Pearl 4
Functional Programming
Test

30 September 2016
13:45 – 14:45

Name:	. . .
Student Number:	. . .
Studies:	TCS / BIT / Other: . . .

- All exercises weigh equally heavy.
- You may use the syllabus "*Algorithmics – The Functional Paradigm*".
- Good luck!

Exercise 1. Given is the following list of lists:

```
xss = [[11,12,13,14,15],[21,22,23,24,15],[31,32,33,34,35],[41,42,43,44,45]]
```

What are the values of the following two expressions (respectively):

(a) `xss!!2!!3`
(b) `(reverse xss)!!2`

Fill in the box at the correct answer:

(A) ☐ 23 and `[12,22,32,42]`

(B) ☐ 34 and `[35,34,33,32,31]`

(C) ☐ 34 and `[21,22,23,24,25]`

(D) ☐ 23 and `[25,24,23,22,21]`

Exercise 2. Given are the definitions of the functions `foo` and `bar`:

```
foo f x 0 = x
foo f x n = foo f (f x) (n-1)

bar (x,y) = (2*x + y, y+1)
```

Wat is the outcome of

```
foo bar (1,0) 4
```

Fill in the box at the correct answer:

(A) ☐ 27

(B) ☐ (58, 5)

(C) ☐ (27, 4)

(D) ☐ 36

Exercise 3. What is wrong with the following expression (with the above definitions for `foo` and `bar`):

```
bar foo (1,0) 4
```

Fill in the box at the correct answer:

(A) ☐ It causes an infinite loop.

(B) ☐ It gives a type error.

(C) ☐ There should be a semicolon (;) at the end.

(D) ☐ It calculates a wrong answer.

Exercise 4. A function `f` has to be defined recursively, the basic clauses are already given:

```
f []  = []
f [x] = [[]]
```

There are four possible candidates for the recursive clause:

(i) `f (x:y:xs) = (x+y) :  f (y:xs)`

(ii) `f (x:y:xs) = [x+y] :  f (y:xs)`

(iii) `f (x:y:xs) = [x+y] ++ f (y:xs)`

(iv) `f (x:y:xs) = [[x+y]] ++ f (y:xs)`

Which of these clauses do *not* give typing problems?

Fill in the box at the correct answer:

(A) ☐ (i) and (ii)

(B) ☐ (i) and (iii)

(C) ☐ (ii) and (iii)

(D) ☐ (ii) and (iv)

Exercise 5. Assume that the function `prime` is given:

```
prime x
```

yields `True` if `x` is a prime number, and `False` otherwise.

Someone needs a definition that calculates the list of the squares of all prime numbers smaller than `10`. Thus, the result of this list should be the list `[4, 9, 25, 49]`. Which of the following definitions calculates this list correctly?

(i) `[ x^2 | x <- [1..9], prime x ]`

(ii) `[ (prime x)^2 | x <- [1..9] ]`

(iii) `filter prime (map (^2) [1..9])`

(iv) `map (^2) (filter prime [1..9])`

Fill in the box at the correct answer:

(A) ☐ (i) and (iii)

(B) ☐ (i) and (iv)

(C) ☐ (ii) and (iii)

(D) ☐ (ii) and (iv)