

# Developing “Bigger” Programs

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# Objectives

- To design and implement methods using stepwise refinement (§6.10)

# Stepwise Refinement

- The concept of method abstraction can be applied to the process of developing programs.
- When writing a large program, you can use the “divide and conquer” strategy, also known as *stepwise refinement*, to decompose it into subproblems.
- The subproblems can be further decomposed into smaller, more manageable problems

# Implementation: Top-Down

- Top-down approach is to implement one method in the structure chart at a time from the top to the bottom.
- Stubs can be used for the methods waiting to be implemented.
- A stub is a simple but incomplete version of a method.
- The use of stubs enables you to test invoking the method from a caller.
- Implement the main method first and then use a stub for a method.

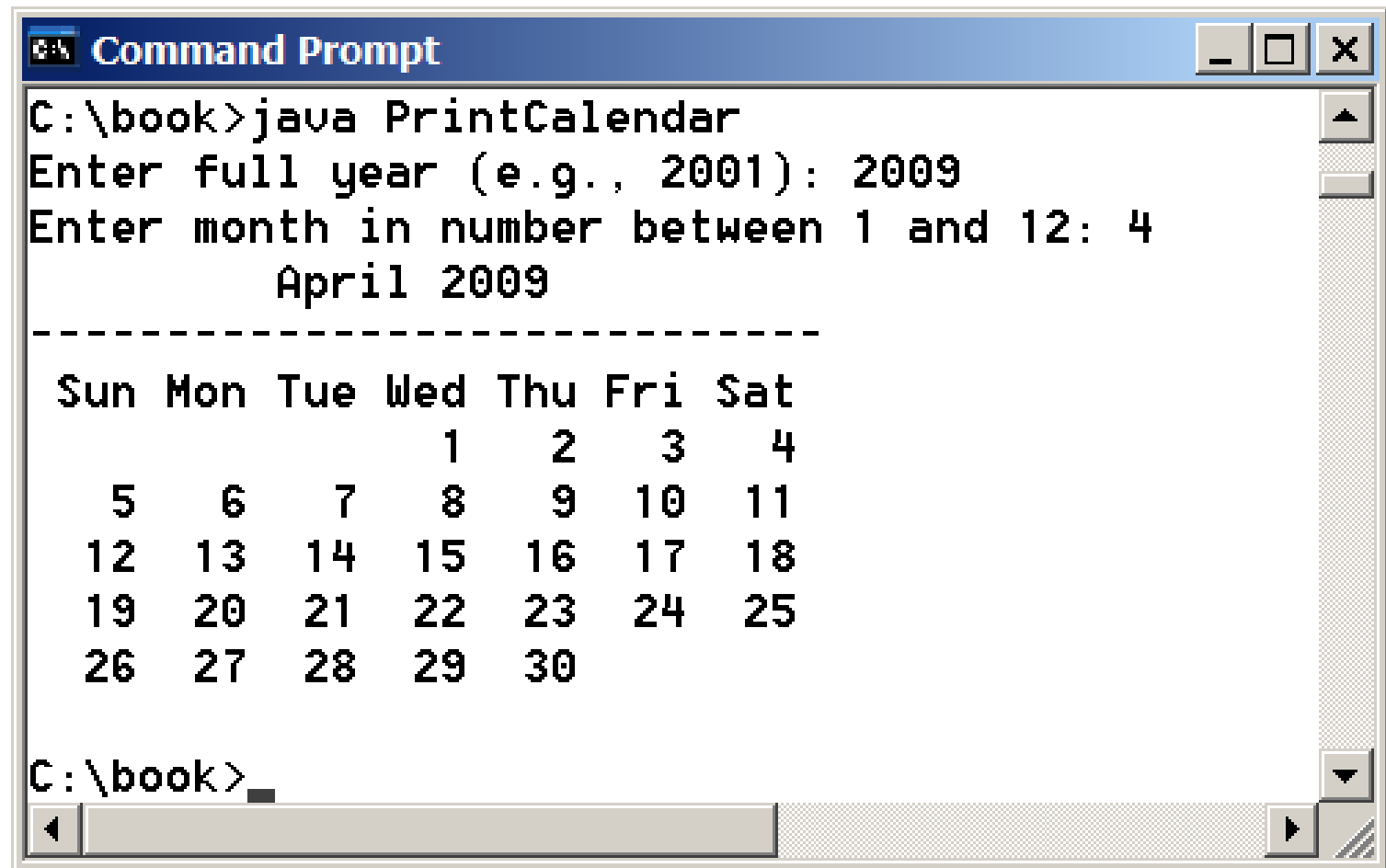
# Implementation: Bottom-Up

- Bottom-up approach is to implement one method in the structure chart at a time from the bottom to the top.
