

Lab Exercise 3: Selection Statements (if/else if and switch)

Cody Raposa

ELEC2850 Microcontrollers Using C Programming

September 30, 2024

1 Problem Statement

Given a table of boiling points of several substances, create a program that gets the user's boiling point of their fluid (in °Celcius) and tells the user what substance their fluid is as long as the substance is within 5% of the given boiling point. When the substance is unknown, let the user know that.

Table 1: Expected boiling points of substances.

Substance	Normal boiling point (°C)
Water	100
Mercury	357
Copper	1187
Silver	2193
Gold	2660

2 Analysis

2.1 Inputs

Boiling Point of fluid (float)

2.2 Outputs

Fluid with boiling point +- 5% of given boiling point (string)

3 Flowchart

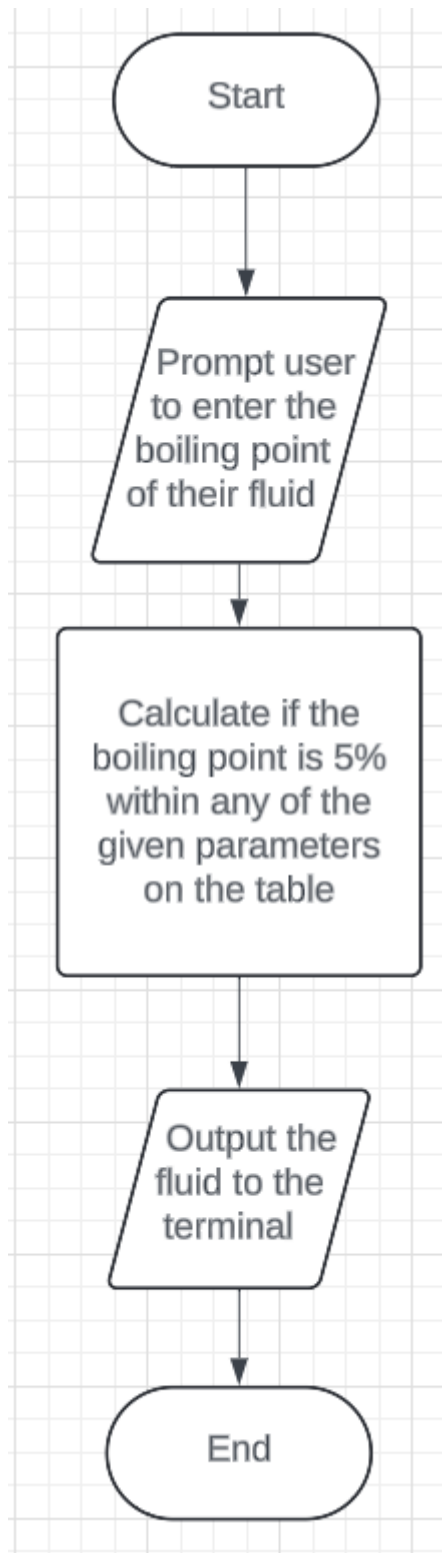
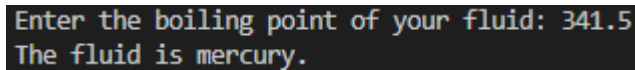


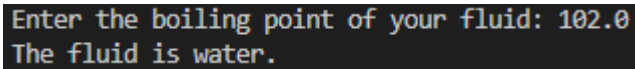
Figure 1: Flowchart for Question 1

4 Output



```
Enter the boiling point of your fluid: 341.5
The fluid is mercury.
```

Figure 2: Output with 341.5 degrees as boiling point



```
Enter the boiling point of your fluid: 102.0
The fluid is water.
```

Figure 3: Output with 102 degrees as boiling point

You cannot handle this problem with a switch case as you cannot use ranges in a switch case.

