Programming Studio #1

ECE 190

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- Announcements
- Recitation
  - Binary representation, hexadecimal notation
  - floating point representation, 2's complement
- In Studio Assignment
  - Introduction to Linux Command-Line Operations

Announcements

- Homework 1
  - Is available on the website. Drop off in basement of Everitt Lab in the ECE 190 Drop Box
  - No late homework accepted. If it's not in the drop box by 5pm on due date, it receives a zero, no excuses.
- Programming Studio Attendance Policy
  - If you score below average on any exam you must go to all but one studio before the next exam. If you fail to meet this requirement you will not be allowed to take the next exam.
  - In order to receive credit for attending a programming studio, you must completely finish lab assignments given during the studio time slot or put in a reasonable effort into solving said problem
- Cheating Policy
  - We actively scan for cheating cases on exams, homeworks, and Machine Problems
  - There is a difference between "working to find a solution together" and "sharing code/answers" (the latter is NOT allowed).
- Course information
  - View the syllabus on the website for deadlines, rules, etc.
  - Check website frequently for announcements
  - Use the web board through my.ece to ask questions

Binary Representation

- 1 and 0 are the only digits. This is a "base 2" counting system
- Left hand bit is the "MSB (Most Significant Digit), right hand bit is the "LSB" (Least Significant Digit)
- Binary -> decimal conversion:
  - Multiply each digit by 2^n where "n" is the number of places away from the right-most bit
  - Sum all the products together
  - Ex: $1110_2 = 1*2^3 + 1*2^2 + 1*2^1 + 0*2^0 = 14_{10}$
- Decimal -> binary conversion
  - Divide the number by two, if the remainder is 0, the bit is 0, otherwise it is 1
  - Subtract the remainder from the decimal value
  - Repeat the above two steps until the decimal value is 0
  - Ex: 6_{10}=> 6/2 = 3.0 => bit: 0
3/2 = 1.5 => bit: 1 => 110_2
1/2 = 0.5 => bit: 1

Hexadecimal Representation

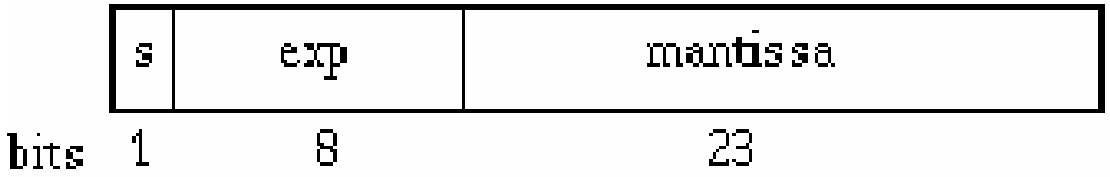
- Concept is the same as binary, except its base 16 instead of 2
  - Digits range from 0 to F
  - To indicate the number is a hexadecimal place an "x" in front
- Hexadecimal -> Decimal Conversion
  - Exactly as in binary, but multiply each digit by 16^n
  - Ex: x1F = $1*16^1 + F * 16^0 = 16 + 15 = 31_{10}$
- Decimal -> Hexadecimal
  - The same as in binary, but divide by 16, remainder values 10 to 15 are represented by letters A to F
  - Ex: 27_{10} => 27/16 = 1 r 11 => xB
1/16 = 0 r 1 => x1 => x1B
- Decimal -> Binary (Shortcut)
  - First convert the decimal to hexadecimal, then convert each hex digit to a 4-bit binary

2's Complement

- A way to represent negative numbers in binary
- If the MSB is "1" the bit pattern represents a negative number. But you can't just multiply each bit by a power of 2 to find its value
  - To find its magnitude: perform 1's complement (change all the 1's to 0's and vice versa)
  - Add 1
  - Use the standard binary->decimal method to obtain the magnitude
- Ex: 1011 => 0100 => 0100 + 1 => 0101 => 5_{10}. So 1011_2 is -5_{10}
- What about 100_2?
- To convert from decimal to 2's complement convert the absolute value of the decimal number to binary as before. If the original decimal value is negative, perform 1's complement on that binary representation and add 1 to it
- What is the decimal range of an n-bit 2's complement representation?

