

# EECS 22: Advanced C Programming

## Lecture 19

Rainer Dömer

doemer@uci.edu

The Henry Samueli School of Engineering  
Electrical Engineering and Computer Science  
University of California, Irvine

## Lecture 19: Overview

- Course Administration
  - Reminder: Final course evaluation
- Programming Courses in EECS
  - Outlook to EECS 22L
- Review Quiz

## Course Administration

- Final Course Evaluation
  - Open until end of 10<sup>th</sup> week (Sunday night)
  - Dec. 2, 2014, through Dec. 14, 2014, 11:45pm
  - Online via EEE Evaluation application
- Mandatory Evaluation of Course and Instructor
  - Voluntary
  - Anonymous
  - Very valuable
- Please spend 5 minutes for this survey!
  - Your feedback is appreciated!

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## Programming Courses in EECS

- Introductory Programming
  - EECS 10: uses C programming language (for EE)
  - EECS 12: uses Python programming language (for CpE)
- Programming from the Ground Up
  - EECS 20: starts with Assembly language (on bare CPU), then introduces C programming language
- Advanced Programming Courses
  - EECS 22: “*Advanced C Programming*” (in ANSI C)
  - EECS 22L: “*Software Engineering Project in C*” (ANSI C/C++)
- Object-Oriented Programming
  - EECS 40: introduces objects and classes, hierarchy, and higher object-oriented programming concepts using Java

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## EECS 22L: Software Eng. Project in C

- *“Developing real C Programs in a Team”*
  - Hands-on experience with larger software projects
  - Introduction to software engineering
    - Specification, documentation, implementation, testing
  - Team work
- Features
  - Design efficient data structures, APIs
  - Utilize programming modules, build libraries, GUIs
  - Develop and optimize contemporary software applications
- Tools
  - Software development, version control: `ssh`, `gcc`, `cvs`, `chmod`
  - Compilation, scripting, packaging: `make`, `bash`, `groff`, `gtar`
  - Testing and debugging with `gdb`, `ddd`, `gprof`, `gcov`, ...

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## EECS 22L: Software Eng. Project in C

- Catalog Data
  - **EECS 22L Software Engineering Project in C Language (Credit Units: 3) W.**
  - Hands-on experience with the ANSI-C programming language.
  - Medium-sized programming projects, team work.
  - Software specification, documentation, implementation, testing.
  - Definition of data structures and application programming interface.
  - Creation of program modules, linking with external libraries.
  - Rule-based compilation, version control.
  - Prerequisites: EECS 22
  - (Design Units: 3)

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## EECS 22L: Software Eng. Project in C

- Course Contents
  - Software engineering topics, including specification, documentation, implementation, testing, debugging, project planning, organization, maintenance, version control, organization of source files, header files, modules
  - Compilation flow, Makefile, shell scripting
  - Definition of data structures and application programming interface
  - External libraries, system programming, POSIX API, interrupts
  - Introduction to C++ language, syntax and semantics, references, inline functions, default arguments, classes, members, and methods, object creation and deletion (constructors, destructors)

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## Review Quiz: Question 1


- Which of the following statements is true for an *algorithm*?  
(Check all that apply!)
  - a) An algorithm must be indeterministic.
  - b) An algorithm solves a problem quickly.
  - c) An algorithm is historically based on Al Gore's rhythm.
  - d) An algorithm executes a program using pseudo code.
  - e) An algorithm must terminate after a finite number of steps.

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## Review Quiz: Question 2

- In C, which properties does every object have?  
(Check all that apply!)
  - a) A size.
  - b) A value.
  - c) A weight.
  - d) A type.
  - e) A location.

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## Review Quiz: Question 2

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(Check all that apply!)

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- b) A value.
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- d) A type.
- e) A location.