5 Code

```
1 #include <stdio.h>
2
3 int main()
4 {
5     float temperature = 0; // initialize
6     printf("Enter the boiling point of your fluid: "); // prompt user
7     scanf("%f", &temperature); // store the
8     // boiling point of the fluid in the variable temperature
9     if (temperature <= ((100 * 0.05) + 100) && temperature >= (100 - (100 * 0.05))) // if the
10     { // temperature is within 5% of the boiling point of water
11         printf("The fluid is water.\n"); // print to the user that the fluid is water
12     }
13     else if (temperature <= ((357 * 0.05) + 357) && temperature >= (357 - (357 * 0.05))) // if the
14     { // temperature is within 5% of the boiling point of mercury
15         printf("The fluid is mercury.\n"); // print to the user that the fluid is mercury
16     }
17     else if (temperature <= ((1187 * 0.05) + 1187) && temperature >= (1187 - (1187 * 0.05))) // if
18     { // the temperature is within 5% of the boiling point of copper
19         printf("The fluid is copper.\n"); // print to the user that the fluid is copper
20     }
21     else if (temperature <= ((2193 * 0.05) + 2193) && temperature >= (2193 - (2193 * 0.05))) // if
22     { // the temperature is within 5% of the boiling point of silver
23         printf("The fluid is silver.\n"); // print to the user that the fluid is silver
24     }
25     else if (temperature <= ((2660 * 0.05) + 2660) && temperature >= (2660 - (2660 * 0.05))) // if
26     { // the temperature is within 5% of the boiling point of gold
27         printf("The fluid is gold.\n"); // print to the user that the fluid is gold
28     }
29     else
30     {
31         printf("The fluid is unknown.\n"); // if the temperature is not within 5% of any of the
32         // boiling points, print to the user that the fluid is unknown
33     }
34     return 0; // quits program nicely
35 }
```

6 Part 2 Problem Statement

Use a switch to create one program that performs the following operations:

- Absolute value
- Maximum
- Minimum
- Sum
- Difference
- Square

7 Analysis

7.1 Inputs

What action the user wants to perform (char) The numbers the user wants the program to perform the action on (float)

7.2 Outputs

The result of the action (float)

7.3 Formulas

- Absolute value: $|x|$
- Maximum: $\max(x, y)$
- Minimum: $\min(x, y)$
- Sum: $x + y$
- Difference: $x - y$
- Square: x^2

