Final Exam Review

Outline

- Java API
- Java Review
- Dynamic Arrays
- Linked Lists
- Enumerations
- Inheritance
- Polymorphism
- Stacks and Queues
- File I/O
- Abstract Data Types
- Generics
- Recursion
- Threads / Concurrency
- Networking and Socket Communication
- Graphical User Interfaces
- Regular Expressions
- Fun with Linux
- Performance

Java API

- Java Library
  - http://docs.oracle.com/javase/8/docs/api/
- API
- javadoc

Java Review

- Data Types
- Arrays
- Boolean Expressions
- Conditionals:
  - if-else
  - switch
- Iteration:
  - while and for loops
- Object Oriented Design and Programming
  - State
  - Behavior
  - Constructors
  - Accessors and Mutators
  - Other Important Methods
  - API
  - Static Methods

Dynamic Arrays

- Dynamically sized arrays
  - Java `ArrayList`
    - Like an array but extra-powerful
    - Has no fixed sized
    - Add/remove elements dynamically as needed
    - Contains objects of a specified reference type
    - Cannot hold primitive types (e.g. `double`, `int`)
      - Wrapper objects used instead (e.g. `Double`, `Integer`)
    - Be careful when you add/remove in a loop!
  - Wrapper classes for primitive types

Linked Lists

- Sequential vs. Linked
- Linked List
- Building a Linked List
- Traversing a Linked List
- Inserting and Removing Elements
- Implementation (Circular)

Enumerations

- Avoiding magic numbers
  - Variables takes on a small set of values
  - Use descriptive names instead of literal values
  - Java enumerations
  - Using in a switch statement

Inheritance

- Inheritance
  - Sharing code between related classes
  - Putting similar objects in the same bucket
  - Extremely common in modern OOP languages
- Managing many objects
  - Create class holding a collection of other objects
  - Let's you simplify your main program
  - Hides details of how you store things
- Object hierarchies
  - Several classes inheriting from same base class
  - Concrete versus abstract classes

Polymorphism

- Extending versus Implementing
- Java Interface
  - Multiple Inheritance
- The Iterable Interface
  - Enhanced for Loop

Stacks and Queues

- Abstract Data Types (ADT)
  - Difference from a data structure
  - "Collections" of data
    - Insert
    - Remove
    - Check if empty
  - Stack ADT
    - Last-In First-Out (LIFO)
    - push, pop, isEmpty
  - Queue ADT
    - First-In First-Out (FIFO)
    - enqueue, dequeue, isEmpty

File I/O

- Streams
  - Input
  - Output
- Buffering
- Binary vs. Text Files
- Text File I/O
  - Output: PrintWriter, FileOutputStream
  - Input: BufferedReader, FileReader, Scanner
- Binary File I/O
  - Output: ObjectOutputStream, FileOutputStream
  - Input: ObjectInputStream, FileInputStream
- Closing a File

Abstract Data Types

- Comparison of Implementations
  - Array
  - Dynamic Array
  - Linked List

Generics

- Generic Abstract Data Type
  - < > Notation to hold data type
  - Reference Types Only – no primitive types

Recursion

- A Method Calling Itself
- Mathematical Induction
- Recursion vs. Iteration
  - When to use each
- Important Parts
  - Base case(s)
  - Inductive Step (must converge)
- Infinite Recursion = Stack Overflow
- Example Applications
  - Factorial
  - Binary Search
  - Recursive Graphics
  - Merge Sort
  - Brownian Motion
- Recursion and the Call Stack – how do return values work…
- Divide and Conquer Strategy

Threads / Concurrency

- Separate paths of execution
- Creating and starting a Thread
- Worker Objects for Threads
  - Runnable Interface
- Indeterminate order of execution
- Thread States
  - Runnable, Running, Blocked
- Launching Multiple Threads
- Waiting for Threads to complete
- Sleeping
- Concurrency Issues
  - Lost Update Problem - Synchronizing Shared Data (Locking)
  - Concurrent Access to the Same Data Structure - Synchronized – again
  - Deadlock - No easy solution

Networking and Socket Communication

- Clients
- Servers
- IP Address / Domain Name System (DNS)
- Port Numbers
- Socket and ServerSocket
- Persistent Connections
- Multiple Connections

Graphical User Interfaces

- JFrame
- Layout Managers
- Widgets
- Events
  - Action Listeners
  - Inner Listener Classes
- Dialog Boxes
- JPanel
  - Drawing Shapes
  - Drawing Images
- Listening for Input
  - Mouse Input
  - Keyboard Input

Regular Expressions

- Pattern Matching
- Regular Expressions in Java

Fun With Linux

- The Command Shell
  - Logging into and out of Linux
  - Changing your Password
  - General Command Format
- Directory Structure
  - Directory and File Commands
  - Directory and File Permissions
    - Changing File Permissions
  - Finding Files
  - Finding Text in Files
    - grep (those darn regular expressions)
  - File Compression and Backup

Fun With Linux

- Processes
  - Compiling and Running a Java Program
  - File Redirection and Piping
  - Controlling Processes
    - Foreground/Background
    - Killing a Process
  - Network Commands
    - Connecting Remotely
    - File Transfer
- User Information
- Printer Control
- Version Control
- Getting Help in Linux

Fun With Linux

- Editing a Text File
  - vi
  - pico and nano
- Shell Scripts
  - Variables
    - Environment Variables
    - Shell Variables
  - Shell Script Constructs
    - if/fi – If statement
    - for/done – For loop
    - do/done – While Loop
    - case/esac – Switch Statement
  - Start Up Shells

Performance

- Time
- Space
- Empirical Analysis
- Order of Growth

Summary

- Java API
- Java Review
- Dynamic Arrays
- Linked Lists
- Enumerations
- Inheritance
- Polymorphism
- Stacks and Queues
- File I/O
- Abstract Data Types
- Generics
- Recursion
- Threads / Concurrency
- Networking and Socket Communication
- Graphical User Interfaces
- Regular Expressions
- Fun with Linux
- Performance