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## Review Quiz: Question 3

- What is the result type of the following expression?

```
-1 + 2.3f * (4.5 / 67f) - (short)89
```

- a) **short int**
- b) **int**
- c) **long int**
- d) **float**
- e) **double**

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
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### Review Quiz: Question 3

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-1 + 2.3f * (4.5 / 67f) - (short)89
```

- a) `short int`
- b) `int`
- c) `long int`
- d) `float`
-  e) **`double`**

### Review Quiz: Question 4

- Given the following code fragment,

```
double x;  
double y;  
  
x = (int)(y + 0.5);
```

which of the following statements is true?  
(Check all that apply!)

- a) for `y=5.0`, `x` is set to `5.0`
- b) for `y=5.1`, `x` is set to `5.0`
- c) for `y=5.49`, `x` is set to `5.0`
- d) for `y=5.5`, `x` is set to `6.0`
- e) for `y=5.95`, `x` is set to `6.0`

## Review Quiz: Question 4

- Given the following code fragment,

```
double x;  
double y;  
  
x = (int)(y + 0.5);
```

which of the following statements is true?  
(Check all that apply!)

- a) for  $y=5.0$ ,  $x$  is set to  $5.0$
- b) for  $y=5.1$ ,  $x$  is set to  $5.0$
- c) for  $y=5.49$ ,  $x$  is set to  $5.0$
- d) for  $y=5.5$ ,  $x$  is set to  $6.0$
- e) for  $y=5.95$ ,  $x$  is set to  $6.0$

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## Review Quiz: Question 5

- What is the value of  $x$  after the following code fragment is executed?

```
int x = 10;  
while(x > 0)  
{ x -= 2;  
}
```

- a) -2
- b) -1
- c) 0
- d) 1
- e) 2

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
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## Review Quiz: Question 5

- What is the value of `x` after the following code fragment is executed?

```
int x = 10;
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{ x -= 2;
}
```

- a) -2
- b) -1
-  c) 0
- d) 1
- e) 2

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## Review Quiz: Question 6

- Given that the C standard math library is included, which of the following expressions results in the value `4.0`?  
(Check all that apply!)

- a) `pow(16.0, .5)`
- b) `4.0 * cos(0.0)`
- c) `3 + sin(0.0)`
- d) `log10(10000.00)`
- e) `sqrt(15.0) + 1`

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## Review Quiz: Question 7

- What is output by the following program fragment?


```
char s[] = "EECS22";
s[4] = 0;
printf("%s %c", s, s[2]);
```

- a) **EECS02 2**
- b) **EEC 22 0**
- c) **E E**
- d) **EECS C**
- e) **EEC C**

## Review Quiz: Question 7

- What is output by the following program fragment?

```
char s[] = "EECS22";
s[4] = 0;
printf("%s %c", s, s[2]);
```

- a) EECS02 2
- b) EEC 22 0
- c) E E
-  d) **EECS C**
- e) EEC C

## Review Quiz: Question 8

- In the program below, what is printed by the function call `g(1)`?

- a) 1 2
- b) 2 3
- c) 1 1
- d) 2
- e) 1

```
1 int f(int x)
2 { printf("%d ", x);
3   return x + 1;
4 }
5 int g(int x)
6 { printf("%d ", f(x));
7   return x + 2;
8 }
```

## Review Quiz: Question 8

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- a) 1 2
- b) 2 3
- c) 1 1
- d) 2
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```

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4 }
5 int g(int x)
6 { printf("%d ", f(x));
7   return x + 2;
8 }

```

## Review Quiz: Question 9

- What is recursion?  
(Check all that apply!)
  - a) A function that does not terminate.
  - b) A function that calls itself.
  - c) A function that contains a loop.
  - d) A function  $f$  that calls a function  $g$  which calls  $f$ .
  - e) A function that returns no value.

## Review Quiz: Question 9

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## Review Quiz: Question 10

- Given the function definition below, what is printed for the function call  $f(3)$ ?

- a) 1 2 3
- b) 1 2 3 4
- c) 3 2 1 0
- d) 4 3 2 1
- e) 3 2 1

```
1 void f(int x)
2 {
3     printf("%d ", x);
4     if (x > 0)
5         { f(x-1); }
6 }
```


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## Review Quiz: Question 10

- Given the function definition below, what is printed for the function call `f(3)`?

