### 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](https://onlinejudge.org/index.php?option=com_onlinejudge&Itemid=8&category=24&page=show_problem&problem=36) **Difficulty:** Beginner

**C++ Solution with Explanation Comments:**

#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;  
 }  
 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](https://onlinejudge.org/index.php?option=com_onlinejudge&Itemid=8&category=24&page=show_problem&problem=10055) **Difficulty:** Beginner

**C++ Solution with Explanation Comments:**

#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](https://open.kattis.com/problems/hello) **Difficulty:** Beginner

**C++ Solution with Explanation Comments:**

#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](https://open.kattis.com/problems/addition) **Difficulty:** Beginner

**C++ Solution with Explanation Comments:**

#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.