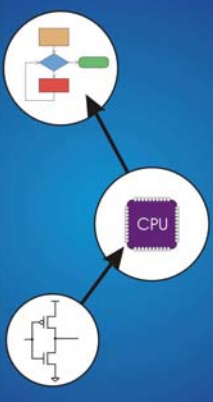




Introduction to Computer Engineering

ECE/CS 252, Fall 2010
 Prof. Mikko Lipasti
 Department of Electrical and Computer Engineering
 University of Wisconsin – Madison



Chapter 6 Part I: Programming

Solving Problems using a Computer

Methodologies for creating computer programs that perform a desired function.

Problem Solving

- How do we figure out what to tell the computer to do?
- Convert problem statement into algorithm, using *stepwise refinement*.
- Convert algorithm into LC-3 machine instructions.

Debugging

- How do we figure out why it didn't work?
- Examining registers and memory, setting breakpoints, etc.

Time spent on the first can reduce time spent on the second!

6-3

Stepwise Refinement

Also known as *systematic decomposition*.

Start with problem statement:

"We wish to count the number of occurrences of a character in a file. The character in question is to be input from the keyboard; the result is to be displayed on the monitor."

Decompose task into a few simpler **subtasks**.

Decompose each subtask into **smaller subtasks**, and these into **even smaller subtasks**, etc.... until you get to the machine instruction level.

6-4

Problem Statement

Because problem statements are written in English, they are sometimes ambiguous and/or incomplete.

- Where is "file" located? How big is it, or how do I know when I've reached the end?
- How should final count be printed? A decimal number?
- If the character is a letter, should I count both upper-case and lower-case occurrences?

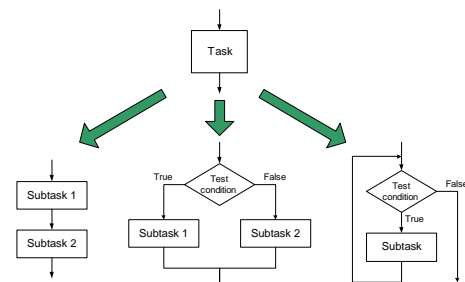
How do you resolve these issues?

- Ask the person who wants the problem solved, or
- Make a decision and document it.

6-5

Three Basic Constructs

There are three basic ways to decompose a task:

