# Homework 3 Functional programming Answers

1. (a) What is a programming paradigm? [1]

 A style of programming

 (b) Name **four** programming paradigms and for each one, give an example of a programming language which supports it. [8]

 (i) Procedural – Python, VB, Delphi, C, other examples

 (ii) Object oriented – Java, Python, VB, Delphi, C++

 (iii) Declarative – SQL, Prolog

 (iv) Functional – Haskell, Standard ML, Scheme, Lisp

2. (a) Use functional programming notation to define a function named trebleMinusFive, defined below.

 f(x) = 3x – 5 [2]

 trebleMinusFive x = 3\*x – 5

 (b) Write a function definition for a second function named doubleIt which
returns the value of g(x) = 2x. [2]

 doubleIt x = 2\*x

 (c) Combine the two functions in **(a)** and **(b)** to write a function h(x) which returns
the value of

h(x) = g(f(x))

 Name the function trebleThenDouble.

 What will be returned when this function is applied to the parameter 4? [2]

 trebleThenDouble x = doubleIt (trebleMinusFive x)

 trebleThenDouble 4 returns 14

3. In a functional programming language, variables are **immutable.**

Explain, with an example, what this means and compare the way variables can be used in the functional and procedural paradigms. [3]

 Immutable means that the value cannot be changed (1). In a procedural language it is possible to assign a new value at any point in a program (1). For example,

 x = x+1

 cannot be implemented in a functional language but can in a procedural one (1)

4. Functional programming is **stateless** and has no **side effects**. Explain the meaning of these two terms. [3]

 Stateless programming does not change the state of memory, for example the values of variables. (1) Therefore there is no record of previous operations/each operation is processed using only the arguments/parameters provided (1)

 will always return the same result for a given input (1) cannot affect other operations within the program (1) *Max 3*

5. (a) List **two** properties of a first-class object. [2]

 may appear in expressions, be assigned to a variable, be assigned as
arguments, be returned in function calls.

 (b) Give **two** examples of first class objects. [2]

 integers, floating point values, characters, strings, functions

 [Total 25 Marks]