- a) 1 2 3
- b) 1 2 3 4
-  c) 3 2 1 0
- d) 4 3 2 1
- e) 3 2 1

```

1 void f(int x)
2 {
3     printf("%d ", x);
4     if (x > 0)
5         { f(x-1); }
6 }

```

## Review Quiz: Question 11

- Given the following definition of the vectors `v1`, `v2` and `v3`, what is a correct way to perform a vector addition of `v1` and `v2`?


```
struct v {int x, y;} v1, v2, v3;
```

- a) `v3 = v1 + v2;`
- b) `v3 = v1[x]*v2[y] + v1[y]*v2[x]`
- c) `v3[0] = v1[0] + v2[0];`  
`v3[1] = v1[1] + v2[1];`
- d) `v3.x = v1.x + v2.x;`  
`v3.y = v1.y + v2.y;`
- e) `v3->x = v1->x + v2->x;`  
`v3->y = v1->y + v2->y;`

## Review Quiz: Question 11

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- c) `v3[0] = v1[0] + v2[0];`  
`v3[1] = v1[1] + v2[1];`
-  d) `v3.x = v1.x + v2.x;`  
`v3.y = v1.y + v2.y;`
- e) `v3->x = v1->x + v2->x;`  
`v3->y = v1->y + v2->y;`

## Review Quiz: Question 12

- What could cause a **bus error**?  
(Check all that apply!)
- a) Waking up late and missing the bus.
  - b) Calling a recursive function.
  - c) Accessing an array with an index out of range.
  - d) Referencing a pointer variable with invalid value.
  - e) Accessing an integer variable with invalid value.

## Review Quiz: Question 12

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## Review Quiz: Question 13

- Given the program segment below, what is the value of **\*p** at the end?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5

```
1 int x[] = {1,2,3,4,5};  
2 int *p = &x[2];  
3  
4 p++;  
5 p -= 2;
```

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## Review Quiz: Question 13

- Given the program segment below, what is the value of `*p` at the end?

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- c) 3
- d) 4
- e) 5

```

1 int x[] = {1,2,3,4,5};
2 int *p = &x[2];
3
4 p++;
5 p -= 2;

```

## Review Quiz: Question 14

- Given the function and variable definitions shown below, which function call is valid? (Check all that apply!)

- a) `StrLen(cp);`
- b) `StrLen(ca);`
- c) `StrLen(c);`
- d) `StrLen(i);`
- e) `StrLen("abc");`

```

1 int StrLen(
2     const char *s)
3 { int l = 0;
4   while(*s)
5     { s++;
6       l++;
7     }
8   return l;
9 }
10 char *cp = "hello";
11 char ca[] = "world";
12 char c = 'c';
13 int i = 42;

```

## Review Quiz: Question 14

- Given the function and variable definitions shown below, which function call is valid? (Check all that apply!)

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3 {
4     int l = 0;
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10    return l;
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14 char c = 'c';
15 int i = 42;

```

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## Review Quiz: Question 15

- What does the following code segment print?

```

1 char s[] = "Hppe!Mvdl!boe!Ibqqz!Ipmjebzt";
2 char *p;
3 p = &s[0];
4 while(*p)
5 { printf("%c", *p - 1);
6   p++;
7 }

```

- a) Hppe!Mvdl!boe!Ibqqz!Ipmjebzt
- b) Happy Holidays and Good Luck
- c) Happy Luck and Good Holidays
- d) Good Holidays and Happy Luck
- e) Good Luck and Happy Holidays

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## Review Quiz: Question 15

- What does the following code segment print?

```
1 char s[] = "Hppe!Mvdl!boe!Ibqqz!Ipmjebzt";
2 char *p;
3 p = &s[0];
4 while(*p)
5 { printf("%c", *p - 1);
6   p++;
7 }
```

- a) Hppe!Mvdl!boe!Ibqqz!Ipmjebzt
- b) Happy Holidays and Good Luck
- c) Happy Luck and Good Holidays
- d) Good Holidays and Happy Luck
-  e) **Good Luck and Happy Holidays**