8 Flowchart

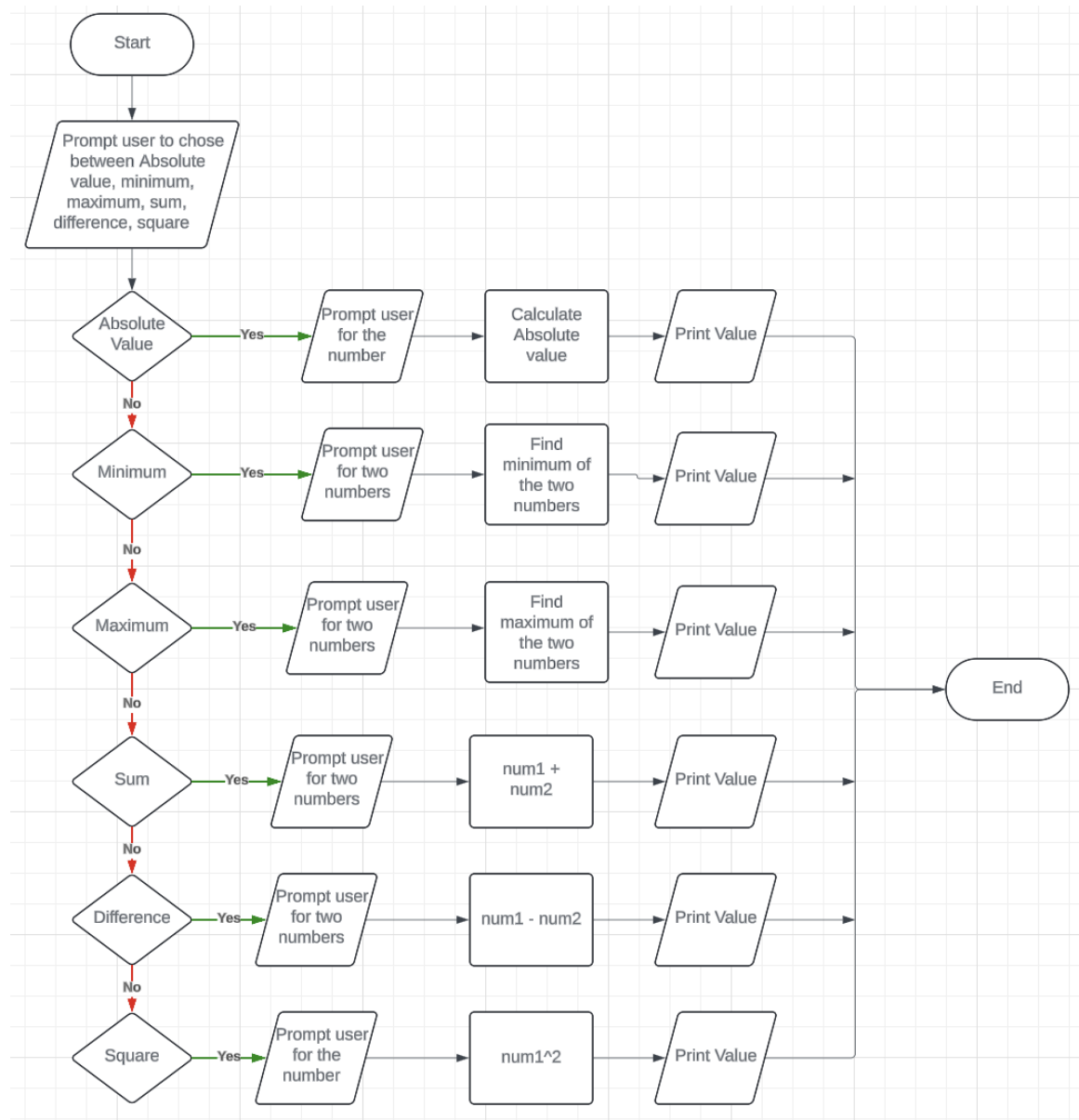


Figure 4: Flowchart for Question 2

9 Output

```
For absolute value of a number, press 'a'.
For maximum of two numbers, press 'm'.
For minimum of two numbers, press 'n'.
For sum of two numbers, press 's'.
For difference of two numbers, press 'd'.
For square of a number, press 'q'.
Enter your choice: a
Enter a number: -235
The absolute value of the number is 235.00
```

Figure 5: Test case for Absolute value

```
For absolute value of a number, press 'a'.
For maximum of two numbers, press 'm'.
For minimum of two numbers, press 'n'.
For sum of two numbers, press 's'.
For difference of two numbers, press 'd'.
For square of a number, press 'q'.
Enter your choice: m
Enter your first number: 234
Enter your second number: 142
The maximum of your two numbers is 234.00
```

Figure 6: Test case for Maximum

```
For absolute value of a number, press 'a'.
For maximum of two numbers, press 'm'.
For minimum of two numbers, press 'n'.
For sum of two numbers, press 's'.
For difference of two numbers, press 'd'.
For square of a number, press 'q'.
Enter your choice: n
Enter your first number: 123
Enter your second number: 72
The minimum of your two numbers is 72.00
```

Figure 7: Test case for Minimum

```
For absolute value of a number, press 'a'.
For maximum of two numbers, press 'm'.
For minimum of two numbers, press 'n'.
For sum of two numbers, press 's'.
For difference of two numbers, press 'd'.
For square of a number, press 'q'.
Enter your choice: s
Enter your first number: 1234
Enter your second number: 723
The sum of your two numbers is 1957.00
```

