Some quotes….

I really hate this damned machine
    I wish that they would sell it.
    It never does quite what I want
    But only what I tell it.

~Anon

These machines have no common sense; they have not yet learned to *think*, and they do exactly as they are told, no more and no less. This fact is the hardest concept to grasp when one first tries to use a computer.

~Donald Knuth

Announcements

- Ian King returns on Friday
  - History of Computing, Part 2

What's The Plan? Algorithmic Thinking

Step-by-step directions for whatever someone, or the computer, needs to do

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Algorithm

- A precise, systematic method for producing a specified result

- In real life we do this all the time:

D.A. Clements, UW Information School

Video

- Algorithms
  - http://uweoconnect.extn.washington.edu/algoithmsdslfit7/

What is an algorithm?

- **Algorithm** is a procedure and sequence of actions to accomplish some task. The concept of an algorithm is often illustrated by the example of a recipe, although many algorithms are much more complex; algorithms often have steps that repeat (iterate) or require decisions (such as logic or comparison). In most higher level programs, algorithms act in complex patterns, each using smaller and smaller sub-methods which are built up to the program as a whole.

  Source: Computer User's online dictionary

Algorithms in our everyday lives

- Directions to our home, workplace, or the shopping mall to meet friends
- Recipes
- Patterns
  - For sewing clothes or soft furnishings
  - For knitting or crochet
- Plans for building furniture
- Owners' manuals

Algorithms in our everyday lives

- Each algorithm
  - Solves a problem
  - Can be repeated over and over
    - With the same results

Video

- [Algorithm example](#)

Clicker questions

Algorithms in our everyday lives

- Always consider the audience
  - Is your friend familiar with North Seattle?
  - How much experience with baking does your friend have?
  - If you're going to add RAM to your laptop yourself, you're probably fairly technically competent

Language in Algorithms

- *Natural language*
  - For people, we use a natural language like English
  - Ambiguity is common in natural language

- *Programming Language*
  - Formal languages designed to express algorithms
  - Precisely defined; no ambiguity

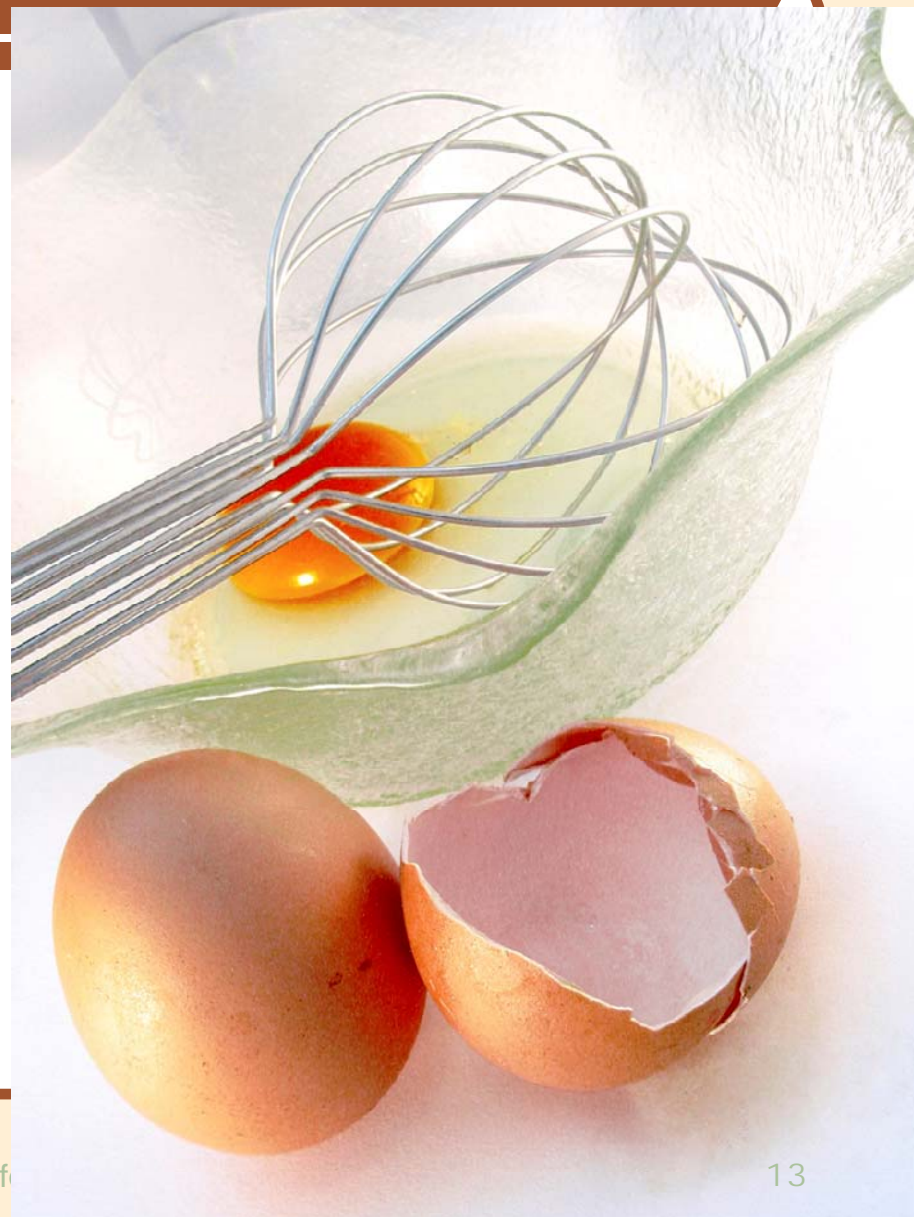# How are algorithms organized?

