- CPSC 275: Introduction to Computer Systems

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Fall 2025

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Homework 34

> 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. Write code to, without using the array notation (`[]`),
   - Declare a pointer `p` to an array of pointers to `double`.
   - Dynamically allocate a 100-by-100 array of `doubles` and assign its address to `p`.
   - Initialize all elements of the array to 0.

2. For each of the following, write the appropriate function pointer declaration:
   A. A pointer to a function that takes an `int` and returns nothing.
   B. A pointer to a function that takes no arguments and returns `int`.
   C. A pointer to a function that takes a `double` and an `int` and returns `char *`.

3. Write the appropriate function prototype for a function that takes a `char` and returns a pointer to a function that takes a `float` and returns an `int`.

4. The Collatz Conjecture [L. Collatz, 1937] states that any sequence of natural numbers, x_0, x_1 ,…, where $x_{i+1} = x_i/2$ if x_i is even; $x_{i+1} = 3\, x_i + 1$ if x_i is odd, will eventually reach 1.
   A. Write a C program (`collatz.c`) which will experimentally verify the conjecture for all positive integers $x < N$ for some large N . If the conjecture is verified for all x, your program should print:

   ```
   Conjecture verified for all positive integers < N
   Total number of steps: nSteps
   ```

   If the conjecture would not hold for some x (you will be famous if you find one such number), your program should print:

   ```
   Found a counterexample: x
   ```

   Use `long` integers throughout the program. Make sure the value of N is passed to the program at the command-line. Use the `time()` function to measure running time.

   B. Rewrite `collatz.c` using T threads. Call your program `collatz_threaded.c`. Make sure the values of N and T are passed to the program at the command-line. Compare its running time with the sequential version using different values of N and T.

- **Welcome: Sean**
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