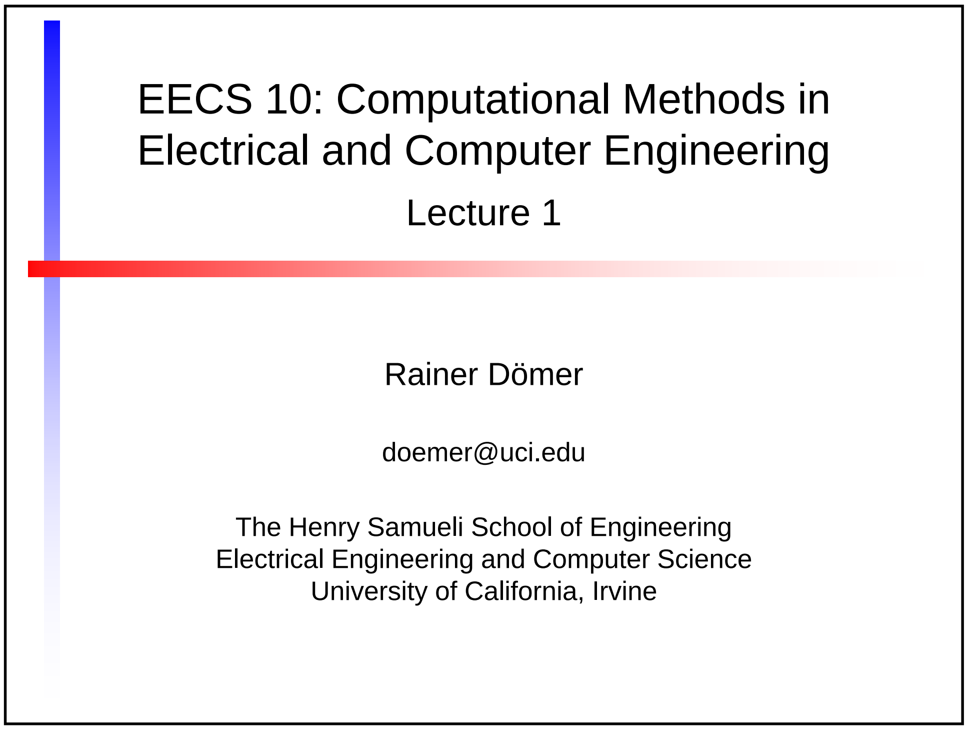

EECS 10: Computational Methods in Electrical and Computer Engineering

Lecture 1

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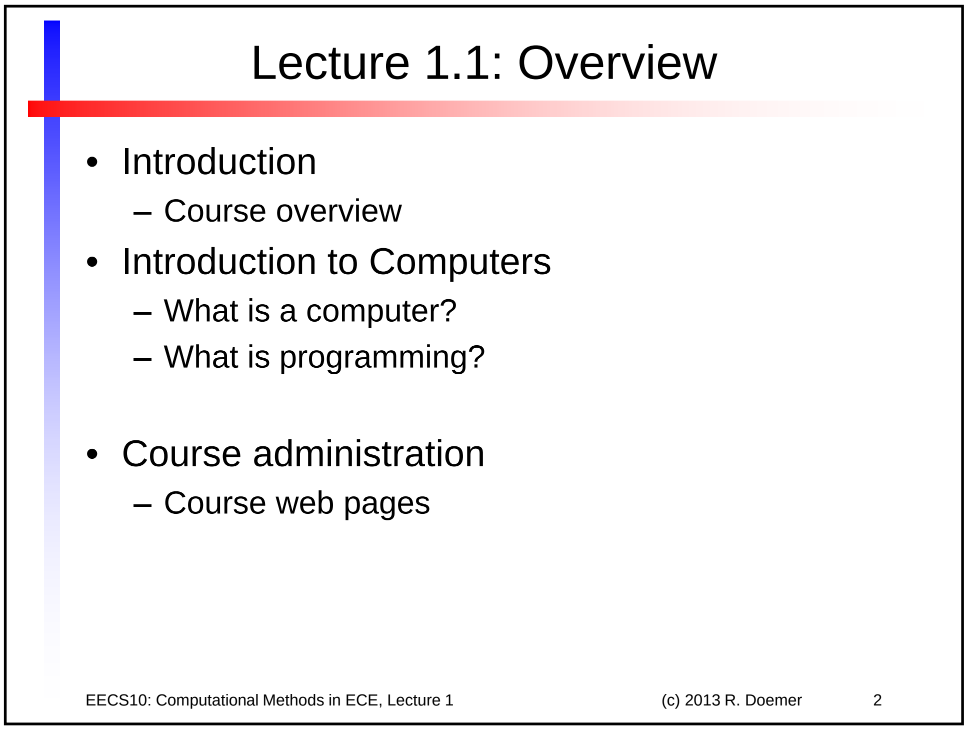
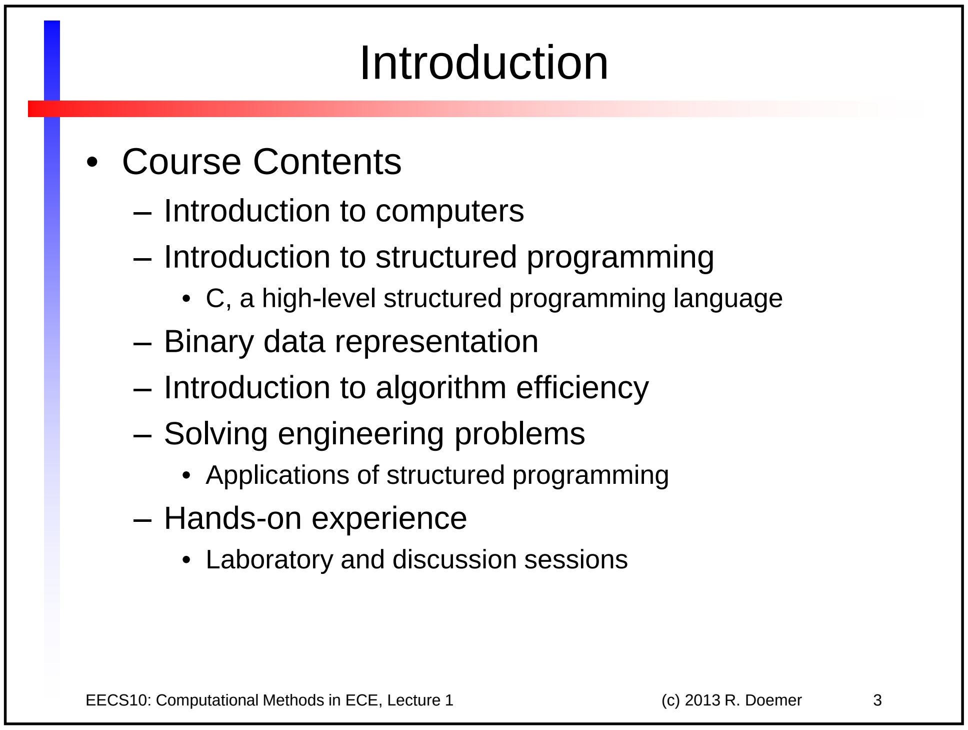


