Algorithm, Pseudocode and Flowchart

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A Model For Creating Computer Software

- Specify the problem
- ***Develop a design (algorithm)***
- Implement the design
- Maintain the design

What Is An Algorithm?

- The steps needed to solve a problem
- Characteristics
  - Specific
  - Unambiguous
  - Language independent

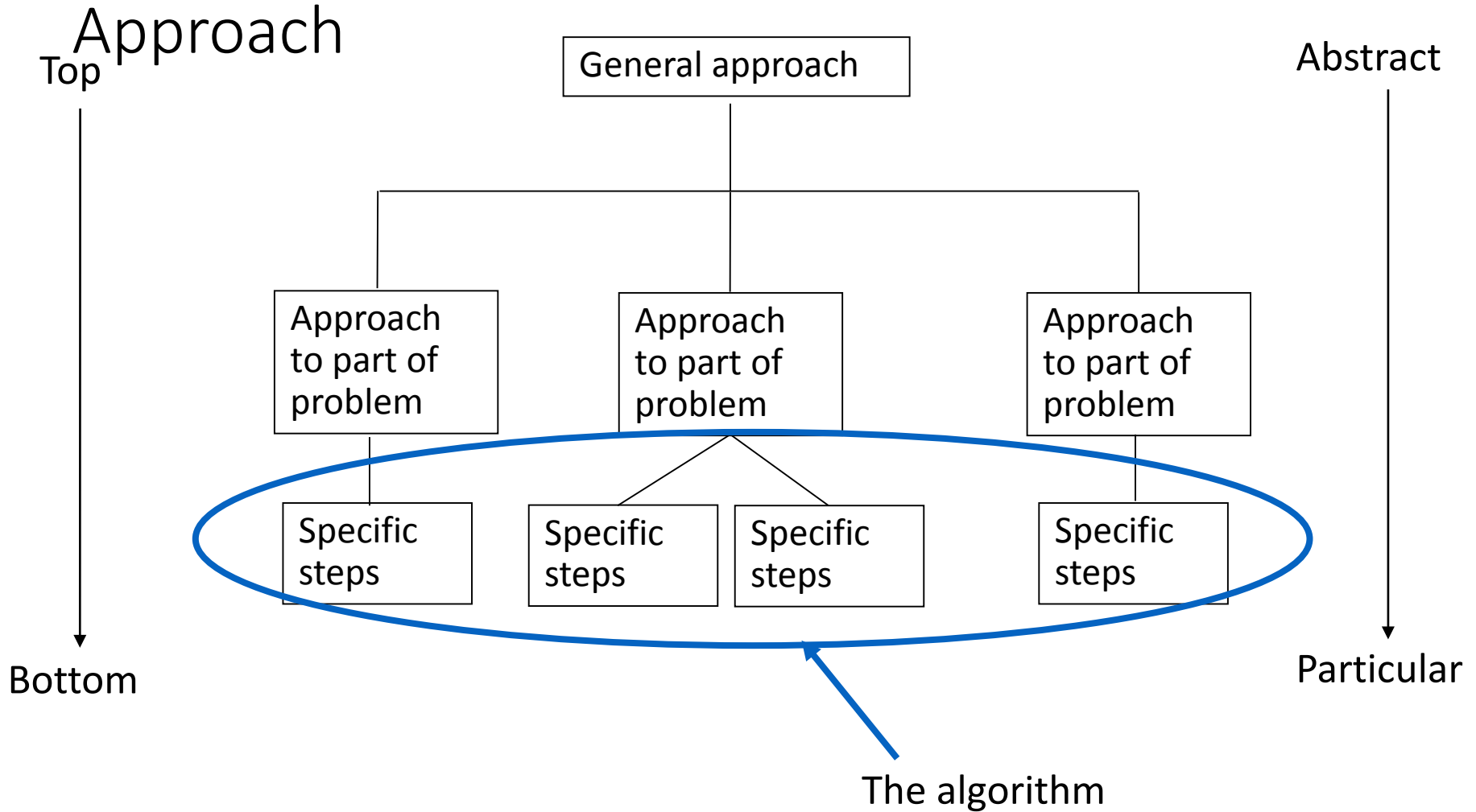# Developing An Algorithm: Top-Down Approach

Top

Abstract

General approach

Approach to part of problem

Approach to part of problem

Approach to part of problem

Specific steps

Specific steps

Specific steps

Specific steps

Bottom

Particular

The algorithm

Figure extracted from Computer Science Illuminated by Dale N. and Lewis J.