- For each method implemented, write a test program to test it.
- Both top-down and bottom-up methods are fine.
- Both approaches implement the methods incrementally and help to isolate programming errors and makes debugging easy.
- They can be used together.

# Benefits of Stepwise Refinement

- Simpler Program
- Reusing Methods
- Easier Developing, Debugging, and Testing
- Better Facilitating Teamwork

# Problem. Generate and Print Calendar



```
Command Prompt
C:\book>java PrintCalendar
Enter full year (e.g., 2001): 2009
Enter month in number between 1 and 12: 4
      April 2009
-----
Sun Mon Tue Wed Thu Fri Sat
      1   2   3   4
  5   6   7   8   9  10  11
 12  13  14  15  16  17  18
 19  20  21  22  23  24  25
 26  27  28  29  30

C:\book>
```

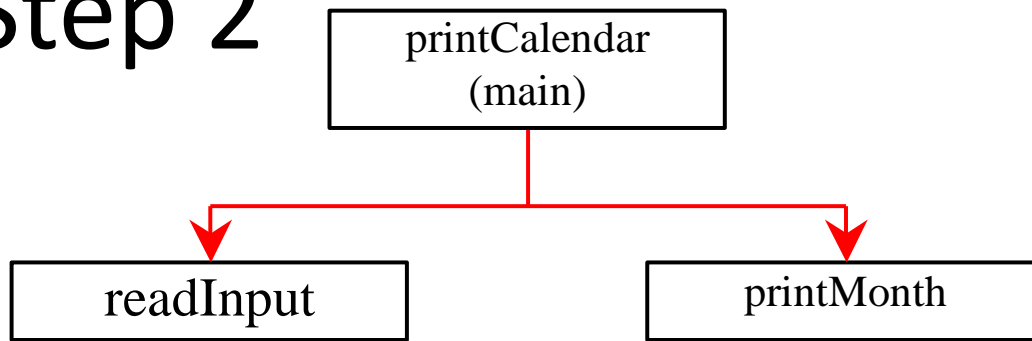
# Step 1

printCalendar (main)
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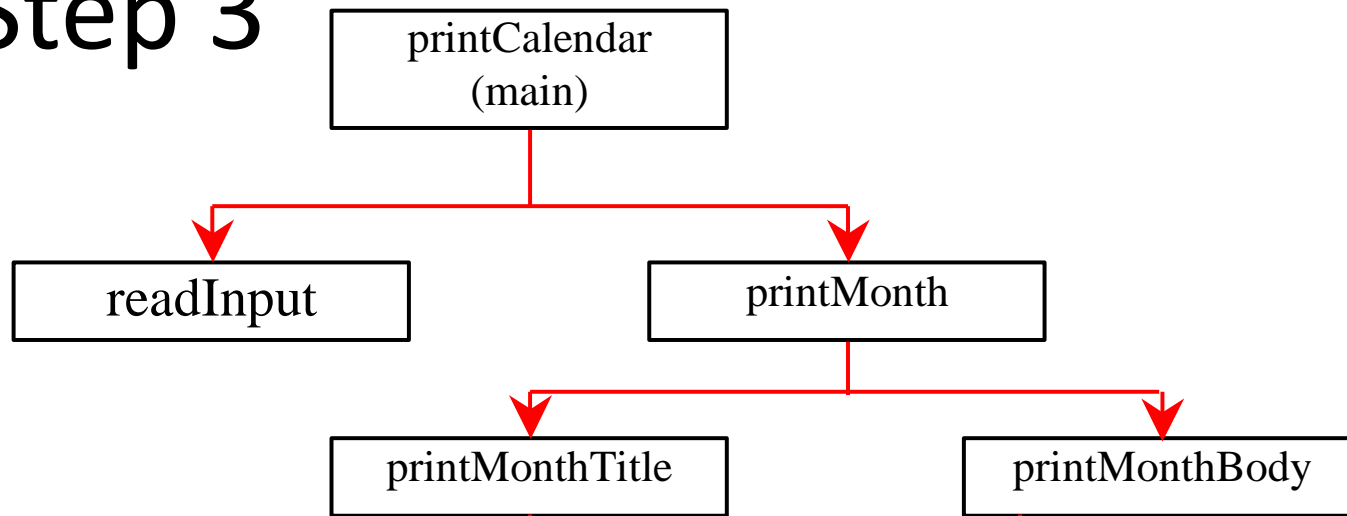
- Using stub methods as we go
- Implement one method at time from top to bottom; if unclear, use the bottom-up approach to understand possible solution



