Writing Your First Programs
Chapter 2

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Program Development
Top Down Design

- Planning is a critical issue
  - Don’t type in code “off the top of your head”
- Programming Takes Time
  - Plan on writing several revisions
  - Debugging your program
- Programming requires precision
  - One misplaced semi-colon will stop the program

Exercise in Frustration

- Plan well (using paper and pencil)
- Start early
- Be patient
- Handle Frustration
- Work Hard
- Don't let someone else do part of the program for you. Understand the Concepts Yourself!

Six Steps To Good Programming Habits #1

- 1. Analyze the Problem
  - Formulate a clear and precise statement of what is to be done.
  - Know what data are available
  - Know what may be assumed
  - Know what output is desired & the form it should take
  - Divide the problem into subproblems

Six Steps To Good Programming Habits #2

- 2. Develop an Algorithm
  - Algorithm:
    - a finite sequence of ***effective*** statements that when applied to the problem, will solve it.
  - Effective Statement:
    - a clear unambiguous instruction that can be carried out.
  - Algorithms should have:
    - a specific beginning and ending that is reached in a reasonable amount of time (Finite amount of time).

Six Steps To Good Programming Habits #3

- 3. Document the Program
  - Programming Style
  - Comments
  - Descriptive Variable Names
  - Pre & Post Conditions
  - Output

Six Steps To Good Programming Habits #4-5

- 4. Code the Program
  - After algorithms are correct
  - Desk check your program

- 5. Run the Program
  - Syntax Errors (semi colon missing, etc.)
  - Logic Errors (divide by zero, etc.)

Six Steps To Good Programming Habits

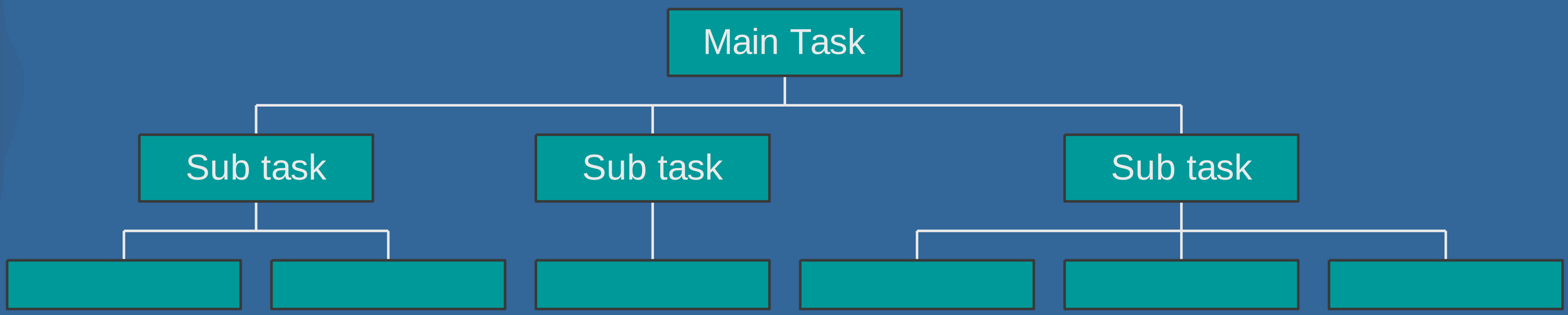
- 6. Test the Results
  - – Does it produce the correct solution?
  - – Check results with paper and pencil.
  - – Does it work for all cases?
    - Border, Edge, Extreme Cases
  - – Revise the program if not correct.

Top Down Design

- Subdivide the problem into major tasks
  - Subdivide each major task into smaller tasks
    - Keep subdividing until each task is easily solved.
- Each subdivision is called stepwise refinement.
- Each task is called a module
- We can use a structure chart to show relationships between modules.

Top Down Design

Structure Chart



Top Down Design

- Pseudocode
  - is written in English with C++ like sentence structure and indentations.
  - Major Tasks are numbered with whole numbers
  - Subtasks use decimal points for outline.