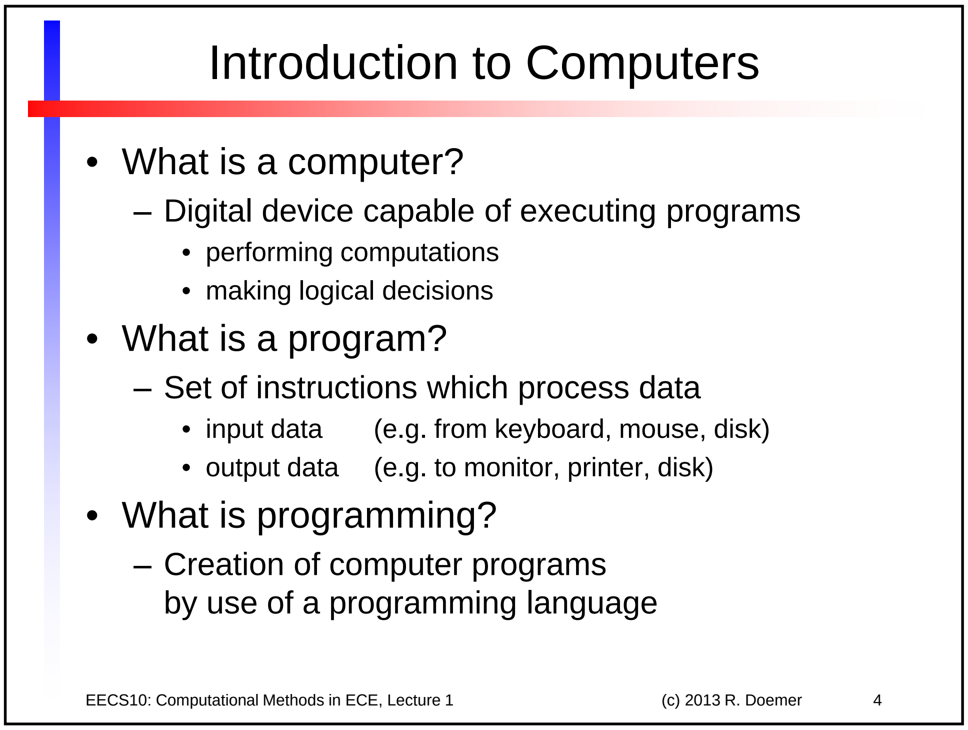
Lecture 1.1: Overview

- Introduction
  - Course overview
- Introduction to Computers
  - What is a computer?
  - What is programming?
- Course administration
  - Course web pages



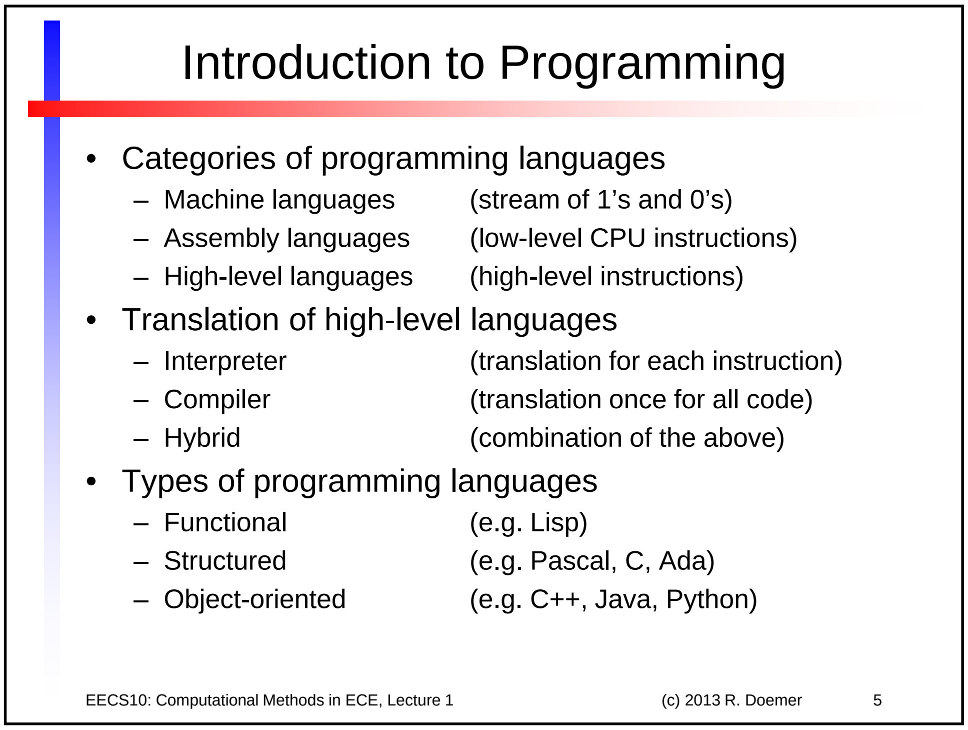
Introduction

- Course Contents
  - Introduction to computers
  - Introduction to structured programming
    - C, a high-level structured programming language
  - Binary data representation
  - Introduction to algorithm efficiency
  - Solving engineering problems
    - Applications of structured programming
  - Hands-on experience
    - Laboratory and discussion sessions



Introduction to Computers

- What is a computer?
  - Digital device capable of executing programs
    - performing computations
    - making logical decisions
- What is a program?
  - Set of instructions which process data
    - input data (e.g. from keyboard, mouse, disk)
    - output data (e.g. to monitor, printer, disk)
- What is programming?
  - Creation of computer programs by use of a programming language



