Name: _____

Matriculation Number: _____

Points: _____

This exam consists of 2 exercises, for a total of 22 points (so there is roughly 1 point per 2 minutes).
The available points per exercise are written in the margin.

Exercise 1: Multiple Choice 12

In each multiple choice question, you get

- 3 points for 3 correct answers,
- 1 point for 2 correct answers,
- 0 points, otherwise.

Consider the following Haskell function.

```
foo x y z = if y == z then 1 else x * foo x y (z + 1)
```

(a) Mark all valid evaluations. (3)

- ☐ `foo 8 6 4 = 8`
- ☐ `foo 7 6 5 = 7`
- ☐ `foo 2 4 0 = 32`

(b) Mark all valid type declarations of `foo`. (3)

- ☐ `foo :: Num a => a -> a -> a -> a`
- ☐ `foo :: (Num a, Num b, Eq b) => a -> b -> b -> a`
- ☐ `foo :: Float -> Float -> Float -> Float`

(c) Mark all valid type declarations of `foo`. (3)

- ☐ `foo :: Integer -> Integer -> (Integer -> Integer)`
- ☐ `foo :: (Integer, Integer, Integer) -> Integer`
- ☐ `foo :: (Integer -> Integer) -> Integer -> Integer`

(d) Mark all declarations that compile without errors. (3)

- ☐ `data Foo a b = Foo Int | Bar Char [a]`
- ☐ `com x y = if x == y then 1 + com x + 1 else 0`
- ☐ `asdf x = asdf x - asdf x`

Exercise 2: Programming 10

(a) Define a datatype `Meal` with three constructors corresponding to a salad, an apple and a cake. (1)

(b) Define a function `price` which converts meals to their price in Euros. Use the prices from the table below. Give both the type definition and the defining equations. (3)

meal	salad	apple	cake
price in Euros	3	0.8	99.99

(c) Write a type-class instantiation such that `Meal` becomes an instance of `Show`. The meals should be displayed as `"A Salad"`, `"An Apple"` and `"A Cake"`. (3)

(d) Define a function `meals_below` which takes a price and a list of meals and returns the filtered list of those meals that cost at most the given price. For instance, `meals_below 3 [Apple, Salad, Cake, Salad] = [Apple, Salad, Salad]`. Give both the type definition and the defining equations. (3)

- You can assume that the `price` function from the previous exercise exists.
- You can use the predefined functions `head`, `tail`, and `null`.
- It is not allowed to use any other predefined function on lists.
- It is not allowed to use pattern matching.