Lab 11 – 08227 Advanced Programming

This tutorial introduces the reader to template classes in C++.

1.0 Template Exercise 1

Download **Lab11.zip** from the module site and extract the contents to the folder **G:/08227/Lab11/**.

Create a new Template class called **Calculator** (see lecture notes for code).

Try the following from the **main()** method:

```
// Create a calculator for integers
Calculator<int> calc(5, 2);
// Should give 10
int z = calc.Mult();


// Create a calculator for doubles
Calculator<double> calc(5.0, 2.5);
// Should give 12.5
double z = calc.Mult();
```

In the **main()** method define a new Calculator which takes two **floats**, namely **1.2** and **1.5**, which will add these numbers together (i.e. use the Add() method).

2.0 Template Exercise 2

Create a new class called **Fraction**. This class will store a fraction as two integers, namely the numerator and the denominator of the fraction (fig 1).

$$\frac{numerator}{denominator}$$

fig 1. The numerator and denominator of a fraction

Add two **int** member data types to **Fraction** called **m_numerator** and **m_denominator**.

Create/amend a **constructor** in **Fraction** that takes two integers, namely **numerator** and **denominator** and assign these values to the two member data variables.

Create accessors (getters) which will return the values of the **m_numerator** and **m_denominator** member data variables. Remember to define the methods as **const** because these methods do not alter the current object.

Using the following declaration, implement the definition of this function that will add two fractions together (fig 2).

```
Fraction operator+ (const Fraction &rhs) const;
```

$$\frac{n1}{d1} + \frac{n2}{d2} = \frac{n1 * d2 + n2 * d1}{d1 * d2}$$

fig 2. Addition of two fractions

Add the following code to your **main()** method. This should produce the fraction **5/6**.

```
Fraction frac1(1, 2);    // 1/2
Fraction frac2(1, 3);    // 1/3

// Create a calculator for Fractions
Calculator<Fraction> calc(frac1, frac2);
// Should give 5/6
Fraction frac3 = calc.add();
```

3.0 Template Exercise 3

Implement as many of the other **Calculator** methods as you can in the **Fraction** class.

Implement the ability for **Fraction** to output the fraction to an output stream using **operator<<** and a **Write()** method.