Introduction to Programming

- Categories of programming languages

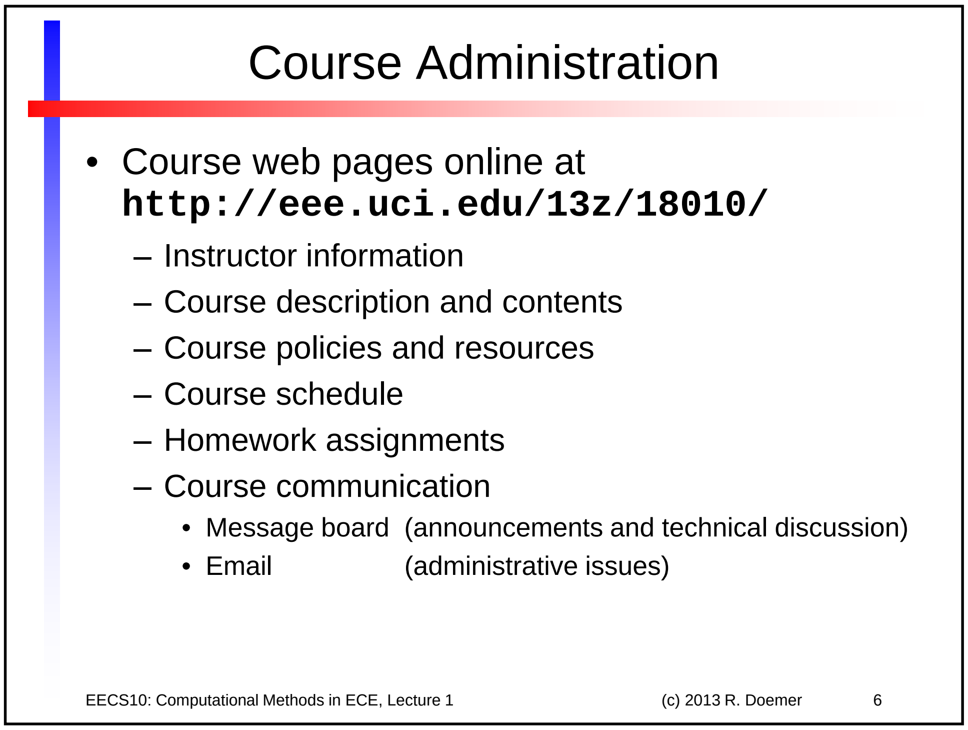
– Machine languages	(stream of 1’s and 0’s)
– Assembly languages	(low-level CPU instructions)
– High-level languages	(high-level instructions)

- Translation of high-level languages

– Interpreter	(translation for each instruction)
– Compiler	(translation once for all code)
– Hybrid	(combination of the above)

- Types of programming languages

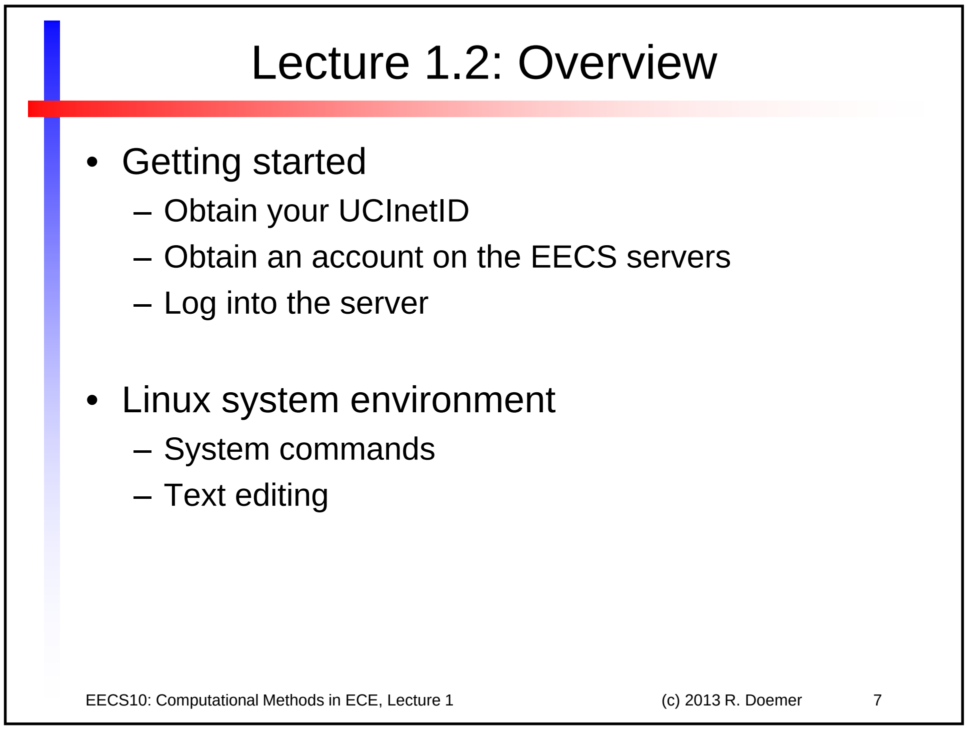
– Functional	(e.g. Lisp)
– Structured	(e.g. Pascal, C, Ada)
– Object-oriented	(e.g. C++, Java, Python)



Course Administration

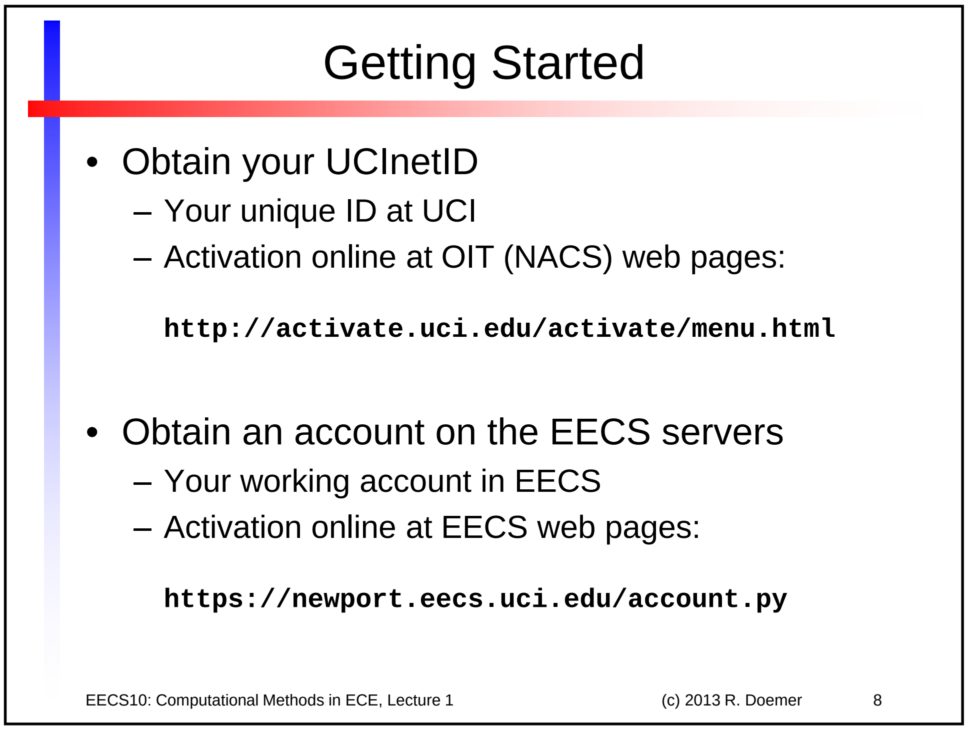
- Course web pages online at **`http://eee.uci.edu/13z/18010/`**
  - Instructor information
  - Course description and contents
  - Course policies and resources
  - Course schedule
  - Homework assignments
  - Course communication

