

**COS 301 Programming Languages**  
**Fall 2009**  
**Project Assignment #2 Due Thursday Oct 15**

**Syntax, Operators, and Basic Data Types**

Write a 6-to-8 page paper that addresses the following topics for your language:

- summary of basic syntactic structure (including statement terminators or separators; block structure; syntactic peculiarities, etc.)
- basic data types available, including range limitations or lack thereof
- arithmetic, logical, and relational, and other (e.g., string) operators available
- precedence and associativity of operators

Note that the goal is to summarize and compare, not to provide reference manuals. Some languages may have dozens of operators. You may want to include lists of operators, data types, etc. in appendices. It might help to imagine that you are writing an article to help beginning computer science students choose which of two languages they want to study.

Continue developing the annotated bibliography of your references. As discussed in class, your bibliography may include references not cited in this particular paper.

**Programming Assignment #2**

Write two short programs in your chosen language:

1. Write a function to count the number of bits set in an 2's complement signed integer of up to 32 bits and write a test driver that calls the function and outputs results. Submit output for the numbers 0, 1, -1, 65535, -65535, 65537, 218893066, -218893066, 2147483647 and -2147483648.

2. Write a program to determine whether your language uses round-to-even or banker's rounding to round floating point numbers(see below) and/or whether rounding can be programmer controlled (which would be the case if there is no implicit rounding function). Output should include examples demonstrating your conclusion.

**Banker's Rounding:**

The banker's rounding taught in elementary arithmetic is to round up to the next integer for values in the form  $n . 5$ . This introduces a systematic bias in arithmetic which can be seen by comparing the sums  $1.5 + 2.5 + 3.5 + 4.5 = 12$  and  $2 + 3 + 4 + 5 = 14$ . An alternative called round-to-even removes this bias by rounding to nearest even number, so both 1.5 and 2.5 round to 2, and 3.5 and 4.5 both round to 4. Note that the round-to-even sum is  $2 + 2 + 4 + 4 = 12$ .