

## Chapter 0. Introduction.

*In which we outline our plans.*

**Key Ideas :** *Abstraction, Calculation, Layout should be easy to read.*

Many textbooks and also many courses on programming have titles such as “An introduction to programming using X”, where X is the name of some programming language. These texts claim to teach you, the reader, how to program. But sadly, few, if any, of them actually do. Instead they introduce you to the various features of programming language X, such as the 4 different types of loop construct, the variety of selection constructs, the various ways to perform input and output and so on.

They illustrate these with examples of programs ranging from the very silly “Hello world” programs through to quite difficult examples. But they do not actually tell you how to program. They show you their examples and somehow expect that you will learn to follow them and be able to invent your own programs to solve new problems.

Eventually, by trial and error, you may succeed in being able to program to some extent. But because you were shown programming in language X you may not be able to distinguish between the programming task and programming in X. This gives rise to the very strange situation where people may refer to themselves as “C programmers” or “Java programmers”. Imagine how people would laugh if you described yourself as a “blue car driver” or a “Toyota van driver”.

We will do things differently in this course. We will avoid speaking about fashionable programming languages altogether and instead concentrate on how to program. We will describe a method of programming, which, if followed, leads to beautiful, simple and correct programs.

Our method is **calculational**, so when you are using it you may actually be able to forget about the problem you are solving !! If that sounds very strange then consider the following little example.

*Example.*

A shopkeeper sells 3 pens and two pencils for 16 RMB, later that day he sells two pens and a pencil for 10 RMB. How much do pens and pencils cost? We model the information given to us as a pair of simultaneous equations.

$$3*X + 2*Y = 16 \quad (i)$$

$$2*X + Y = 10 \quad (ii)$$

= {multiply (ii) by 2}

$$3*X + 2*Y = 16 \quad (i)$$

$$4*X + 2*Y = 20 \quad (ii)$$

= {subtract (i) from (ii)}

$$X = 4$$

Now consider

$$3*X + 2*Y = 16 \quad (i)$$

= {X = 4 from above}

$$3*4 + 2*Y = 16$$

= {arithmetic evaluating 3\*4}

$$12 + 2*Y = 16$$

= {arithmetic subtracting 12 from each side}

$$2*Y = 4$$

= {arithmetic dividing each side by 2}

$$Y = 2$$

So we have solved the problem, pens cost 4 euro and pencils cost 2 euro.

There are three things to note about this. Firstly, we choose a nice notation in which to express the problem and once we had expressed it we forgot about pens, pencils and shopkeepers. Secondly, we used a standard set of rules of calculation to arrive at our solution, knowing that these rules guaranteed that our solution would be correct. Finally, we used a layout for our calculation which allowed our reader see exactly what steps we were taking. They did not have to guess, our indented hints told them. This style is sometimes called polite mathematics.

*End of example.*

So you see it is not such a strange idea after all. Now as we begin our journey I must ask you to do something which you may find difficult. I want you to **try to forget everything you have learned about programming up until now**. We shall start afresh at the beginning. I hope you enjoy the journey.