

This exam in 2 pages, make sure to answer all the questions.

1. (20 points) Find whether the following statements are True or False in Haskell, (Explain why?):

(a) `d=2 :: Int`
`e=d`

(d) `x :: Int`
`x=6.5`

(b) `mul Int, Int -> Int`

(e) `z :: [Int]`

(c) `y :: double`

`z = []`

2. (20 points) Find a different way to rewrite the following statements in Haskell.

(a) `sum :: Int -> Int -> Int.`

(b) `y :: Int`
`y = 3`

(c) `greaterThan100 :: [Integer] -> [Integer]`
`greaterThan100 xs = filter (\x -> x > 100) xs`

(d) `evenOdd :: Integer -> String`
`evenOdd n`
`| n `mod` 2 == 0 = "Even"`
`| otherwise = "Odd"`

(e) `myFun :: [Integer] -> Bool`
`myFun xs = even (length (greaterThan100 xs))`

3. (20 points) Use the following Haskell program to answer the questions: .

1	<code>anonymous :: [Int] -> Int</code>
2	<code>anonymous (h:[]) = h</code>
3	<code>anonymous (h:t) = anonymous t</code>

(a) What does Haskell return for the query: `*Main> anonymous [2, 7,1] .`

(b) What does Haskell return for the query: `*Main> anonymous 7.`

(c) If we removed line (2), What does Haskell return for the same query in (a).

(d) If we change line (3) into:

`anonymous (_: t) = anonymous t`

What does Haskell return for the same query in (a).

(e) Suggest a better name instead of "anonymous".

4. (20 points) Use the following Haskell program to answer the questions

```
1 data Thing = Shoe
2             | Ship
3             | Cabbage
4             deriving Show
5
6 data Person = Person String Int Thing
7             deriving Show
8
9 baz :: Person -> String
10 baz p@(Person n _) = "The name field of (" ++ show p ++ ") is " ++ n
```

(a) What does Haskell return for the query: `*Main> baz (Person "Bell" 22 Cabbag)`.

(b) What does Haskell return for the query: `*Main> baz (Person "Saly" 40 Mango)`.

(c) Is there any difference if we change line (10) into:

```
baz p@(Person n _) = "The name field of (" ++ show p ++ ") is " ++ show n
```

- Explain why?

(d) Modify line (10) to print the age field for the same query in (a) .

(e) What is the difference between first and second term "Person" in line 6.

5. (10 points) Given the following Haskell program:

```
fun :: [Integer] -> Integer
fun [] = 0
fun (x:xs)
  | even x = (x*x) + fun xs
  | otherwise = fun xs
```

(a) What does Haskell return for the query: `*main> fun [1, 2, 3, 4, 5]`.

(b) Rewrite the previous program in a wholemeal (point-free) style.

6. (10 points) Write the Haskell function "mean" to calculate the mean of a list of numbers. (Hint: The mean is the average of a set of numbers).

Sample run:

```
*main> mean [4, 6]
```

```
5
```

```
*main> mean [2, 1, 3, 5]
```

```
2.75
```

Do your best; Good Luck.