Figure 8: Test case for Sum

```

For absolute value of a number, press 'a'.
For maximum of two numbers, press 'm'.
For minimum of two numbers, press 'n'.
For sum of two numbers, press 's'.
For difference of two numbers, press 'd'.
For square of a number, press 'q'.
Enter your choice: d
Enter the number to be subtracted from: 02934
Enter the amount to be subtracted: 123447
The difference of your two numbers is -120513.00

```

Figure 9: Test case for Difference

```

For absolute value of a number, press 'a'.
For maximum of two numbers, press 'm'.
For minimum of two numbers, press 'n'.
For sum of two numbers, press 's'.
For difference of two numbers, press 'd'.
For square of a number, press 'q'.
Enter your choice: q
Enter your number: 123
The square of your number is 15129.00

```

Figure 10: Test case for Square

```

For absolute value of a number, press 'a'.
For maximum of two numbers, press 'm'.
For minimum of two numbers, press 'n'.
For sum of two numbers, press 's'.
For difference of two numbers, press 'd'.
For square of a number, press 'q'.
Enter your choice: i
Invalid input

```

Figure 11: Invalid input

10 Code

```

1 #include <stdio.h>
2 #include <math.h>
3 #include <ctype.h>
4
5 int main()
6 {
7     char input;           // declare variable for user input to select operation with a lowercase
8     letter
9     float number1, number2, ans = 0; // declare variables for all needed variables for each operation
10    printf("For absolute value of a number, press 'a'.\n \
11           For maximum of two numbers, press 'm'.\n \
12           For minimum of two numbers, press 'n'.\n \
13           For sum of two numbers, press 's'.\n \
14           For difference of two numbers, press 'd'.\n \
15           For square of a number, press 'q'.\n \
16           Enter your choice: "); // prompt user to select which operation they want to perform
17    scanf("%c", &input); // get users choice of operation
18
19    switch(toupper(input)) // switch statement to determine which operation to perform based on user
20    {
21        case 'A':           // absolute value
22            printf("Enter a number: "); // collect number and preform absolute value operation
23            scanf("%f", &number1);
24            ans = abs(number1);
25            printf("The absolute value of the number is %.2f\n", ans); // print the completed operation
26            break;
27        case 'M':           // maximum
28            printf("Enter your first number: "); // collect two numbers and preform maximum operation
29            scanf("%f", &number1);

```

```

29     printf("Enter your second number: ");
30     scanf("%f", &number2);
31     ans = fmax(number1, number2);
32     printf("The maximum of your two numbers is %.2f\n", ans); // print the completed operation
33     break;
34 case 'N': // minimum
35     printf("Enter your first number: "); // collect two numbers and preform minimum operation
36     scanf("%f", &number1);
37     printf("Enter your second number: ");
38     scanf("%f", &number2);
39     ans = fmin(number1, number2);
40     printf("The minimum of your two numbers is %.2f\n", ans); // print the completed operation
41     break;
42 case 'S': // sum
43     printf("Enter your first number: "); // collect two numbers and preform sum operation
44     scanf("%f", &number1);
45     printf("Enter your second number: ");
46     scanf("%f", &number2);
47     ans = number1 + number2;
48     printf("The sum of your two numbers is %.2f\n", ans); // print the completed operation
49     break;
50 case 'D': // difference
51     printf("Enter the number to be subtracted from: "); // collect two numbers and preform
52     difference operation
53     scanf("%f", &number1);
54     printf("Enter the amount to be subtracted: ");
55     scanf("%f", &number2);
56     ans = number1 - number2;
57     printf("The difference of your two numbers is %.2f\n", ans); // print the completed operation
58     break;
59 case 'Q': // square
60     printf("Enter your number: "); // collect number and preform square operation
61     scanf("%f", &number1);
62     ans = pow(number1, 2);
63     printf("The square of your number is %.2f\n", ans); // print the completed operation
64     break;
65 default:
66     printf("Invalid input\n"); // print to user that their input was invalid
67     break;
68 }
69 return 0; // quits program nicely

```