• Message board	(announcements and technical discussion)
• Email	(administrative issues)



Lecture 1.2: Overview

- Getting started
  - Obtain your UCInetID
  - Obtain an account on the EECS servers
  - Log into the server
- Linux system environment
  - System commands
  - Text editing

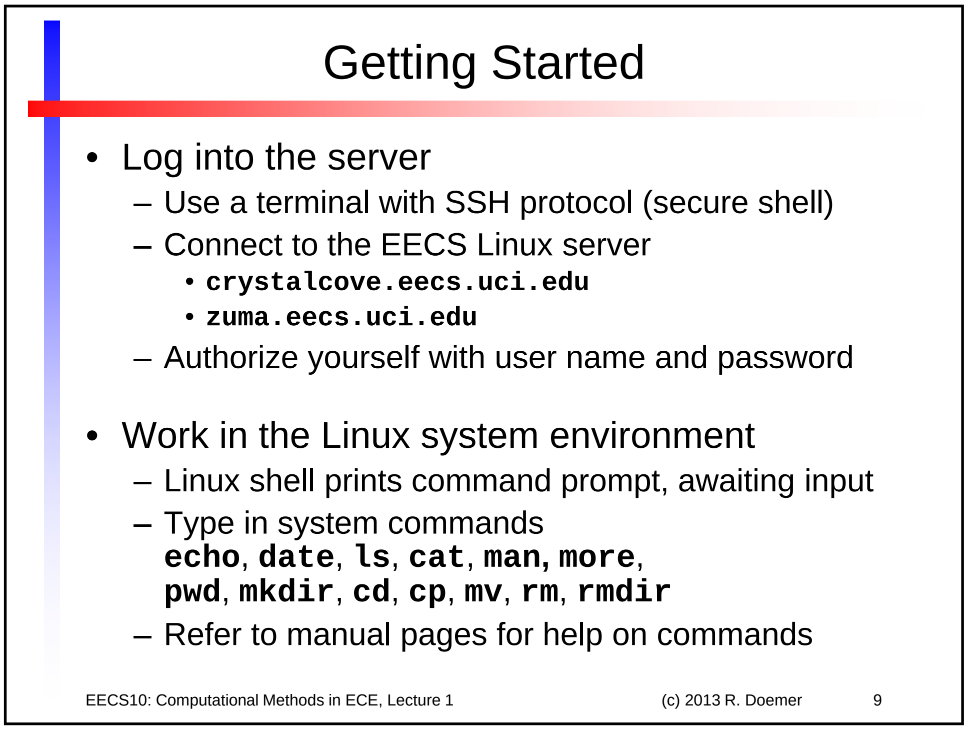


Getting Started

- Obtain your UCInetID
  - Your unique ID at UCI
  - Activation online at OIT (NACS) web pages:

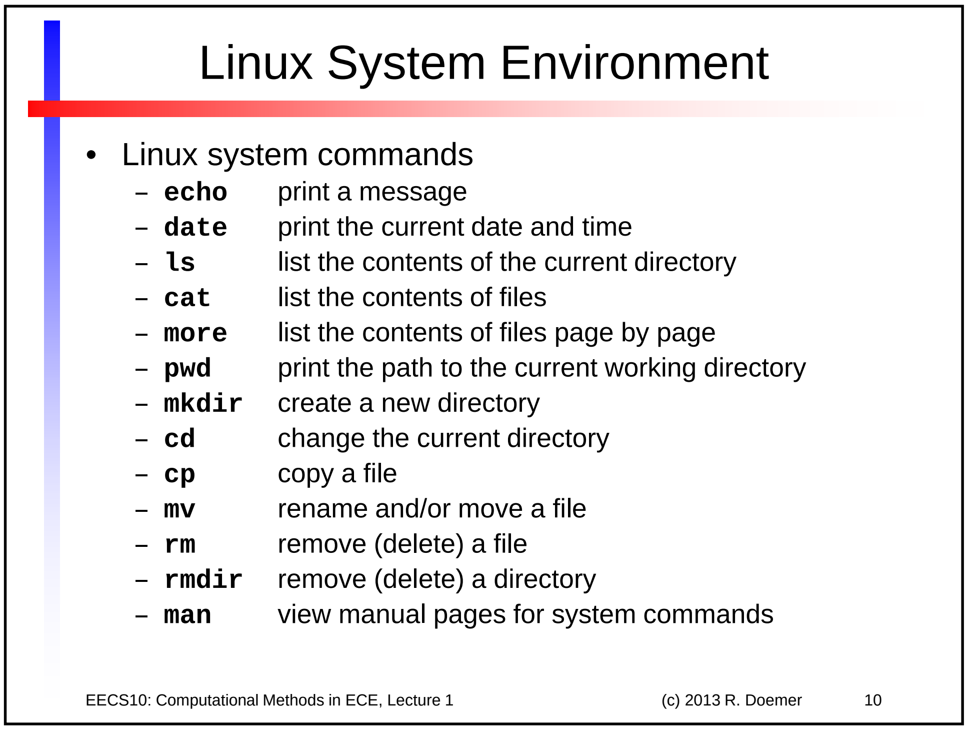
    `http://activate.uci.edu/activate/menu.html`
- Obtain an account on the EECS servers
  - Your working account in EECS
  - Activation online at EECS web pages:

