open%20source,JAVA%20as%20the%20implementation%20language.

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