WEEK ELEVEN

Acknowledgements: Slides created based off material provided by Dr. Travis Doom

SOFTWARE DEVELOPMENT

- Analysis
- Design
- Implementation
- Testing
- Maintenance

ANALYSIS

- Description of the desired system/application
  - Tasks it performs
  - Provided data
  - Specifications
- Could involve working with a non-programmer
  - Non-technical language
  - General descriptions

DESIGN

- Decomposition
  - Break requirements down into subsystems/subcomponents
  - Utilize objects, methods to simplify problem
- Pseudocode
  - Describe task in general programming terms
  - Identify useful programming structures (conditionals, loops, methods)
  - Syntax does not need to be followed
  - Verify correctness of logic
- Diagrams
  - UML, flowcharts, etc.

IMPLEMENTATION

- Select language
- Determine necessary packages/libraries, input data
- Utilize good decomposition and structure
- Provide thorough documentation and clean style
- Often need to redesign portions

TESTING

- Critical step
- Perform tests with sample data, inputs, user interactions, etc.
- May test components individually before testing the entire design
- Find and squash bugs (errors in code)
- Debugger is useful for determining cause of issues

MAINTENANCE

- Ensure program continues to work
  - Account for updates to dependencies (packages/libraries)
  - Account for hardware upgrades or wider system compatibility
- Continue to document changes
- Built-in automated tests to avoid new errors
- Often, software development cycle is not linear

OBJECT ORIENTED DESIGN

- Look for nouns in problem description/requirements
  - Potential classes
- Refine the list
  - Look for nouns that may mean the same thing or be represented in the same way
  - Check for nouns that are too broad or not necessary for the problem
  - Determine if each noun represents a class or instance of the class (object)
  - Check for nouns that could be stored as a variable in a class
- For each class
  - Determine what it knows (instance variables)
  - Determine what it does (methods)

UML DIAGRAMS

- Basic structure
  - Class name
  - Attributes (instance variables)
  - Operations (methods)
- Access modifiers are also specified
  - + : public
  - - : private

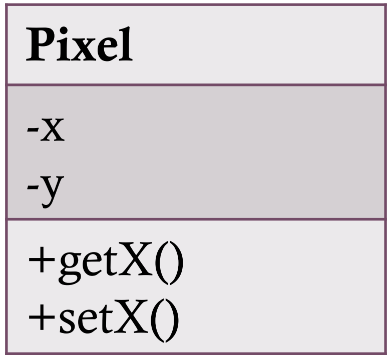
Class name
Attributes
Operations

UML DIAGRAMS CONTINUED

```
public class Pixel {
        private int x = 0;
        private int y = 0;

        public int getX() {
                return x; }

        public void setX(int newX) {
                x = newX; }
}
```



UML DIAGRAMS CONTINUED

- Signatures can also be specified
  - Data type for attributes
  - Parameters for methods
  - Return types for methods

Class name
Attributes : data type
Operation(name : data type) Operation() : return type

UML DIAGRAMS CONTINUED

```
public class Pixel {
        private int x = 0;
        private int y = 0;

        public int getX() {
                return x; }

        public void setX(int newX) {
                x = newX; }
}
```

Pixel
-x : int -y : int
+getX() : int +setX(newX : int) : void

GOOD CONCEPTS TO FOLLOW

- Abstraction: ability to view a complex operation in a simplified form
    - Good classes are abstract representations of objects in the problem domain
- Method Cohesion: degree to which a method implements a single function
    - Methods should execute a well-specified task
    - No surprise side-effects
    - Reusable
- Precondition/postcondition enforcement (defensive programming)
    - Enforce preconditions by verifying input is as expected/necessitated
    - Maintain postcondition consistency

DOCUMENTATION GUIDELINES

- Each class header:
  - Short description of the general purpose of the class
- Each method header:
  - Brief description of method function, parameters, return type
  - Any preconditions/postconditions
- Internal documentation:
  - Description of vague/potentially confusing variables
  - Comment per block of significant code
  - Comment for any strange/unusual operations