Awesome Oat Cake with Broiled Topping

1 1/4 cups *boiling* water
1 cup quick or old fashioned oats
1 3/4 cups all-purpose flour
1 teaspoon baking soda
1 teaspoon ground cinnamon
1/4 teaspoon ground nutmeg
1/4 teaspoon salt
5 tablespoons butter, softened
1 cup granulated sugar
1 cup brown sugar, firmly packed
1 large egg
1 teaspoon vanilla extract

Broiled Coconut Topping:
1/2 cup sweetened shredded coconut
1/2 cup brown sugar, firmly packed
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3 tablespoons milk
2 tablespoons butter, melted

Title

1. Heat oven to 350°F (175°C). Lightly grease and flour 9-inch square baking pan.
2. For Cake: In a medium bowl, pour boiling water over oats and mix well; set aside.
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5. Pour batter into pan.
6. Bake 50 to 60 minutes or until wooden pick inserted in center comes out clean. Transfer cake in pan to wire rack.
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8. Broil about 4-inches from heat 1 to 2 minutes or until topping is bubbly. Watch closely; topping burns easily.
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Makes 12 servings.

How are algorithms organized?

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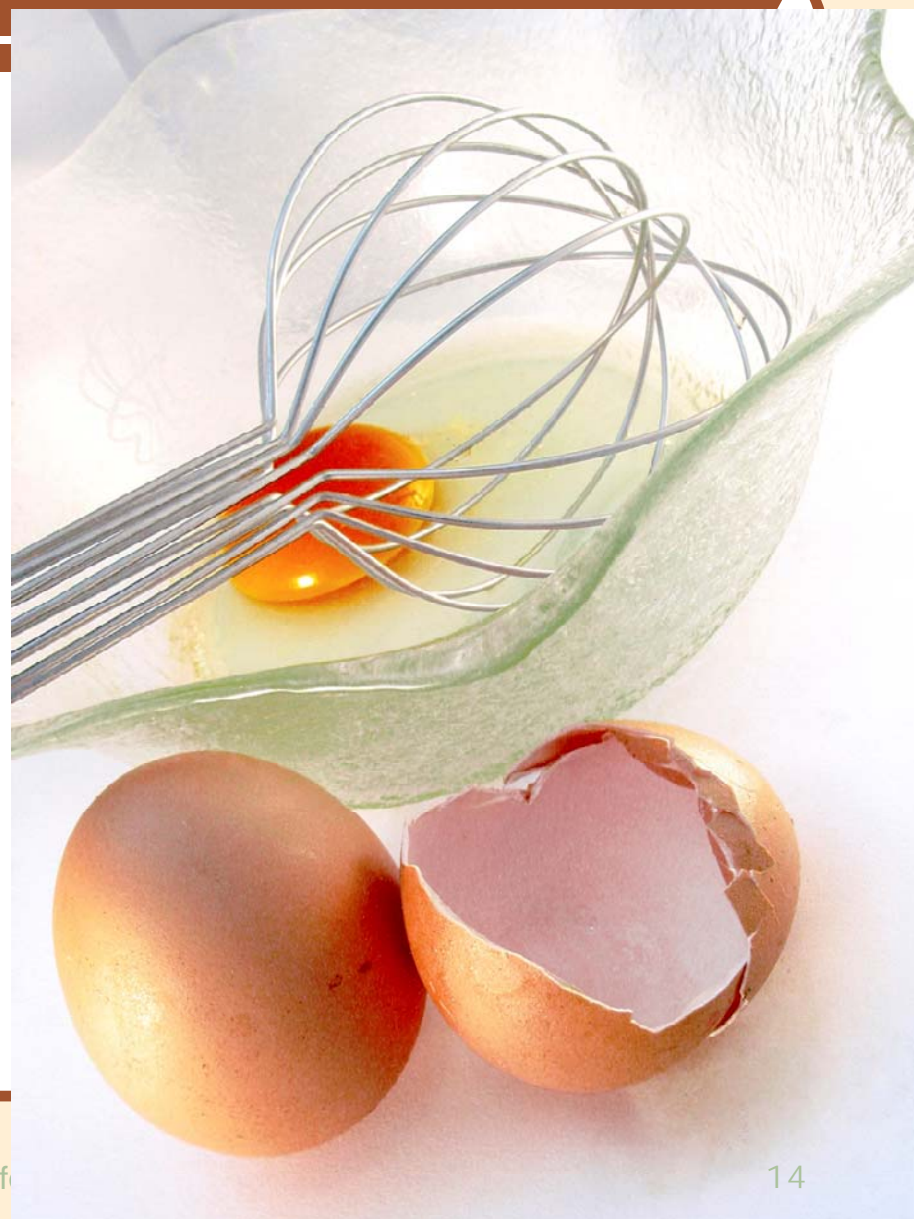
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How are algorithms organized?