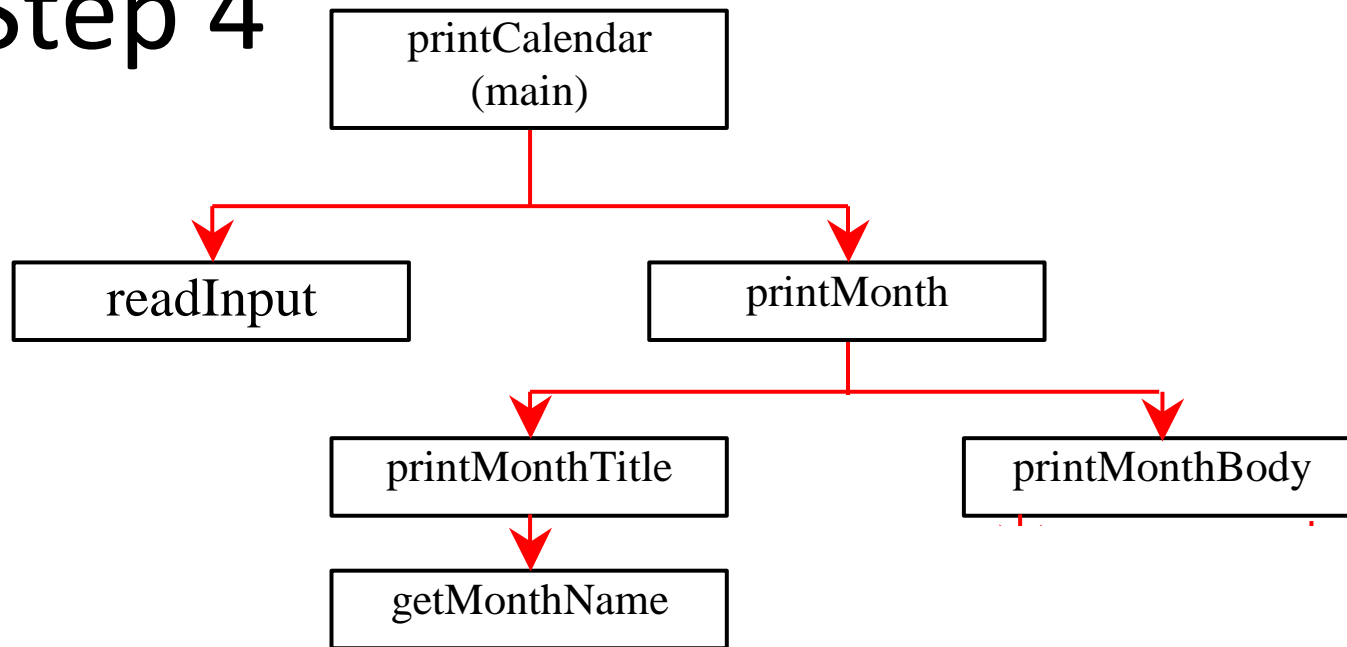
# Step 2



