Week 1: Basics & Implementation

Topics: - Input/Output, Loops, Conditionals - Arrays, Strings, Basic Math - Simple sorting

Weekly Tips: - Focus on writing clean, readable code. - Always test edge cases (0, 1, negative numbers, large numbers). - Use online judge IDE or local compiler to verify behavior.

Problem 1: The 3n+1 problem

Link: UVa 100 **Difficulty:** Beginner

C++ Solution with Explanation Comments:

```cpp
#include <iostream>
using namespace std;

// Function to calculate the Collatz sequence length
int collatzLength(int n) {
    int length = 1; // Start counting the first number
    while (n != 1) {
        if (n % 2 == 0) {
            n /= 2;
        } else {
            n = 3 * n + 1;
        }
        length++;
    }
    return length;
}

int main() {
    int a, b;
    // Read multiple pairs until EOF
    while (cin >> a >> b) {
        int maxLength = 0;
        int start = min(a, b);
        int end = max(a, b);
        // Loop through all numbers in the range
        for (int i = start; i <= end; i++) {
            maxLength = max(maxLength, collatzLength(i));
        }
        cout << a << " " << b << " " << maxLength << endl;
    }
```

```cpp
        return 0;
    }
```

Explanation Comments: - Function `collatzLength` counts the number of steps to reach 1. - `main` reads pairs and calculates maximum sequence length in the range. - `min` / `max` ensures proper range even if input order is reversed. - Using `while(cin >> a >> b)` allows reading until EOF.

Problem 2: Hashmat the Brave Warrior

Link: UVa 10055 **Difficulty:** Beginner

C++ Solution with Explanation Comments:

```cpp
#include <iostream>
#include <cstdlib> // for abs()
using namespace std;

int main() {
    long long a, b;
    while (cin >> a >> b) {
        // Output the absolute difference
        cout << llabs(a - b) << endl; // llabs for long long absolute
    }
    return 0;
}
```

Explanation Comments: - Use `long long` to avoid overflow with large integers. - `llabs` computes absolute value for long long integers. - `while(cin >> a >> b)` reads until EOF.

Problem 3: Hello World

Link: Kattis Hello World **Difficulty:** Beginner

C++ Solution with Explanation Comments:

```cpp
#include <iostream>
using namespace std;

int main() {
    cout << "Hello World!" << endl; // Print the required string
    return 0;
}
```

Explanation Comments: - Simple output using `cout`. - `endl` adds newline. - Useful to practice basic syntax.

Problem 4: Addition

Link: [Kattis Addition](#) **Difficulty:** Beginner

C++ Solution with Explanation Comments:

```cpp
#include <iostream>
using namespace std;

int main() {
    int a, b;
    while (cin >> a >> b) {
        cout << a + b << endl; // Output sum of the two integers
    }
    return 0;
}
```

Explanation Comments: - Continuously read pairs of integers until EOF. - Compute sum and print immediately. - Basic practice for I/O and arithmetic operations.

End of Week 1 - Practice all problems until you can solve them **without looking at code**. - Try modifying code to handle negative inputs or zero. - Test edge cases for learning robustness.