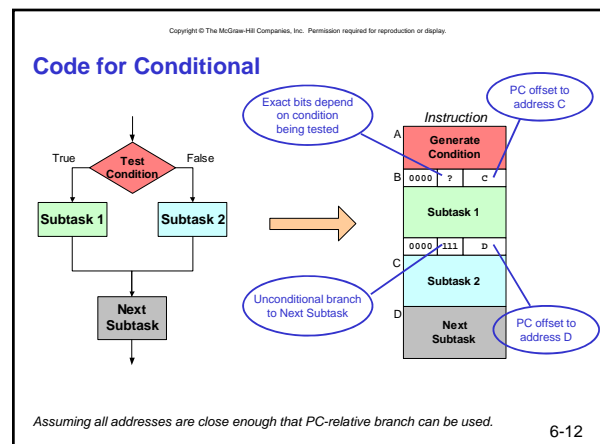
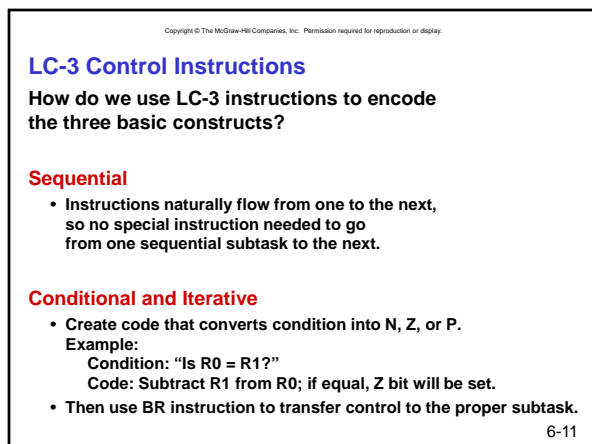
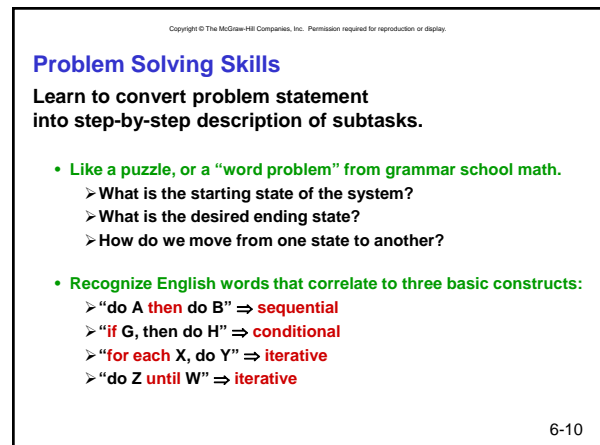
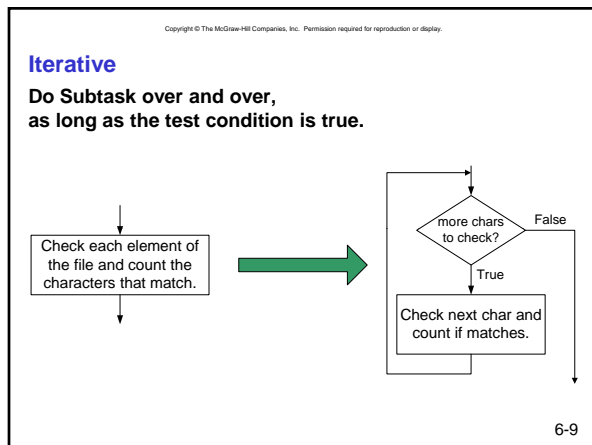
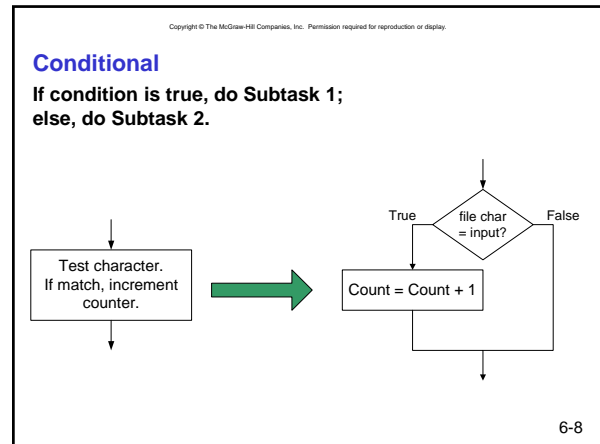
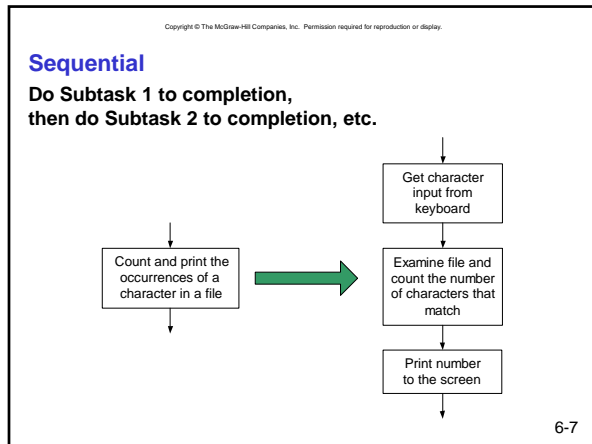


