

CSE 142 Computer Programming I

Problems, Algorithms, and Programs

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Today

High-level overview

- Problems and algorithms
- Problem solving and program design
- Compiling and running a C program
- Errors and debugging

Focus on the big ideas

- Many details to cover in future lectures

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Key Concepts

Problem

- Definition of the task to be performed

Algorithm

- A particular sequence of steps that will solve a problem
- Steps must be precise and mechanical
- Steps must obey a particular “model of computation”:
what can be done in one action?
- The notion of an algorithm is a (the?) fundamental intellectual concept associated with computing

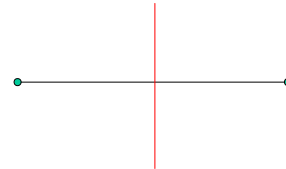
Program

- An algorithm expressed in a specific language

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An Example from HS Geometry

Given a line segment, draw a line perpendicular to it through its midpoint

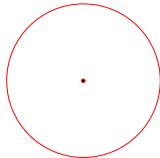


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The “Model of Computation”

What operations is it legal to ask for?

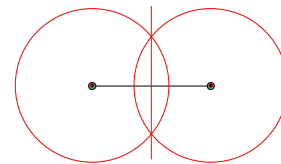
1. You can use a compass
2. You can use a straightedge



Can't use a ruler, can't ask your older sister to do it for you, ...

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A Proposed Algorithm

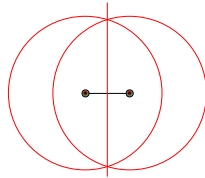


1. Draw a circle centered on one end of the line segment.
2. Draw a circle centered on the other end of the line segment.
3. Draw a straight line through the points of intersection of the two circles

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Does It Work?

1. "Looks good to me"
2. Testing



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Does It Work?



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Where's the Bug?

1. Draw a circle centered on one end of the line segment.
2. Draw a circle centered on the other end of the line segment.
3. Draw a straight line through the points of intersection of the two circles

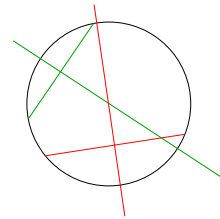
1. Draw a sufficiently big circle centered on one end of the line segment.
1. Draw a circle of radius greater than one half the line segment length centered on one end of the line segment.
1. Draw a circle of radius equal to the length of the line segment centered on one end of the line segment.

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Problem / Algorithm II

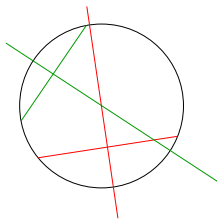
Using the same tools (a compass and straightedge):

Given a circle, find its center



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Was That Cheating?



I drew the perpendicular lines in one step, as though that operation were a part of the computational model (which is isn't).

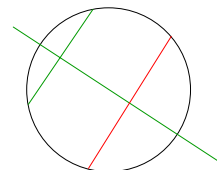
But, I know how to draw perpendicular lines "legally."

It's okay to build new algorithms that use operations provided by previously developed algorithms. In programming computers, we call these operations *subroutines* or *functions*.

Subroutines vastly simplify writing complex programs.

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Does The Algorithm Work?



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On to C Programming

Problem: Write a program that returns the coins required in change at a cashier.

Example: If the total change is \$28.22, return:
- 22 pennies, or
- one dime, 2 nickels, 2 pennies, or
-

Example: If the total change is \$20.84, return:
- 3 quarters, 1 nickel, and 4 pennies.

Refinement: Return the fewest coins possible.

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Vocabulary / Concepts

- Problems and algorithms
- Variables and variable names
- Keywords
- Comments
- Stepwise (top-down) development of the program
- Compiling versus executing
- (Sequential) Control flow
- Breakpoints and debugger execution
- Syntax (errors) versus semantics (errors)

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