    `https://newport.eecs.uci.edu/account.py`



Getting Started

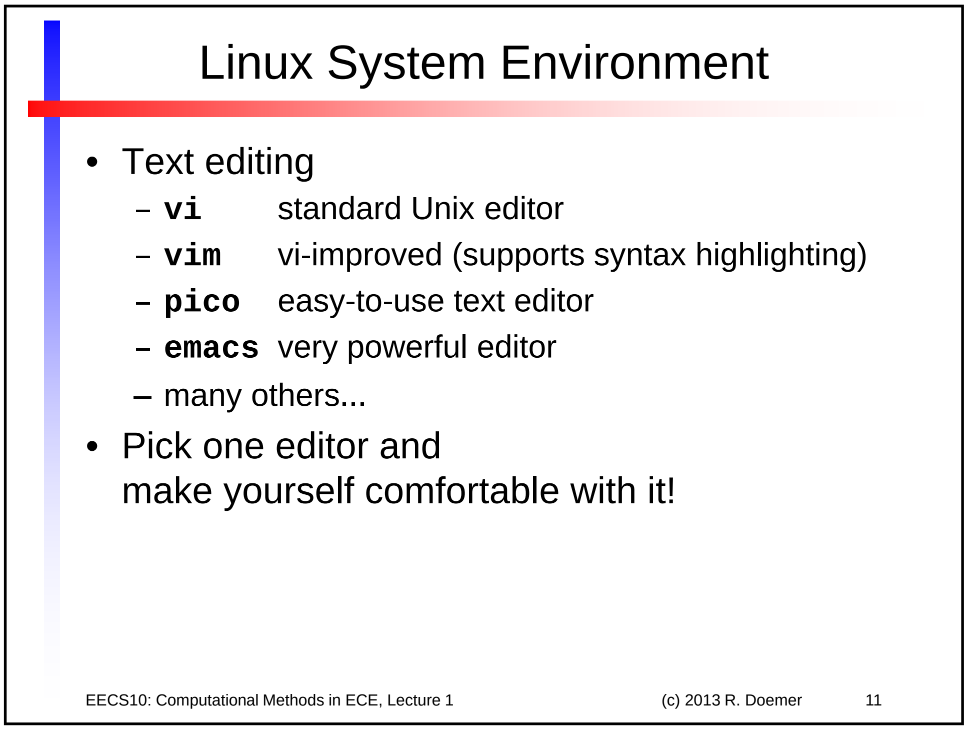
- Log into the server
  - Use a terminal with SSH protocol (secure shell)
  - Connect to the EECS Linux server
    - **`crystalcove.eecs.uci.edu`**
    - **`zuma.eecs.uci.edu`**
  - Authorize yourself with user name and password
- Work in the Linux system environment
  - Linux shell prints command prompt, awaiting input
  - Type in system commands
    `echo`, **`date`**, **`ls`**, **`cat`**, **`man`**, **`more`**,
    `pwd`, **`mkdir`**, **`cd`**, **`cp`**, **`mv`**, **`rm`**, **`rmdir`**
  - Refer to manual pages for help on commands



Linux System Environment

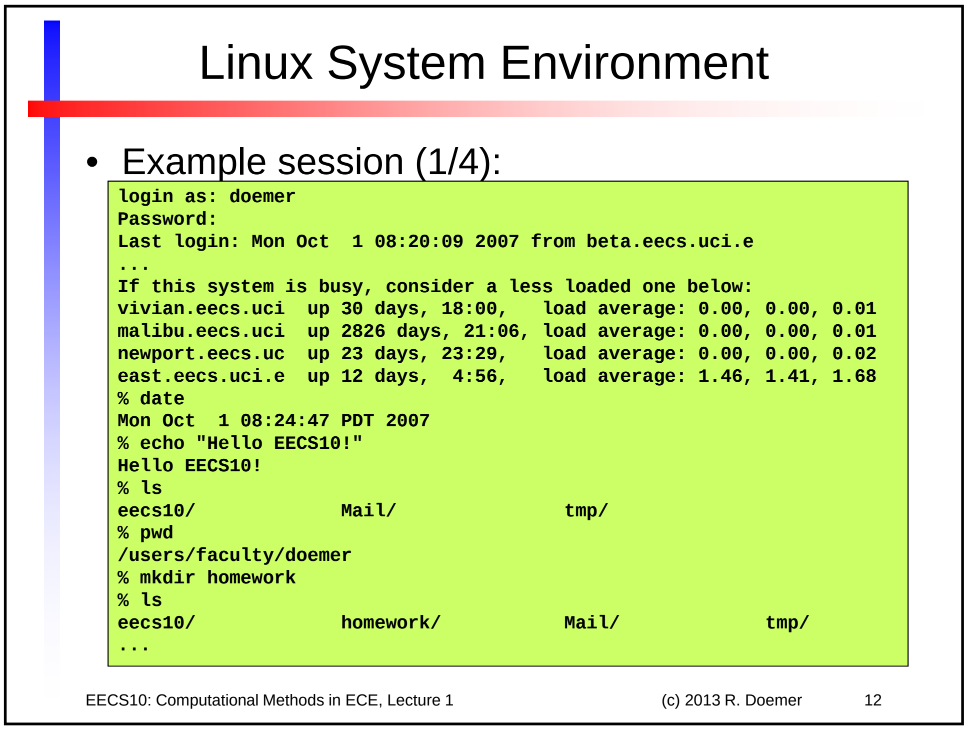
- Linux system commands

– **`echo`**	print a message
– **`date`**	print the current date and time
– **`ls`**	list the contents of the current directory
– **`cat`**	list the contents of files
– **`more`**	list the contents of files page by page
– **`pwd`**	print the path to the current working directory
– **`mkdir`**	create a new directory
– **`cd`**	change the current directory
– **`cp`**	copy a file
– **`mv`**	rename and/or move a file
– **`rm`**	remove (delete) a file
– **`rmdir`**	remove (delete) a directory
– **`man`**	view manual pages for system commands



Linux System Environment

- Text editing
  - **`vi`** standard Unix editor
  - **`vim`** vi-improved (supports syntax highlighting)
  - **`pico`** easy-to-use text editor
  - **`emacs`** very powerful editor
  - many others...
- Pick one editor and
  make yourself comfortable with it!



