# Homework 5 Lists in functional programming Answers

1. The list **fish = ["Cod", "Trout", "Hake", "Chub", "Pike", "Dab"]**

 What is returned by these function calls?

 (a) tail fish [1]

 ["Trout","Hake","Chub","Pike","Dab"]

 (b) head (tail fish) [1]

 “Trout”

 (c) null (tail (tail( tail ( tail (tail (tail fish )))))) [1]

 True

2. Write statements in Haskell to:

 (a) prepend the numbers 5, 10 to the list **num1 = [15, 20, 25]**, storing the result
in **num2**. [2]

 num2 = [5,10] ++ num1

 (b) append the numbers 30, 35, to the list **num2**, storing the result in **num3**. [2]

 num3 = num2 ++ [30,35]

 (c) Why is it not possible to append numbers to **num2**, leaving the result in **num2**? [1]

 Lists in Haskell are immutable/cannot be changed

 (d) What would be the result of concatenating the lists **num2** and **num3**? [1]

 [5,10,15,20,25,5,10,15,20,25,30,35]

3. Readings from a sensor are stored in the list **humidity = [45, 67, 81, 73, 62, 41]**

What is returned by these function calls?

 (a) map (+5) humidity [1]

 [50, 72, 86, 78, 67, 46]

 (b) filter (>70) humidity [1]

 [81, 73]

 (c) map (+10) (filter (>70) humidity) [2]

 [91, 83]

4. In Haskell, strings of characters can be treated as lists. The following list contains 3 strings:

 **sentence = ["Here", "we", "are"]**

 (a) **length** is a function which returns the number of elements in a list.

 (i) Write a statement which will return the number of strings in **sentence**. [1]

 length (sentence) (Alternative: length sentence)

 (ii) **map** is a function which takes a list and the function to be applied to the elements in the list, and returns a list made by applying the function to each element of the list.

 Write a statement which will return a list containing the lengths of each
word in the list **sentence** given above. [2]

 map length (sentence) (Alternative: map length sentence)

 (iii) What will be the list returned by this statement? [1]

 [4,2,3]

 (b) The **foldl** function reduces a list to a single value, so that

 foldl (+) 10 [2,3,4,5] evaluates to 10 + 2 + 3 + 4 + 5 = 24

 Write a statement using the **foldl, map** and **length** functions which will count
all the characters in the list **sentence**. [3]

 foldl (+) 0 (map length sentence)

 Which should return 0 + 4 + 2 + 3 i.e. 9

 [Total 20 Marks]