# 16.216: ECE Application Programming

Summer 2012

Lecture 3: Key Questions
July 17, 2012

1. What are the basic binary arithmetic operators supported by C?

2. Explain the modulus operator (%).

3. What determines the type of a binary operation's result?

4. What is the difference between division of integers and floating-point types?

5. Explain the operation of the unary negation operator (e.g., `-x`).

6. **Example:** Evaluate each of the following expressions, including the type (`int` or `double`) in your answer.

a. `19/3`

b. `3/19`

c. `19%3`

d. `3%19`

e. `5 + 7/2`

f. `5.0 + 7/2`

g. `5 + 7.0/2`

h. `5 * 3 % 3 / 6 + 14 + 10 / 2`

i. `5 * (3 % 3) / 6 + 14.0 + 10/3`

7. Describe the C bitwise operators.

8. Explain C bit shift operators and their uses.

9. What is the order of operations for C operators?

10. **Example:** Evaluate each of the following expressions if you have the following unsigned ints: `A = 7, B = 10, and C = 0xFFFFFFFF`

a. `A & B`

b. `A | ~B`

c. `A ^ C`

d. `A << 4`

e. `B >> 5`

f. `A | (B << 2)`

11. **Example:** Given an unsigned int, n, and a number, b, how would you:

a. Clear all bits of n?

b. Clear the lower 16 bits of n (mask out lower bits)?

c. Flip all bits of n?

d. Flip bit b of n?

e. Set bit b of n (i.e., make sure bit b is 1)?

f. Clear bit b of n (i.e., make sure bit b is 0)?

12. Describe how, in general, you perform the operations below on a bit or range of bits:

a. Setting bit(s) (desired bit(s) = 1, all others unchanged)

b. Clearing bit(s) (desired bit(s) = 0, all others unchanged)

c. Flipping bit(s) (desired bit(s) change from 0→1 or 1→0, all others unchanged)

13. Explain how to set the field width, alignment, and padding characters for values printed using `printf()`.

14. Explain how to set the precision of a value printed using `printf()`, and what the precision means for the different data types.

15. Explain how to format hexadecimal values printed using `printf()`.

16. **Example:** Assume `int x = 123; float y = 4.56; double z = 7.89991;`
What does each of the following lines print?

a. `printf("%4d %5f %6lf\n", x, y, z);`

b. `printf("%.4d %.4f %.4lf\n", x, y, z);`

c. `printf("%08d %-7.1f %+-4.1lf !\n", x, y, z);`

17. **Example:** Write a short code sequence to do each of the following:

a. Print three integers—x, y, and z

- Use field widths of 10, 20, and 30, respectively
- Put an extra space between each field
- Show the signs of all values and left justify them

b. Print four doubles—d1, d2, d3, d4

- Use field widths of 7 for all values
- Put an extra space between each field
- Show 1, 2, 3, and 4 places after the decimal point, respectively

c. Given three variables—int w, p; double var;

- Read values for w and p from the input
- Print var using field width w and precision p