Linux System Environment

- Example session (1/4):

```
login as: doemer
Password:
Last login: Mon Oct  1 08:20:09 2007 from beta.eecs.uci.e
...
If this system is busy, consider a less loaded one below:
vivian.eecs.uci  up 30 days, 18:00,   load average: 0.00, 0.00, 0.01
malibu.eecs.uci  up 2826 days, 21:06, load average: 0.00, 0.00, 0.01
newport.eecs.uc  up 23 days, 23:29,   load average: 0.00, 0.00, 0.02
east.eecs.uci.e  up 12 days,  4:56,   load average: 1.46, 1.41, 1.68
% date
Mon Oct  1 08:24:47 PDT 2007
% echo "Hello EECS10!"
Hello EECS10!
% ls
eecs10/            Mail/              tmp/
% pwd
/users/faculty/doemer
% mkdir homework
% ls
eecs10/            homework/          Mail/              tmp/
...
```

Linux System Environment

- Example session (2/4):

```
...
% cd homework
% pwd
/users/faculty/doemer/homework
% ls
% mkdir hw1
% ls
hw1/
% cd hw1
% ls
% vi program.c
% ls
program.c
doemer@vivian% ls -l
total 2
-rw-------   1 doemer   smmsp         51 Oct  1 08:32 program.c
% more program.c
This is my new program file.
I don't know C yet...
...
```

Linux System Environment

- Example session (3/4):

```
...
% cp program.c mybackup.c
% ls
mybackup.c   program.c
% ls -l
-rw-------   1 doemer   smmsp         51 Oct  1 08:34 mybackup.c
-rw-------   1 doemer   smmsp         51 Oct  1 08:32 program.c
% cd ..
% pwd
/users/faculty/doemer/homework
% ls
hw1/
% /ecelib/bin/turnin
=========================================
EECS 10 Fall 2007:
Assignment "hw1" submission for doemer
Due date: Mon Oct  8 11:59:59 2007
=========================================
...
```

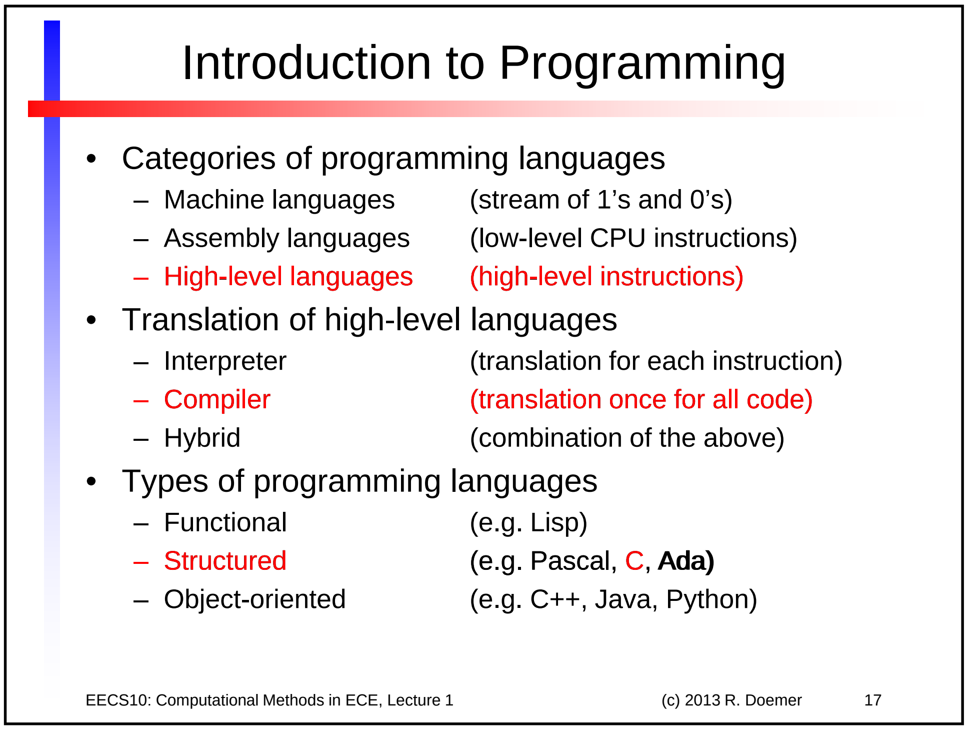
Linux System Environment

- Example session (4/4):

```
...
Submit program.c [yes, no]? y
Cannot read file program.c
Submit mybackup.c [yes, no]? n
=========================================
  Summary:
=========================================
You just submitted file(s):
   program.c
You have not submitted file(s):
   mybackup.c
doemer@vivian% ~eecs10/bin/listfiles.py
=========================================
EECS 10 Fall 2007: "hw1" listing for doemer
=========================================
Files submitted for assignment "hw1":
program.c
% logout
```

Lecture 1.3: Overview

- Introduction to Programming in C
  - History of C
  - Introduction to C
- Our first C Program
  - Example **`HelloWorld.c`**
  - Structure of a C program
  - **`printf()`** function
  - Program compilation and execution
  - String constants



Introduction to Programming

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  - Machine languages (stream of 1's and 0's)
  - Assembly languages (low-level CPU instructions)
  - High-level languages (high-level instructions)
- Translation of high-level languages
  - Interpreter (translation for each instruction)
  - Compiler (translation once for all code)
  - Hybrid (combination of the above)
- Types of programming languages
  - Functional (e.g. Lisp)
  - Structured (e.g. Pascal, C, **Ada)**
  - Object-oriented (e.g. C++, Java, Python)

