C Programming Language

Lecture 5 (10/20/2000)

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Control Structures

- Controls the flow of execution in a program or function
- Three kinds of control structures:
  - sequence --- what we’ve done so far
  - selection --- if, switch
  - repetition --- for, while
Compound Statement

- Written as a group of statements bracketed by { and }
- used to specify sequential flow

```text
{ 
    statement 1;
    statement 2;
    ...
    statement n;
}
```
Conditions and Related Operators

- Relational and equality operator
- <  less than
- >  greater than
- <= less than or equal to
- >= greater than or equal to
- == equal to
- != not equal to
Logical Operators

- && and
- || or
- ! not

Examples:
- (score < 0 || score > 100)
- !(score < 0 || score > 100)
Operator Precedence

- Function calls
- !, +, -, &, (unary operators)
- *, /, %
- +, -
- <, <=, >=, >
- ==, !=
- &&
- ||
- =
Example

- Evaluating

!flag || (y+z >= x-z)

where

  flag is 0
  x is 3.0
  y is 4.0
  z is 2.0
Comparing Numbers, Characters

- Relational and equality operators can be used to compare numbers and characters.
- How about strings (group of characters terminated by the null character -- \0)
- Check string.h if you are interested.
Logical Assignment

- C has no Boolean data type
- use 0 to represent false, 1 (or non-zero) to represent true
- Examples:
  - `int senior_citizen = (age >= 65);`
  - `is_letter = ( 'A' <= ch && ch <= 'Z') || ('a' <= ch && ch <= 'z'))`
Complementing a condition

- Use !
- Use DeMorgan’s Theorem

\[ A + B = \overline{A} \cdot \overline{B} \]

\[ A \cdot B = \overline{A} + \overline{B} \]
The if Statement

- if statement with one alternative
- if statement with two alternatives
- Example:
  ```java
  if (score >= 60)
      pass = 1;
  else
      pass = 0;
  ```
- Use flow chart to facilitate the design process.
if statement with compound statements

```java
if (score >= 60) {
    num_pass = num_pass+1;
    pass = 1;
} else {
    num_fail = num_fail+1;
    pass = 0;
}
```
Decision Steps in Algorithms

- Case study: water bill problem
- Water bill = demand charge
  + use charge
  + unpaid balance
  + applicable late charge
Nested if and Multiple-Alternative Decisions

- Code decisions with multiple alternatives with nested if statements.
- Can also use sequence of ifs in certain conditions.
The switch statement

- Used to select one of several alternatives.
- Useful when the selection is based on the value of a single variable or of a simple expression.
- The value may be of type int or char, but not double.
Switch statement syntax

- `switch (controlling expression){
  label set1:
  statements1
  break;
  .
  .
  .
  label setn:
  statementsn
  break;
  default:
  statements
  }
`
Example

```c
switch (class) {
    case 'B':
    case 'b':
        printf("Battleship\n");
        break;

    case 'C':
    case 'c':
        printf("Cruiser\n");
        break;

    case 'D':
    case 'd':
        printf("Destroyer\n");
        break;

    case 'F':
    case 'f':
        printf("Frigate\n");
        break;

    default:
        printf("Unknown ship class %c\n", class);
}
```
Common Programming Errors

- if ( 0 <= x <= 4)
  printf("Condition is true\n");
- if ( x = 10)
  printf ("x is 10");
- incorrect placement of brackets and parenthesis.
Your Homework

- Read Chapter 4 of textbook
- Use nested if statements to implement programming project 4.3 (page 204).
- Due on 10/27/2000. Please send the source code to your TA via e-mail.