Pseudocode

1. Get Information
    1.1. Get starting balance
    1.2. Get transaction type
    1.3. Get transaction amount
2. Perform computations
    2.1. If deposit then
        add to balance
        Else
        subtract from balance
3. Display the results
    3.1. Display starting balance
    3.2. Display transaction
        3.2.1. Display transaction type
        3.2.2. Display transaction amount
    3.3. Display ending balance

Checkbook.cpp

Writing Programs

- C++ Vocabulary
  - reserved words
    - have a predefined meaning that can’t be changed
  - library identifiers
    - words defined in standard C++ libraries
  - programmer supplied identifiers
    - defined by the programmer following a well defined set of rules

Writing Programs

- Words are CaSe SeNsItIvE
  - For constants use ALL CAPS (UPPERCASE)
  - For reserved words and identifiers use lowercase
- Syntax
  - rules for construction of valid statements, including
    - order of words
    - punctuation

Library Identifiers

- Predefined words whose meanings could be changed.
- Examples:
  - iostream
    - cin cout
  - iomanip
    - setprecision setw
  - cmath
    - pow sin sqrt

Identifiers

- Must start with a letter of the alphabet or underscore _ (we will not use underscores to start identifiers)
- aim for 8 to 15 characters
- common use is to name variables & constants

Basic Program Components

- Comments
- Preprocessor Directives
- using namespace std;
- Constant Declaration Section
- Type Declaration Section
- Function Declarations
- Main Program Heading: int main( )
  - Declaration Section (eg. variables)
  - Statement Section

A Sample Program
reserved words

Reswords.doc

Writing Code in C++

- Executable Statement
  - basic unit of grammar
    - library identifiers, programmer defined identifiers, reserved words, numbers and/or characters
  - A semicolon almost always terminates a statement
    - usually not needed AFTER a right curly brace }
      - Exception: declaring user defined types.
- Programs should be readable

noformat.cpp format.cpp

Simple Data Types

- Type int
  - represent integers or whole numbers
  - Some rules to follow:
    - Plus signs do not need to be written before the number
    - Minus signs must be written when using negative #'s
    - Decimal points cannot be used
    - Commas cannot be used
      - A comma is a character and will "crash" your program, no joke.
    - Leading zeros should be avoided (octal or base 8 #'s)
    - limits.h   int_max   int_min

Simple Data Types

- Type double
  - used to represent real numbers
  - many programmers use type float, the AP Board likes the extra precision of double
  - avoid leading zeros, trailing zeros are ignored
  - limits.h, float.h
    - dbl_max, dbl_min, dbl_dig

Simple Data Types

- Type char
  - used to represent character data
    - a single character which includes a space
    - See Appendix 4 in our text
  - must be enclosed in single quotes eg. ‘d’
  - Escape sequences treated as single char
    - ‘\n’ newline
    - ‘\’’ apostrophe
    - ‘\”’ double quote
    - ‘\t’   tab
    - ‘\\’   pathnames for files

Simple Data Types

- Strings
  - used to represent textual information
  - string constants must be enclosed in double quotation marks eg. “Hello world!”
    - empty string “”
    - new line char or string “\n”
    - “the word \”hello\”” (puts quotes around “hello”)

Output

- #include <iostream>
  - cout pronounced see-out
  - cout << ‘\n’;
  - cout << endl;
  - cout << “Hello world!”;
  - cout << “Hello world!” << endl;

printadd2.cpp

Formatting Integers

- #include <iomanip>
  (input/output manipulators)
- right justify output
  - cout << setiosflags (ios::right);
- specify field width
  - cout << setw(10) << 100   (output: *******100, where * represents a space.)
- specify decimal precision
  - cout<<setiosflags (ios::fixed | ios::showpoint | ios::right)<< setprecision (2);

Setprecision

- Precision is set and will remain until the programmer specifies a new precision
  - The decimal uses one position
  - Trailing zeros are printed the specified number of places
  - Leading plus signs are omitted
  - Leading minus signs are printed and use 1 position
  - Digits are rounded, not truncated.

Test Programs

- Test programs are short programs written to provide an answer to a specific question.
- You can try something out
- Play with C+ +
- Ask “what if” questions
- Experiment: try and see