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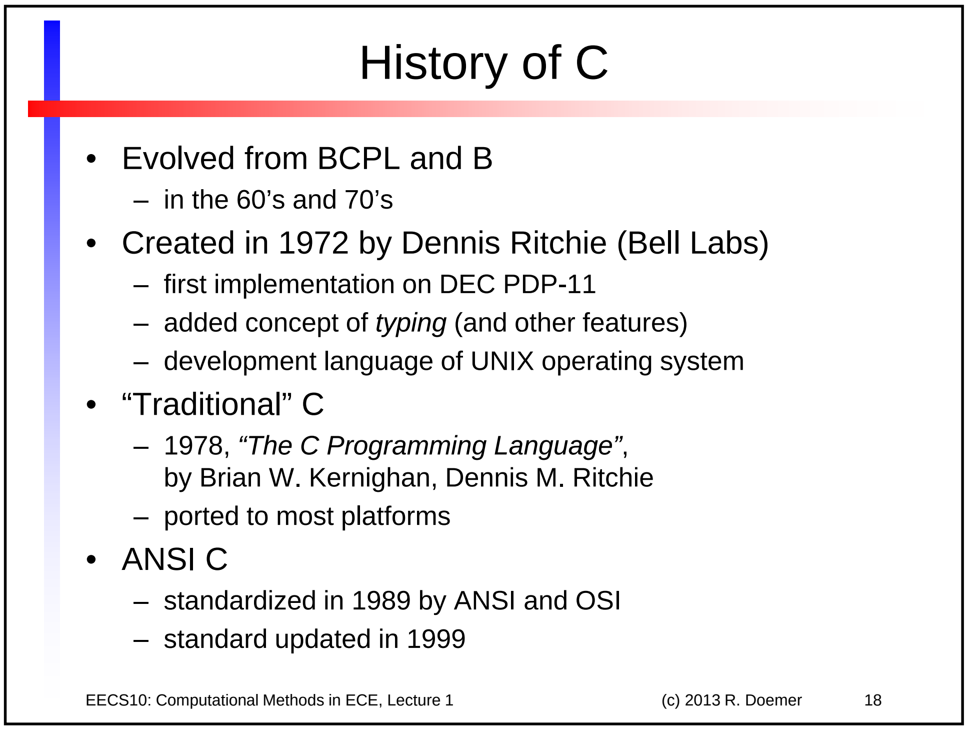

History of C

- Evolved from BCPL and B
  - in the 60's and 70's
- Created in 1972 by Dennis Ritchie (Bell Labs)
  - first implementation on DEC PDP-11
  - added concept of *typing* (and other features)
  - development language of UNIX operating system
- "Traditional" C
  - 1978, *"The C Programming Language"*,
    by Brian W. Kernighan, Dennis M. Ritchie
  - ported to most platforms
- ANSI C
  - standardized in 1989 by ANSI and OSI
  - standard updated in 1999

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Introduction to C

- What is C?
  - Programming language
    - high-level
    - structured
    - compiled
  - Standard library
    - rich collection of existing functions
- Why C?
  - de-facto standard in software development
  - code is portable to many different platforms
  - supports structured and functional programming
  - easy transition to object-oriented programming
    - C++ / Java
  - freely available for most platforms

Our first C Program

- Program example: **HelloWorld.c**

```
/* HelloWorld.c: our first C program    */
/*                                      */
/* author: Rainer Doemer                */
/*                                      */
/* modifications:                       */
/* 09/28/04 RD  initial version         */

#include <stdio.h>

/* main function */

int main(void)
{
    printf("Hello World!\n");
    return 0;
}

/* EOF */
```

Our first C Program

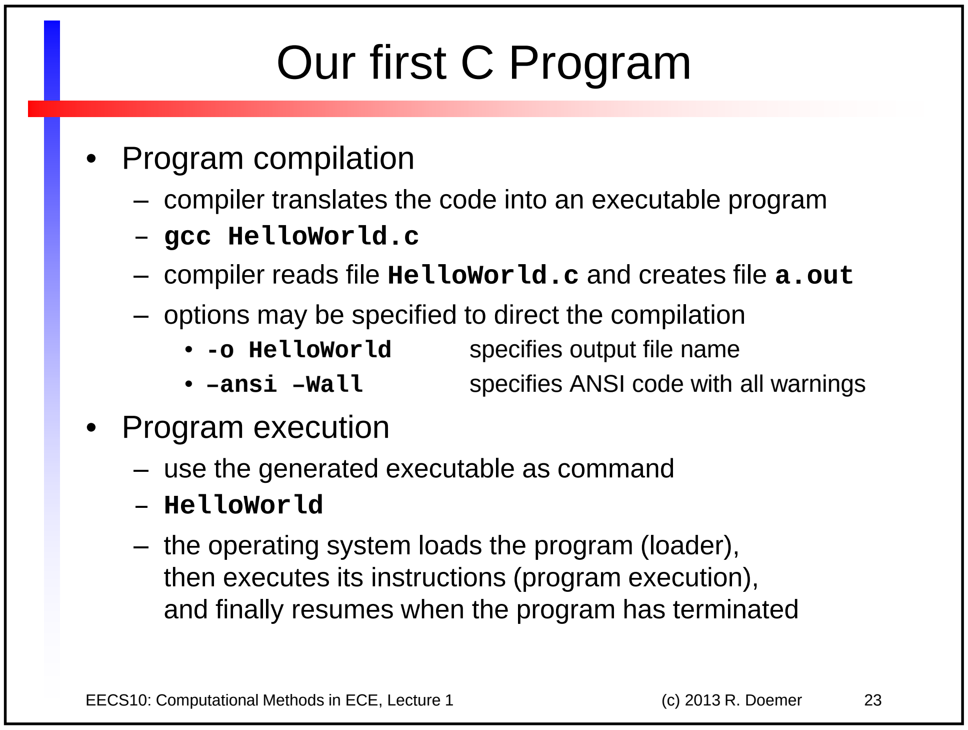
- Program comments
  - start with `/*` and end with `*/`
  - are ignored by the compiler
  - should be used to
    - document the program code
    - structure the program code
    - enhance the readability
- **`#include`** preprocessor directive
  - inserts a header file into the code
- standard header file **`<stdio.h>`**
  - part of the C standard library
  - contains declarations of standard types and functions for data input and output (e.g. function **`printf()`**)

```
/* HelloWorld.c: our first C program */
/* author: Rainer Doemer              */
/* modifications:                     */
/* 09/28/04 RD  initial version       */
#include <stdio.h>
/* main function */
int main(void)
{
    printf("Hello World!\n");
    return 0;
}
/* EOF */
```

Our first C Program

- **`int main(void)`**
  - main function of the C program
  - the program execution starts (and ends) here
  - **`main`** must return an integer (**`int`**) value to the operating system at the end of its execution
    - return value of 0 indicates successful completion
    - return value greater than 0 usually indicates an error condition
- function body
  - block of code (definitions and statements)
  - starts with an opening brace (**{**)
  - ends with a closing brace (**}**)
- **`printf()`** function
  - formatted output (to **`stdout`**)
- **`return`** statement
  - ends a function and returns its argument as result

```
...
/* main function */
int main(void)
{
    printf("Hello World!\n");
    return 0;
}
/* EOF */
```