- Title
- Ingredients
- Steps
  - Exceptions
- Servings

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How are algorithms organized?

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- Ingredients
- Steps
  - Exceptions
  - When to stop
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10/28/

The Five Essential Properties of Algorithms

1. ## Input specified

   - Data to be transformed during the computation to produce the output

   - Must specify type, amount, and form of data

2. ## Output specified

   - Data resulting from the computation—intended result

   - It is possible to have no output

Five Essential Properties (cont'd)

3. Definiteness
   - Specify the sequence of events
   - Details of each step, including how to handle errors

4. Effectiveness
   - The operations are do-able

5. Finiteness
   - Must eventually stop

Clicker questions

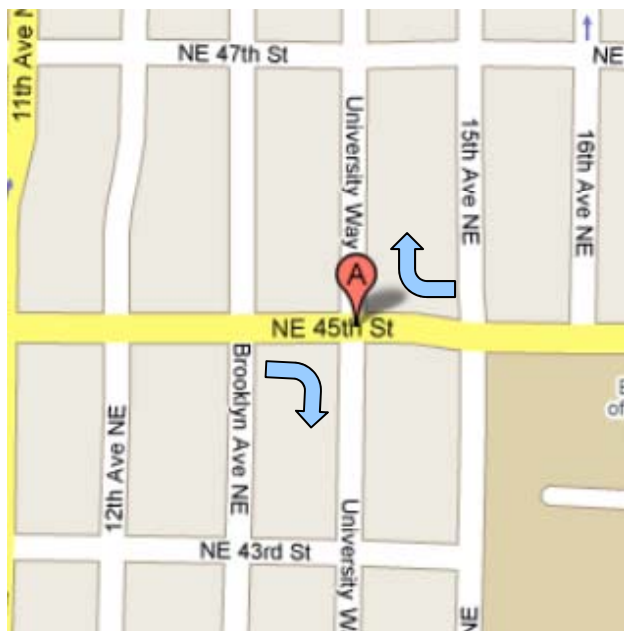D.A. Clements, UW Information School

Context matters—sorting names

- Program can fulfill five properties of an algorithm, be unambiguous, and still not work right because it is executed in the wrong context
  - e.g., last name in Western countries means family name; in Asian countries it may mean given name

Context matters—driving instructions

Driving instructions

"From 45th go to University Avenue and turn right."

● Assumes you are traveling in a specific direction.
If you are not, the directions will fail.

Diagram of approaching a street (the Ave) from different directions, giving the "turn right" instruction different meanings

Context matters—bread ovens

Baking bread….

- The final baking step depends on the type of oven

Source: http://www.leftoverqueen.com

Context Matters—electric ovens

Context Matters—brick ovens

Context matters—bread machine

Program vs. Algorithm

- A program is an algorithm that has been customized to

  - solve a specific task

    - under a specific set of circumstances

      - using a specific language

- Algorithm is *general*

- Program is *specific*

A practice algorithm…

- Grab a piece of paper
- In the next few slides, I'll name the property of an algorithm and you can fill in the blanks for making a salad.

Algorithm: Input sp

- Algorithm for preparing a salad
    1. Input specified

Algorithm—Out

- Algorithm for preparing a salad
  2. Output specified

Algorithm—Definiteness & Effectiveness

- **Algorithm for preparing a salad**
  3. Definiteness
  4. Effectiveness

- Algorithm for preparing a salad
  5. Finiteness

Clicker questions

CD or DVD sorting in a rack

- Exchange sort algorithm

Exchange Sort Algorithm

- The Alphabetize CDs example illustrates the standard *Exchange Sort* algorithm

  - The idea of comparing pairs of items chosen in a particular way, exchanging them if they are out of order, and continuing to sweep through the items

  - We could use the same algorithm to sort on a different principle

D.A. Clements, UW Information School

Friday

- Learn the vocabulary on GoPost