Techniques For Laying Out An Algorithm

- Pseudo-code
- Flowcharts

Pseudo-Code

- Employs 'programming-like' statements to depict the algorithm
- No standard format (language independent)

Pseudo-Code Statements

- Output
- Input
- Process
- Decision
- Repetition

Statements are carried out in order

Example: calling up a friend
1) Look up telephone number
2) Enter telephone number
3) Wait for someone to answer

:   :

Variables

- Are symbols used to store values
- The value stored can change during the algorithm

Pseudo-Code: Output

- Used to display information
- General format:
  - Line of text: Output 'Message'
  - Variable: Output Name of variable
- Example
  - Output 'Available credit limit: ' limit

Pseudo-Code: Input

- Used to get information
- Information is stored in a variable
- General format:
-    Input: Name of variable
- Example:
-    Input   user_name

Pseudo-Code: Process

- For computer programs it's usually an assignment statement (sets a variable to some value)
- General form:
- variable← arithmetic expression
- Example:
- x ← 2
- x ← x + 1
- a ← b * c

Pseudo-Code: Decision Making

- If-then

- General form:
- if (condition is met) then
-     statement(s)

- Example:
- if temperature < 0 then
-     wear a jacket
- If-then-else

- General form:
- if (condition is met) then
-     statement(s)
- else
-     statements(s)

Pseudo-Code: Decision Making (2)

-
- Example:
- if (at work) then
-     Dress formally
- else
-     Dress casually

Pseudo-Code: Repetition

- repeat-until
- while-do

Pseudo-Code: Repetition (2)

- repeat-until
-
-   Repeat at least once (check condition after statement(s))
-
-   General form:
-    repeat
-       statement(s)
-    until (condition is met)

-   Example:
-   repeat
-      Go up to buffet table
-   until full
-

Pseudo-Code: Repetition (3)

- while-do
-
-   Repeat zero or more times (check condition before statement(s))
-
- General form:
-   while (condition is met)
-     statement(s)

- Example:
- while students ask questions
-     Answer questions
-
-

Pseudo-Code: Fast Food Example

- Use pseudo-code to specify the algorithm for a person who ordering food at a fast food restaurant. At the food counter, the person can either order not order the following items: a burger, fries and a drink. After placing her order the person then goes to the cashier.
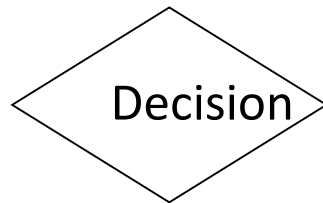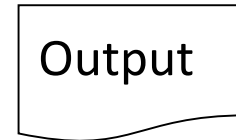
Pseudo-Code: ATM Example

- Use pseudo-code to specify the algorithm for an ATM bank machine. The bank machine has four options: 1) Show current balance 2) Deposit money 3) Withdraw money 4) Quit. After an option has been selected, the ATM will continue displaying the four options to the person until he selects the option to quit the ATM.

Summary Of Pseudo-Code Statements
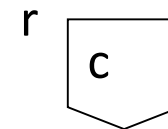
- Statement   Purpose

- Output   Display information
- Input   Get information
- Process   Perform an atomic (non-divisible) activity
- Decision Choose between different alternatives
- Repetition   Perform a step multiple times

Basic Flowcharts Element

Terminator

Process

Input

Output

Off page
Connector

c

Decision

Arrow

Variables

Flowchart: Fast Food Example

- Draw a flowchart to outline the algorithm for a person who ordering food at a fast food restaurant. At the food counter, the person can either order not order the following items: a burger, fries and a drink. After placing her order the person then goes to the cashier.

Flowchart: ATM Example

- Draw a flowchart to outline the algorithm for an ATM bank machine. The bank machine has four options: 1) Show current balance 2) Deposit money 3) Withdraw money 4) Quit. After an option has been selected, the ATM will continue displaying the four options to the person until he selects the option to quit the ATM.

Summary

- Laying out an algorithm using flowcharts and pseudo-code
- Learning basic elements of algorithms:
  - Input
  - Output
  - Decision-Making
  - Repetition
  - Processes