Our first C Program

- Program compilation
  - compiler translates the code into an executable program
  - **`gcc HelloWorld.c`**
  - compiler reads file **`HelloWorld.c`** and creates file **`a.out`**
  - options may be specified to direct the compilation
    - **`-o HelloWorld`** specifies output file name
    - **`–ansi –Wall`** specifies ANSI code with all warnings
- Program execution
  - use the generated executable as command
  - **`HelloWorld`**
  - the operating system loads the program (loader), then executes its instructions (program execution), and finally resumes when the program has terminated

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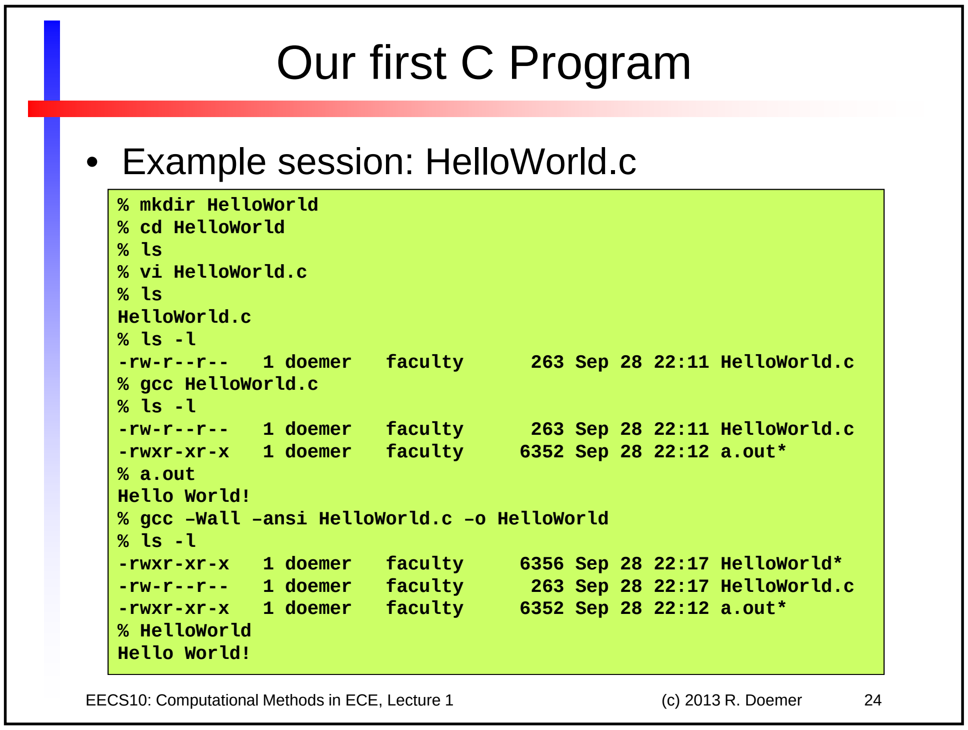

Our first C Program

- Example session: HelloWorld.c

```
% mkdir HelloWorld
% cd HelloWorld
% ls
% vi HelloWorld.c
% ls
HelloWorld.c
% ls -l
-rw-r--r--   1 doemer   faculty      263 Sep 28 22:11 HelloWorld.c
% gcc HelloWorld.c
% ls -l
-rw-r--r--   1 doemer   faculty      263 Sep 28 22:11 HelloWorld.c
-rwxr-xr-x   1 doemer   faculty     6352 Sep 28 22:12 a.out*
% a.out
Hello World!
% gcc –Wall -ansi HelloWorld.c –o HelloWorld
% ls -l
-rwxr-xr-x   1 doemer   faculty     6356 Sep 28 22:17 HelloWorld*
-rw-r--r--   1 doemer   faculty      263 Sep 28 22:17 HelloWorld.c
-rwxr-xr-x   1 doemer   faculty     6352 Sep 28 22:12 a.out*
% HelloWorld
Hello World!
```

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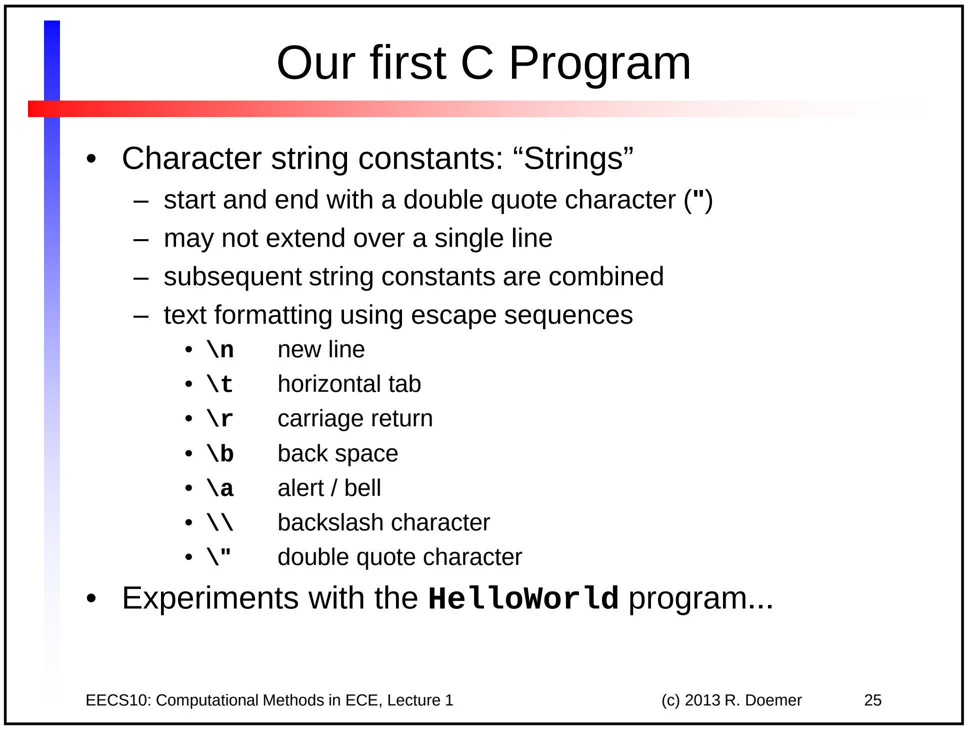

Our first C Program

- Character string constants: “Strings”
  - start and end with a double quote character (**"**)
  - may not extend over a single line
  - subsequent string constants are combined
  - text formatting using escape sequences

`\n`	new line
`\t`	horizontal tab
`\r`	carriage return
`\b`	back space
`\a`	alert / bell
`\\`	backslash character
`\"`	double quote character

- Experiments with the **`HelloWorld`** program...

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