Announcements

• P3 specification typo
  – Changed on webpage
• Quiz 3 tomorrow
• P5 will be posted on Friday
• “Any checked exception must be surrounded with try-catch”
  – Unless the throws keyword is used
Bugs

Outcomes that do not match expectations.

isPrime(11) → false
isComposite(11) → true
inBase(2013,10) → “02013”
inBase(0,10) → “”
rollBiasedDie() → NullPointerException

Debugging: Identifying the cause of the mismatch and fixing it.
Manual debugging

• Printing additional information to the console
  – Tedious
  – Hard-coded
  – Floods the console
  – Takes experience – rollBiasedDie example
    • A single well-placed print can reveal the bug
• Tracing your code mentally or by hand
  – Tedious
  – Error-prone
  – Flexible and Intuitive – IntList example
IntList

Entry data 4 next @

Entry data 2 next @

Entry data 88 next null
With Stealees

Entry
data
next

Entry
data
next

Entry
data
next null

Student
first
stealee

Student
first
stealee

Student
first
stealee

Student
first
stealee

Student
first
stealee

Student
first
stealee
Debuggers

- Automated
- Fast
- Error-free
- User-friendly?
- Also take experience
Debugger Concepts

• Break-points
  – Execution will flow normally until encountering a break-point
  – At a break-point, execution hangs until the user chooses to continue
  – The user chooses the break-points
    • Can be activated/inactivated during execution
    • “Hit counts”: Break-point must be encountered a certain number of times before activating
Debugger Concepts

• Stepping
  – To the next line of code
  – “Into” a method call
    • Go to method code and continue line by line
  – “Over” a method call
    • Execute method call without pause
    • Active break-points take precedence
  – “Out of” a method call
    • The remainder of the method is executed without pause
Debugger Concepts


• Watch-points
  – Placed on variables, rather than executable commands
  – Whenever the variables are accessed or modified, the execution pauses for user-input

• Conditional break-points
  – Only pause execution when an additional condition (in the form of a user-provided code snippet) is met

• Manual intervention
  – Variables can be manually overwritten by the user mid-execution
Debugging examples

• Primates, Dogs, Bugs
• isPrime/isComposite
• inBase
More on Static data/methods

• Constructors and null
  – Constructor returning null?
  – Passing null to copy constructor?

• Inserting into empty list?
More on Static data/methods

• Static “factory methods” to replace constructors
  – Descriptive naming
    • Different names with same parameters
  – Null handling
  – Recycling existing allocations

• import static somePackage.SomeClass.*;
  – Makes static members directly accessible
More on initializing fields

• Default initial values for fields (static or instance):
  – Numeric primitives: zero
  – Booleans: false
  – Chars: ‘ ‘
  – Reference variables: null

• Over-riding defaults values
  – Instance fields can be initialized when declared, they do not need to be initialized in every constructor
  – If final fields are initialized in every constructor, they do not need to be initialized when declared

• Local variables in methods (not static or instance fields) are not initialized by default.