

MTH 4300: Algorithms, Computers and Programming II

Fall 2025

Section: STRA

Problem Set 1

Due Date: September 4, 2025

Question 1: Temperature and Distance Converter

Write a C++ program that performs unit conversions and calculations using the concepts from Lecture 2:

1. Input Collection:

- Ask for the user's name (handle spaces properly using `std::getline()`)
- Ask for a temperature in Fahrenheit (can be decimal)
- Ask for a distance in miles (can be decimal)
- Ask for number of hours traveled (integer)

2. Conversions and Calculations:

- Convert Fahrenheit to Celsius using: $C = (F - 32) \times 5/9$
- Convert miles to kilometers using: $km = miles \times 1.60934$
- Calculate average speed in miles per hour: $speed = distance \div hours$
- Convert that speed to kilometers per hour

3. Output Display:

- Show the user's name
- Display temperature in both Fahrenheit and Celsius (2 decimal places)
- Display distance in both miles and kilometers (2 decimal places)
- Show average speed in both mph and km/h (2 decimal places)

Requirements:

- Use appropriate data types (`std::string`, `double`, `int`)
- Use `std::getline()` for name input
- Use `static_cast<double>()` when dividing integers to ensure proper decimal results
- Use compound assignment operators where appropriate (e.g., for intermediate calculations)
- Format all decimal outputs to 2 decimal places using `std::fixed` and `std::setprecision()`
- Include proper headers (`#include <iostream>`, `#include <string>`, `#include <iomanip>`)

Provide complete source code and sample output demonstrating all conversions and calculations.

Sample Output:

```
=== Temperature and Distance Converter ===
```

```
Enter your name: Sarah Johnson
Enter temperature in Fahrenheit: 75.5
Enter distance in miles: 120.75
Enter hours traveled: 3
```

```
=== Conversion Results ===
```

```
Name: Sarah Johnson
Temperature: 75.50°F = 24.17°C
Distance: 120.75 miles = 194.33 km
Average Speed: 40.25 mph = 64.78 km/h
```

Question 2: Recipe Scaling Calculator

Write a C++ program that helps scale a recipe up or down based on the number of servings needed. Your program should demonstrate arithmetic operations, type casting, and I/O operations:

1. Input Collection:

- Ask for the recipe name (handle spaces using `std::getline()`)
- Ask for original number of servings the recipe makes (integer)
- Ask for desired number of servings (integer)
- Ask for three ingredient amounts from the original recipe:
 - Flour in cups (can be decimal, like 2.5)
 - Sugar in tablespoons (integer)
 - Milk in fluid ounces (can be decimal)

2. Scaling Calculations:

- Calculate the scaling factor: $\text{desired servings} \div \text{original servings}$
- Scale each ingredient by multiplying by the scaling factor
- Convert scaled flour from cups to tablespoons (1 cup = 16 tablespoons)
- Convert scaled milk from fluid ounces to cups (1 cup = 8 fluid ounces)

3. Demonstration of Operators:

- Use compound assignment operators to adjust one ingredient amount (e.g., add 0.25 cups to flour using `+=`)
- Show increment operators by increasing the serving count: `int new_servings = desired_servings++`
- Calculate total dry ingredients: flour (in tbsp) + sugar (in tbsp)

4. Output Display:

- Show recipe name and scaling information
- Display original and scaled ingredient amounts
- Show converted measurements (flour in tbsp, milk in cups)
- Display the final serving count after increment operation

Requirements:

- Use appropriate data types (`std::string`, `int`, `double`)
- Use `static_cast<double>()` when dividing integers for the scaling factor
- Use compound assignment and increment operators as specified
- Format decimal outputs to 2 decimal places
- Include headers: `#include <iostream>`, `#include <string>`, `#include <iomanip>`

Provide complete source code and sample output showing the recipe scaling process.

Sample Output:

```
=== Recipe Scaling Calculator ===
```

```
Enter recipe name: Chocolate Chip Cookies
Enter original number of servings: 12
Enter desired number of servings: 18
Enter flour amount (cups): 2.5
Enter sugar amount (tablespoons): 8
Enter milk amount (fluid ounces): 6.0
```

```
=== Scaling Results ===
```

```
Recipe: Chocolate Chip Cookies
Scaling factor: 1.50
```

```
Original Ingredients:
```

```
- Flour: 2.50 cups
- Sugar: 8 tablespoons
- Milk: 6.00 fluid ounces
```

```
Scaled Ingredients:
```

```
- Flour: 3.75 cups (60.00 tablespoons)
- Sugar: 12.00 tablespoons
- Milk: 9.00 fluid ounces (1.12 cups)
```

```
After adjustments:
```

```
- Flour (adjusted): 4.00 cups
- Total dry ingredients: 72.00 tablespoons
- Final serving count: 19
```