Coursework 1

Question 1. (Hutton, Ch. 3) What are the types of the following values?

- ['a', 'b', 'c']
- ('a', 'b', 'c')
- [(False, '0'), (True, '1')]
- [tail, init, reverse]

[10 marks]

Question 2. (Hutton, Ch. 3) What are the types of the following functions?

```haskell
second xs = head (tail xs)
swap (x, y) = (y, x)
pair x y = (x, y)
double x = x * 2
palindrome xs = reverse xs == xs
twice f x = f (f x)
```

Hint: take care to include the necessary class constraints if the functions are defined using overloaded operators.

[10 marks]

Question 3. Pizzeria Alfredo sells pizzas of varying sizes and numbers of toppings. They would like to have program that computes the selling price of a pizza. The pizza base costs £0.001 per cm$^2$ and the cost for each topping are £0.002 per cm$^2$. In order to make profit, they multiply the cost of a pizza by a factor of 1.5. Write a function `alfredo` that takes as inputs the diameter (in cm) and number of toppings of the pizza, both given as integers, and calculates the price of the pizza as a floating point number.

Which pizza costs more, Pizza Bambini (tomatoes, mozzarella, ham, salami, broccoli, mushrooms, 15 cm), or Pizza Famiglia (tomatoes, mozzarella, 32 cm)?

[20 marks]

Question 4. Let us represent a point in the 2 dimensional plane by a pair (x, y) where x and y are the cartesian co-ordinates (measured in cm, say). Define the following functions:

```haskell
dist computes the distance of two points
close tests if the distance of two points is less than 0.5.
scale multiplies both co-ordinates of a point by a given floating point number
addPt ‘adds’ two points componentwise
```

Hint: It is convenient to give the type of points a name: `type Pt = (Float, Float)`

[20 marks]
Question 5. (Hutton, Ch. 4) Using library functions, define a function
halve :: [a] -> ([a],[a])
that splits an even-lengthed list into two halves. \[20 \text{ marks}\]

Question 6. (Hutton, Ch. 4) Consider a function
safetail :: [a] -> [a]
that behaves as the library function \texttt{tail}, except that \texttt{safetail} maps the empty list to itself, whereas \texttt{tail} produces an error in this case. Define \texttt{safetail} using:

(a) a conditional expression;
(b) guarded equations;
(c) pattern matching.

Hint: make use of the library function \texttt{null}. \[20 \text{ marks}\]

Due date: Thursday, 27 October 2005

Notes:

1. Functions must be defined in Haskell, must have a signature and must be tested.

2. Submit your solutions by email. Cs221 students use as subject
\texttt{cs221-05-cw1-surname-first name}
Csm36 students replace \texttt{cs221} with \texttt{csm36}. Example: Cs221 student John Smith uses the subject
\texttt{cs221-05-cw1-smith-john}
Please submit only one version. If a resubmission seems unavoidable, attach a version number to the \texttt{end} of the subject. For example
\texttt{cs221-05-cw1-smith-john-1}
Only if this format is used, the coursework will be marked!

3. Make sure your submitted file compiles correctly. All text must be behind comment signs (\texttt{--}). Submissions that do not compile will not be marked.

4. Each solution must contain your printed name, code of the course (CS221 or CSM36), number of coursework and date of submission. Please use the template available at
http://www.cs.swan.ac.uk/~csulrich/cs221html.
Please keep each line of your code shorter than 50 characters.

5. Late submissions will be penalised by taking off marks.

6. Lab classes (Linux lab, room) are on Mondays, 3-4pm, Tuesdays, 11-12am, and Thursdays, 2-3pm. Start: Thursday, 13th of October.