Computer Programming

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Session: Sequential Execution in C++ Programs

Quick Recap of Some Relevant Topics

- Structure of a simple C++ program
- Variables and type declarations
- Assignment statements
- Arithmetic and logical expressions

Overview of This Lecture

- Simple C++ programs with sequential execution
- Programming to solve problems

Recalling Some Useful Facts

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- Program: sequence of compiler directives, declarations, instructions
- Compiler directives used during compilation
- Declarations tell what variables (mostly) to be used
  - How much memory to allocate for variables
  - How to interpret stored sequence of bits
- Instructions tell what computer (or Mr. Dumbo) should do
  - By sequencing instructions carefully, we can get computer to do highly non-trivial tasks efficiently
  - Art of Programming !!!

Simplest Programs

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- Simplest programs: linear sequence of instructions
  - Computer executes instructions in linear order

; used to separate one executable statement from next

Simplest Programs: Another Example

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- Simplest programs: linear sequence of instructions
  - Computer executes instructions in linear order

Sequential Execution of Programs

- All variables must be declared before being used
- Executable statements executed in sequence from “top” to “bottom”
- If a statement changes value of a variable, and a “later”/”below” statement refers to the variable, it sees the changed value
- Executing a “return” statement returns control back to the caller (function/OS)
  - Subsequent statements not executed

Programming To Solve Problems

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- Given a problem:

  "Given two integers A and B, find if B divides A?"

- Think of sequence of steps you would take if solving by pencil-and-paper
  - Find the remainder of A on division by B
  - If remainder is 0, then B divides A, otherwise not
- Think in terms of program statements seen so far
  - Can we sequence them in a linear order to do the same thing as we did on pencil-and-paper?
  - We didn't learn to conditionally execute "If …. then …", have we?

Programming to Solve Problems

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- We haven't learnt to conditionally execute instructions
  - But could there be a way to solve our problem by a linear sequence of instructions?
- How about
  - Calculate remainder R of A divided by B

    R = A % B
  - Set a boolean flag to true if R equals 0 and to false otherwise

    flag = (R == 0);
  - Output flag

    flag is true if and only if B divides A

A Simple C++ Program

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```
#include <iostream>
using namespace std;
// Program to find if B divides A
int main() {
  int A, B, R;              // Variable declarations
  bool dividesFlag;   // Variable declarations
  cout << “Give A and B: “ << endl;
  cin >> A >>  B;
  R = A % B;   // Remainder of A divided by B
  dividesFlag = (R == 0);  // Is the remainder 0?
  cout << “Does B divide A? “ << dividesFlag << endl;
  return 0;
}
```

Note the importance of the sequence: What happens if we swap the order of R = A%B and dividesFlag = (R == 0) ?

Summary

- Sequential execution of statements in C++ programs
- Problem solving by programming
  - Without conditional execution of statements, we are handicapped
  - Still, some interesting problems can be solved by sequential execution of programs