Function Examples

Lecture 19

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1. Convert Fahrenheit to Celsius
   - The Problem
   - The Input and Output
   - An Example
   - The Algorithm
   - The Code

2. Find the Dimensions of a Rectangle
   - The Problem
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The Problem

The Problem

Write a program that will

- Compute the equivalent Celsius temperature of each Fahrenheit temperature within a specified range.
- Print the Fahrenheit temperature in that range and its Celsius equivalent.
- Round the Celsius temperature to the nearest 10th of a degree.

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The Input and Output

- Input: the starting temperature and the ending temperature, in Fahrenheit.
- Output: each Fahrenheit temperature in the range, its Celsius equivalent, rounded to the nearest 0.1.

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Example

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$$\begin{aligned}\text{temp in C} &= (65 - 32) \cdot 5/9 \\ &= 33 \cdot 5/9 \\ &= 165/9 \\ &= 18.3333\ldots\end{aligned}$$

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- The output should be 65 and 18.3.
- Do the same for the other temperatures.

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The Algorithm

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- Add 1 to *fahr_temp*.

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- Subtract 32 from *fahr_temp* and multiply by 5/9.
- Round off the result to one decimal place. Call it *cels_temp*.
- Output *fahr_temp* and *cels_temp*.
- Add 1 to *fahr_temp*.
- Repeat the previous three steps until *fahr_temp* exceeds the ending temperature.

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The Code

- We will use two functions.
  - `float Fahr2Cels(int fahr_temp);`
  - `float round(float value, int places);`
- The function `Fahr2Cels()` will convert the Fahrenheit temperature and return its Celsius equivalent, rounded to one decimal place.
- The function `round()` will round the first parameter to the number of decimal places specified by the second parameter.

The Code

- Clearly, we should use a `for` loop to step through the Fahrenheit temperatures.
- For each temperature, we will call on the `Fahr2Cels()` function to get the Celsius equivalent.
- Then output the two temperatures.

The Code

The Code – `main()`

```
int main()
{
    int start;
    int end;
    cin >> start >> end;
    for (int fahr_temp = start; fahr_temp <= end; fahr_temp++)
    {
        float cels_temp = Fahr2Cels(fahr_temp);
        cout << fahr_temp << "   " << cels_temp << endl;
    }
    system("pause");
    return 0;
}
```

The Code

The Code – `Fahr2Cels()`

```
float Fahr2Cels(int fahr_temp)
{
    float cels_temp = (fahr_temp - 32)*5.0/9.0;
    return round(cels_temp, 1);
}
```

The Code

The Code – round()

```
float round(float value, int places)
{
    float shift = power(10.0, places);
    float temp = value*shift;
    temp = round(temp)/shift;
    return temp;
}
```

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The Problem

The Problem

- Given the area and perimeter of a rectangle, find the length and width of that rectangle.

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The Input and Output

The Problem

- The input is the area and perimeter of the rectangle.
- The output is the length and width of the rectangle.

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Example

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- Let the area be 24 and the perimeter be 20.

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- Let the length be L and the width be W.

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- Then $LW = 24$ and $L + W = 10$ (half the perimeter).

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Example

- Let the area be 24 and the perimeter be 20.
- Let the length be L and the width be W.
- Then $LW = 24$ and $L + W = 10$ (half the perimeter).
- How do we find L and W?

Example

Example

- Solve the equations for L by eliminating W.

Example

Example

- Solve the equations for L by eliminating W.
- We have $W = 10 - L$, so

$$\begin{aligned} 24 &= L(10 - L) \\ 24 &= 10L - L^2 \\ L^2 - 10L + 24 &= 0. \end{aligned}$$

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- We have $W = 10 - L$, so

$$\begin{aligned} 24 &= L(10 - L) \\ 24 &= 10L - L^2 \\ L^2 - 10L + 24 &= 0. \end{aligned}$$

- We can factor that equation as

$$(L - 4)(L - 6) = 0.$$

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- Thus, $L = 4$ or $L = 6$.
- And so $W = 6$ or $W = 4$.

Example

Example

- In the example, we solved the quadratic equation

$$L^2 - 10L + 24 = 0$$

  by factoring it.
- To solve it in a program, we should use the quadratic formula:

$$\begin{aligned} L &= \frac{10 \pm \sqrt{10^2 - 4(1)(24)}}{2(1)} \\ &= \frac{10 \pm \sqrt{4}}{2} \\ &= 5 \pm 1 \\ &= 4 \text{ or } 6. \end{aligned}$$

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- The solutions are

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- Find $W = \text{area}/L$.

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- Output @ and L.

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The Code

The Code

- We will break the program up into functions.
  - `int main()`
  - `void findDims(float area, float perim, float& len, float& wid)`
  - `void solveQuadEq(float a, float b, float c, float& root1, float& root2)`

The Code

The Code – main()

```
int main()
{
    float area;
    float perim;
    cin >> area >> perim;
    float length;
    float width;
    findDims(area, perim, length, width);
    cout << "Length = " << length;
    cout << ", width = " << width << endl;
    return 0;
}
```

The Code

The Code – findDims()

```
void findDims(float area, float perim, float& len, float& wid)
{
    solveQuadEq(1.0, -perim/2.0, area, len, wid);
    return;
}
```

The Code

The Code – solveQuadEq()

```
void solveQuadEq(float a, float b, float c, float& root1,
        float& root2)
{
    float discr = sqrt(b*b - 4.0*a*c);
    root1 = (-b + discr)/(2.0*a);
    root2 = (-b - discr)/(2.0*a);
    return;
}
```