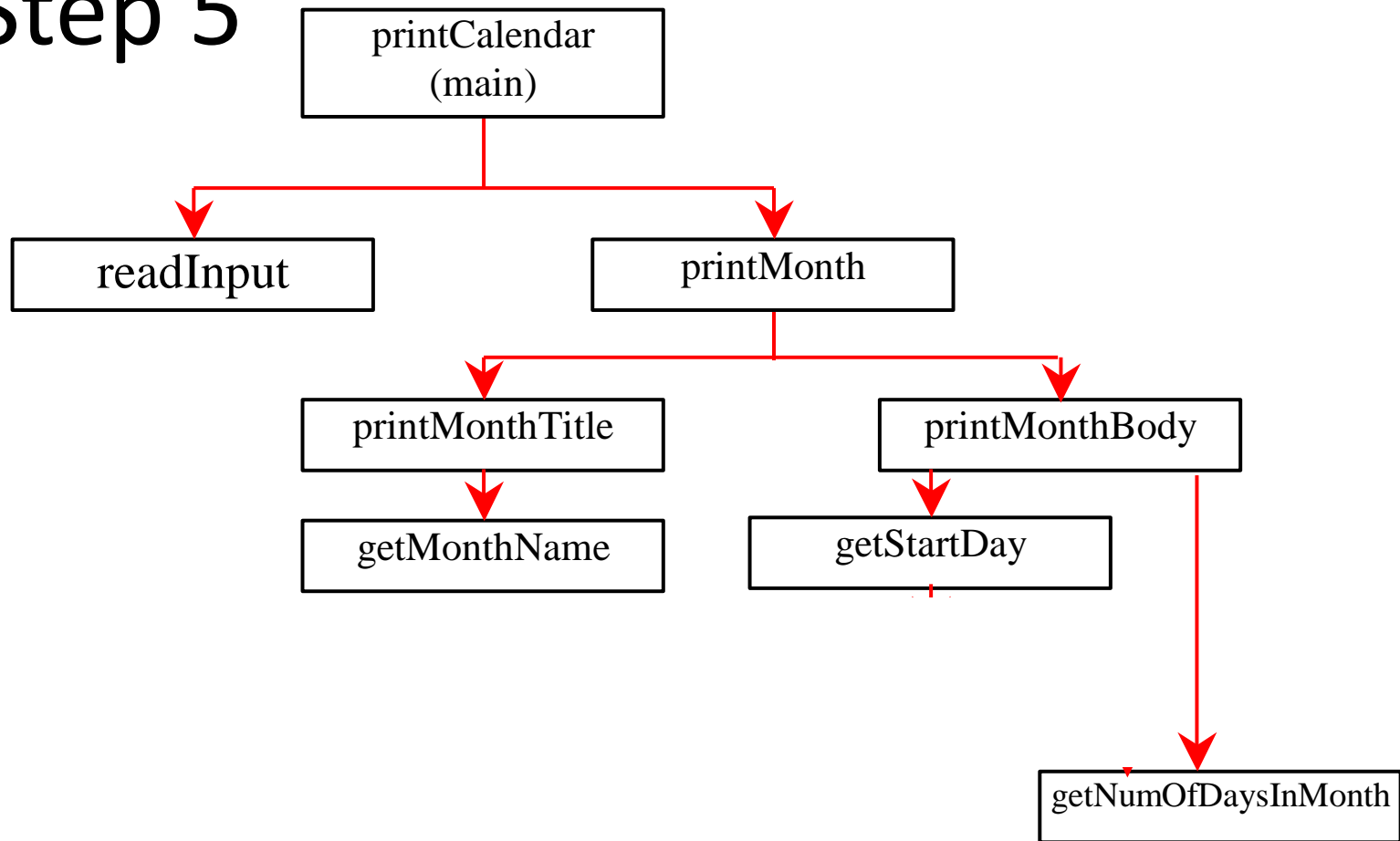
# Step 3



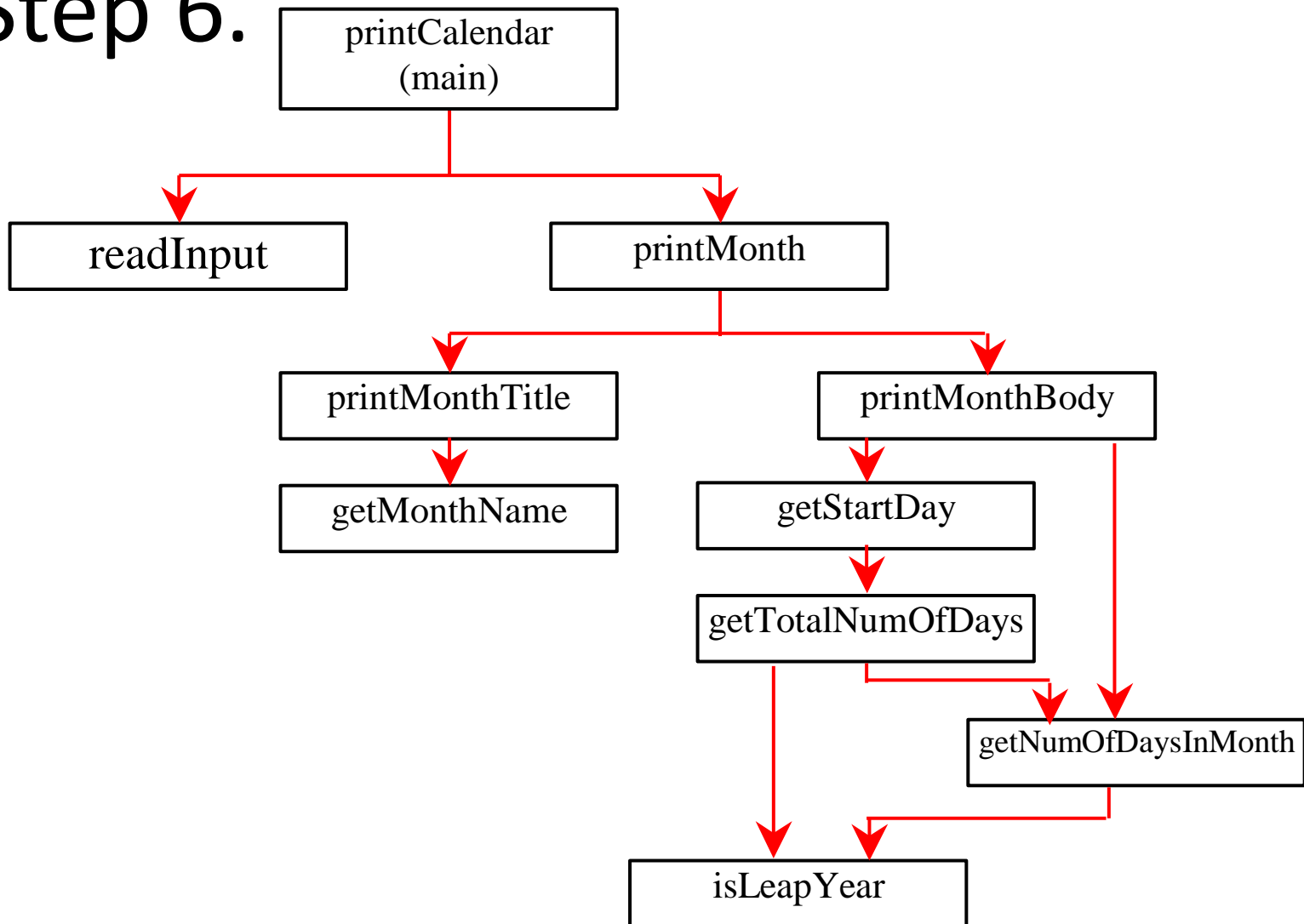
# Step 4



# Step 5



# Step 6.



# Questions