- CPSC 275: Introduction to Computer Systems

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Fall 2025

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Homework 11

NOTE: You are not required to hand in the following exercises, but you are strongly encouraged to complete them to strengthen your understanding of the concepts covered in class.

1. Assuming a 3-bit unsigned integer arithmetic, multiply each pair of the following numbers:
   A. 100 × 101
   B. 010 × 111
   C. 110 × 110

   Indicate whether an overflow occurred.

2. Assuming a 3-bit two's complement integer arithmetic, multiply each pair of the following numbers:
   A. 100 × 101
   B. 010 × 111
   C. 110 × 110

3. For each of the following values of K, find ways to express `x * K` using only the specified number of operations, where we consider both additions and subtractions to have comparable cost. For example, when K `= 12`, `x * K` can be computed using two shifts and one addition: `x * 12 = x * (4 + 8) = x * 4 + x * 8 = (x << 2) + (x << 3)`.

K	Shifts	Add/Subs
6	2	1
31	1	1
-6	2	1
55	2	2

4. Assume we are running code on a 32-bit machine using two's-complement arithmetic for signed values. Right shifts are performed arithmetically for signed values and logically for unsigned values. The variables are declared and initialized as follows:

```
int x = foo(); /* Arbitrary value */
int y = bar(); /* Arbitrary value */
unsigned ux = x;
unsigned uy = y;
```

For each of the following C expressions, either (1) argue that it is true (evaluates to 1) for all values of `x` and `y`, or (2) give values of `x` and `y` for which it is false (evaluates to 0):

A. `(x > 0) || (x-1 < 0)`
B. `(x & 7) != 7 || (x<<29 < 0)`
C. `(x * x) >= 0`
D. `x < 0 || -x <= 0`
E. `x > 0 || -x >= 0`
F. `x+y == uy+ux`
G. `x*~y + uy*ux == -x`

5. Write a function `printupper()` that given a line of text as a parameter, prints it in uppercase letters. Do this without using the built-in function like `toupper()`. For example, `printupper("Hello")` should print the string `"HELLO"`. Hint: See ASCII table.

6. Write a function `str2num()` that given a numeric string as a parameter, returns an integer equivalent to the string. For example, `str2num("2025")` should return `2025`.

- **Welcome: Sean**
  - LogOut