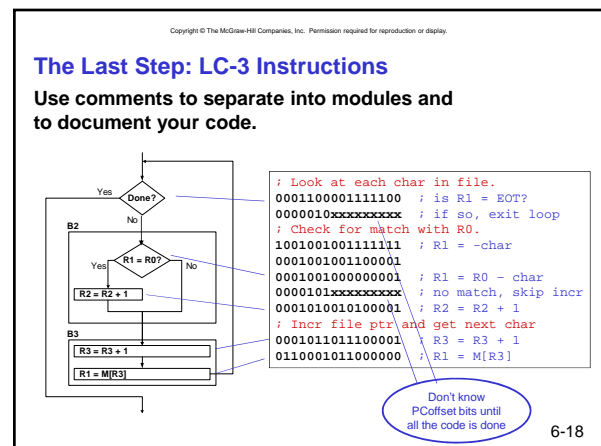
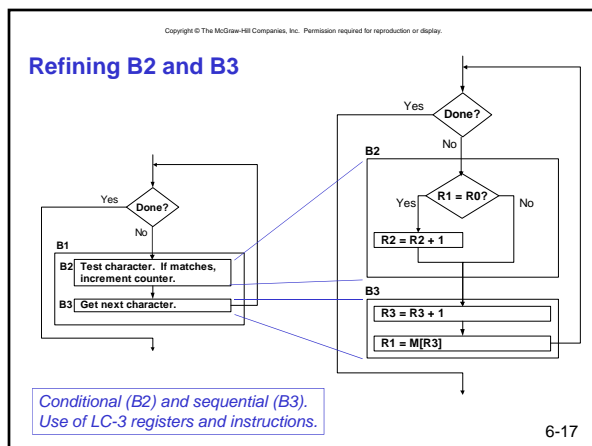
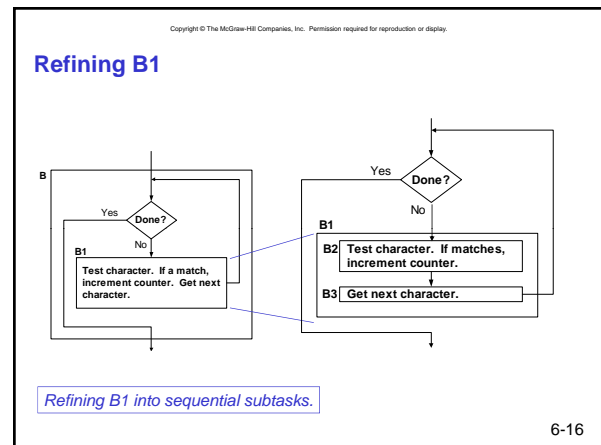
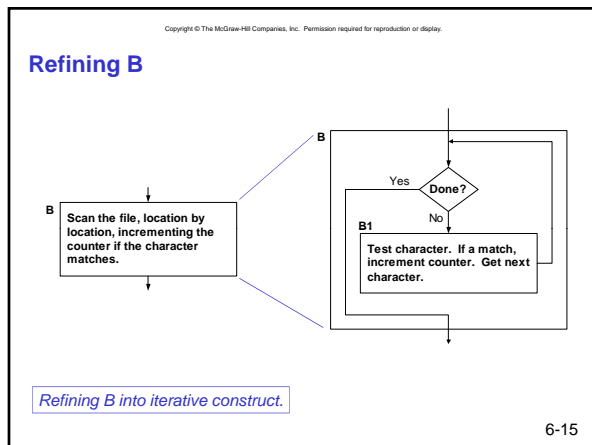
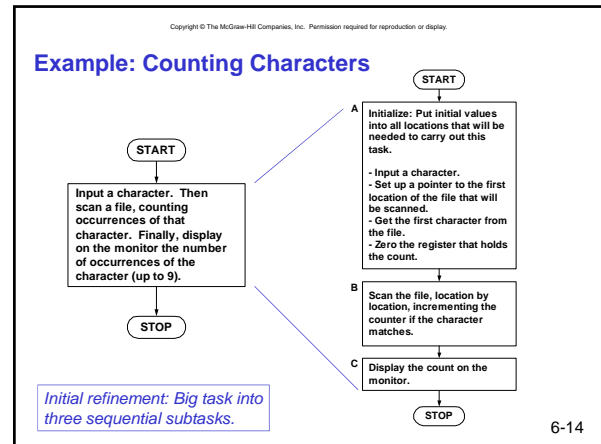
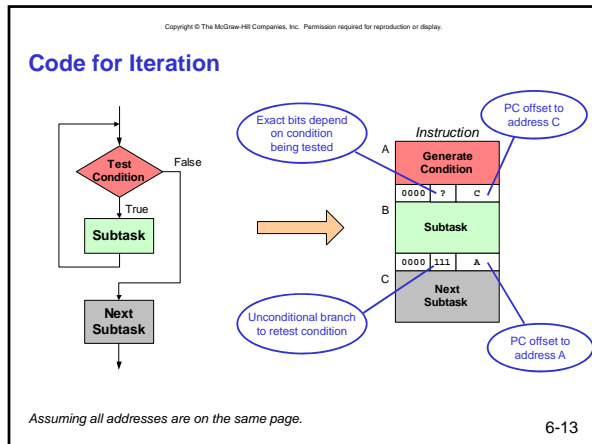
Sequential

Conditional

Iterative

6-6





Summary

Creating a machine program

- **Convert problem statement to algorithm**
- **Convert algorithm to machine code**

Stepwise refinement

- **Sequential construct**
- **Conditional construct**
- **Iterative construct**

Mapping to LC-3 instructions