Basic C and Bit Puzzles

CSCI 237: Computer Organization Lab 1

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Prelab

- Log in using CS credentials
 - Can use machines in TBL 301 or TCL 312
- Open VS Code (or your favorite editor...no Dr. Java or Eclipse!)
- Open Terminal
- Update path to include submit237
 - Raise your hand if you need help!

Today's Plan

- Compilation of C programs
- C syntax and examples
 - Primitive types
 - Operators

C Program Compilation



gcc -o hello hello.c

Variables and Data Types

Type specifies # of

bits/range of values and

interpretation of bits

- C requires you to specify the type for every variable
- Primitives:
 - bool // #include <stdbool.h>
 - char
 - short
 - int
 - long
 - float
 - double
- sizeof(...)
- Integral types also have unsigned versions
 - Must take care with comparisons between signed and unsigned!!!

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Arithmetic Operators

Addition
val = 3 + 2;

Subtraction

val = 3 - 2;

Multiplication

Division

double dval = 3.0 / 2.0;

Modulo / remainder

• val = 4 % 3;

- Operator with assignment
 - +=, -=, *=, /=

- Auto-increment/decrement
 - x++;
 - ++x;
 - x--;
 - --x;

Relational Operators and Logical Operators

Boolean values: true is 1, false is 0

Relational Operators evaluate to 0 or 1

 \bullet <, >, >=, <=, ==, !=

Logical Operators evaluate to 0 or 1

- AND : & &
- OR : ||
- NOT : !

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- AND : & &
- OR : ||
- NOT : !
 - !x, !(!x), etc.

Note: Compound conditionals evaluate left to right and *short circuit*

Bit Manipulations

Logical Operators (&&, ||, !) evaluate to 0 or 1

- -4 & -4 & -4 = 0
- 1 & & 1 = 1
- **4** || 0 = 1

Bitwise Operators (&, |, ~) evaluate on every bit
4 & 0 = 0 // AND
4 & 1 = 0 // AND
1 & 1 = 1 // AND
4 | 1 = 5 // OR

 $\sim 0 = -1$ // NEGATION

Makefiles

- Provide a convenient way to compile
- Not just for C!
- I will often provide a Makefile for labs
- Shouldn't need to modify, but worth looking at

Autograder

- submit237 script
- Get automatic feedback once per day (+ 5 bonus submissions)
- Encourages you to start early!

Lab 1

- Fetch lab1.tar
 - using wget or from a browser
- Unpack it
 - tar xvf lab1.tar
- Change into lab1 directory
 - cd lab1
- Modify bits.c
 - Open bits.c in favorite text editor (VS Code? emacs?)
- Save changes
- Compile using Makefile
 - make
- Run using btest
 - ./btest
- Scoreboard totally optional!

bitNor

DeMorgan's Laws to the rescue!