
UNIT 1: Classes and Objects

- Problem Solving via Microbot
- Classes vs instances/objects
- Class diagrams, Object diagrams
- State of an object
- Designing your own class (on a pseudocode level)
- Structure of a class (fields, constructor(s), method(s))
- Naming conventions

UNIT 2: Algorithms and Introduction to Java

- Algorithms, pseudocode, and flow charts
- Summation notation (sigma notation)
- Java syntax and style
- Console output (print vs println)
- Literal values vs evaluated expressions
- Variables and data types
- Casting
- Assignment statements
- Scope of a variable (principle of narrowest scope)
- String concatenation
- Boolean expressions, order of operators, De Morgan Laws
- Conditionals, short-circuit evaluation

UNIT 3: Working with Objects and Classes in Java

- Structure of a Java class (fields, constructor(s), method(s))
- Signature of a method
- Method parameters
- Accessor and mutator methods
- Object Creation
- Using a user-defined class as a variable type
- Primitive types vs. Objects
- Method Calls
  - Internal method calls (should be declared as private)
  - External method calls (should be declared as public)
  - Dot notation
- Static class variables
- this keyword
- Abstraction and Modularization
- Encapsulation and information hiding
- Public vs. private
- Debugging strategies (println statements, debugger, tester classes)
- Copy constructors
- Static methods
- Choosing pseudo-random numbers in Java (Math.random, Random class)
UNIT 4: Loops and Iteration
- While loops
- Do while loops
- for loops
- return, continue, and break in loop
- Nested loops

UNIT 5: Strings and the Java API
- Methods of the String class
- Immutability of Strings
- Javadoc comments
- Use class documentation to alter a class

UNIT 6: Arrays and ArrayLists
- Arrays (1-D and 2-D)
- Write an array-based implementation of an ArrayList
- ArrayList class
- For-each loops

UNIT 7: Searching and Sorting
- Sequential search
- Binary search
- Introduction to Big Oh notation / algorithm efficiency
- Selection sort
- Insertion sort
- Bubble sort

UNIT 8: Interfaces and Inheritance
- Single inheritance
- Polymorphism
- Interfaces
- Abstract classes

UNIT 9: Recursion
- Infinite, head, and tail recursion
- Recursive searching algorithms (binary, sequential)
- Recursive sorting algorithms (mergesort, quicksort)

UNIT 10: Data Structures
- Stacks
- Prefix, Infix, Postfix Notation
- Queues

FINAL EXAM + optional AP Exam for all students on Tuesday, May 3, 2016
(Note: This year, the AP exam is the day after we return from Spring Recess)

Topics below will be covered with non-seniors only:

UNIT 11: Exploration of Other Programming Languages
- Introduction to Python (text: Think Python: How to Think Like a Computer Scientist)