• Java prerequisites
  Topics:
  – Classes, objects, and references
  – Access modifiers
  – Arguments and parameters
  – Garbage collection

Self-test questions: Appendix C

• Designing classes
  Topics:
  – Composition and inheritance
  – Access modifiers
  – static keyword
  – Overriding methods
  – Dynamic binding and method polymorphism
  – Reference type vs. object type
  – Interfaces
  – Typecasting
  – Generic interfaces, classes, and methods
  – Generic type declarations, including bounded types, type wildcards, and bounded wildcards
  – Assertions

Self-test questions: Appendix D; Prelude; Java Interludes JI1, JI3

Exercises:
  – Prelude: 1, 2
• Bag

Note: Since this was our first data structure, we covered several topics in this section even though they weren’t specific only to bags.

Topics:

– ADTs, collections, data structures and their relation to interfaces and classes
– Client vs. implementer
– Considering corner cases
– Test methods
– Bag ADT and interface
– Bag array vs. linked implementations
– Resizing arrays
– Inner classes, static and non-static

Self-test questions: Chapters 1–3

Exercises:

– Chapter 1: 1, 5
– Chapter 2: 1, 5, 6, 11
– Chapter 3: 1, 5, 12, 14

• Algorithm analysis

Topics:

– Asymptotic analysis
– Big-O notation
– Growth rates
– Amortized analysis
– Sum of the first \( n \) integers
– Analysis of bag implementations

Self-test questions: Chapter 4

Exercises:

– Chapter 4: 1–6, 10–12, 17
• Stack
Topics:
  – Stack interface
  – Using stacks to match brackets
  – Using stacks to evaluate postfix
  – Using stacks to convert infix to postfix
  – Array vs. linked implementations of stack (runtime, memory usage)
  – Program stack / run-time stack

Self-test questions: Chapters 5, 6
Exercises:
  – Chapter 5: 1, 3, 6–8
  – Chapter 6: 1, 3, 5, 8, 9

• Recursion
Topics:
  – Breaking problems into subproblems
  – Requirements for recursion to work
  – Activation records
  – Divide & conquer vs. general recursion
  – Tail recursion
  – Easy vs. hard recursive algorithms to make iterative
  – Overheads of recursion
  – Recursive backtracking
    * General goals
    * The specific structure we used (next, extend, isFullSoln, reject)
  – Analyzing recursive methods with recursion trees
  – Processing arrays recursively by specifying bounds of subarray

Self-test questions: Chapters 7, 18
Exercises:
  – Chapter 7: 1, 2, 5, 8, 16
  – Chapter 18: 4, 6, 7
• Sorting
  
  Topics:
  
  – Simple sorts
    * Selection sort
    * Bubble sort
    * Insertion sort
  
  – Shell sort
  
  – Runtime analysis of sort methods

Self-test questions: Chapters 8

Exercises:

  – Chapter 8: 1–3, 11, 13