Floating Point

- Need a way to represent non integers in binary
- The common representation follows a standard set by IEEE (IEEE-754)
- 32 bits needed for single precision, 64 bits for double



- Sign bit: 1 if number is negative, 0 if it is positive
- Mantissa: normalized so that it always contains an implied 1 in front of the most significant bit
- Exponent: 127 + n, where n is the number of places the decimal point was shifted to the left in order to normalize the mantissa (n can be a negative number if we shifted the decimal point to the right)

Representation

- If you see a binary number "1011", what is its value?
  - It's just a bit pattern, the person reading it adds meaning to it
    - If we treat it as an unsigned notation the decimal value is 11
    - If we treat it as a signed 2's complement notation the decimal value is -5
    - Or we could interpret it as a different encoding, like floating point

Programming Studio Assignment: Introduction to Linux

Logging In

- Log into your machine
  - Use your netid and AD password
  - If you cannot log in because you are not an engineering student ask your TA to create an account for you
- If you are using a Windows workstation you must connect to an EWS Linux machine using SSH
  - Open PuTTY
    - In the Host Name box type "remlnx"
    - Make sure the Port is set to "22"
    - Click Open
    - When prompted to log in, use your netid and AD password
- It is possible to connect to an EWS workstation from home. Look on the EWS website for instructions

Working in Command Line

- Instead of pointing and clicking we tell the computer what to do by typing a command
  - Most of the ECE tools are only command line based
- In Linux, open the "Terminal" application to enter command line mode
- To see which directory you are in type "pwd"
  - Initially you should be in "/home/engr/your_net_id"
- To see the contents of the current directory type "ls"
  - To see more details about the contents type "ls –l"
- To obtain help for most Linux commands/programs type "man <command_name>"
  - Let's see the help information for the "ls" command
    - Type: "man ls"

Creating/changing directories

- We use the "mkdir dir_name" command to create a directory called "dir_name"
- Create a directory called "mydir"
  - Type "mkdir mydir"
- Confirm that a directory was created by typing "ls" and seeing that the "mydir" directory shows up in the list
- To enter into a directory we use the "cd" command
  - Type "cd mydir" to enter the "mydir" directory
  - To exit to the parent directory of "mydir" type "cd ../"

Moving Files/Directories

- Make sure you are out of the mydir directory
  - Type "pwd" to confirm you are in your home directory
- Create a directory called "dir2"
  - Type "mkdir dir2"
- To move dir2 using the "mv source dest" command
  - Type "mv dir2 mydir"
- Make sure you moved it to "mydir"
  - Type "ls mydir" to see the contents inside "mydir"
- Many times you will want to make backup copies of files/directories by using the "cp" command
  - Make a backup copy of "mydir" and call it "mydir_backup" by executing: "cp –r mydir mydir_backup
  - The "-r" tells the "copy" command to also make a copy of all the contents inside mydir. If you are copying files you don't need it
- Type "ls" to confirm that you made a backup copy

Deleting Files/Folders

- We use the "rm" command to delete things
  - **WARNING! This is an irreversible operation. There is no way to undo it. Make sure you use this command with caution and double check before your press ENTER. If you accidentally delete a project file it will be lost for ever.**

- To delete a file called "filename" type "rm filename"
- Try to delete mydir by typing "rm mydir"
  - To delete a directory you must add a "-r" after rm: "rm –r mydir"
  - You will be prompted to confirm that you want to delete it as well as the contents inside of it
  - To delete it without having to confirm type "rm –rf mydir"

Practice

- Practice creating directories, renaming them using the "mv" command, deleting them, changing in and out of directories, printing their contents
- When you are done type "exit" to close the terminal and/or close the SSH connection.
- Make sure to log out of your machine