

## Informatics 1, 3. Written Exam (2017-12-04)

1	2	3	4	$\Sigma$

The answers should fit next to the questions, if you used a separate paper let us know clearly!

### 1. Octave

a) What is the result of the command `(4:1:-1)`? Explain it why! (1 points)

b) What are the results of the following commands? (3 points)

```
diag(ones(1,3))
```

```
diag([1, 2, 3], 1)
```

```
(2*eye(2, 2)+ones(2, 2)).^2
```

c) What is the default number representation in **MatLab**? (e.g. what is the type of the result of `a=1/3`?) (1 points)

d) What is the result of `f(5)` if the `f` function is defined as follows? (2 points)

```
function M=f(n)
    a = ones(n, n);
    b = diag(-1:n-2)
    M = 2*a + b
end
```

e) How can we access the third column of a given matrix `M` as a column vector? (2 points)

2. What are the results of the following **sage** commands? (2 points)

a) `3^2`

b) `5/2`

c) `sin(4)`

d) `n(4/3)`

### 3. Sage list comprehension

a) Provide the resulting list of the following command:

```
[n for n in range(1, 50) if n % 10 == 1 and is_prime(n+1)]
```

(1 points)

b) Provide a function with a list comprehension that generates the following list:

```
[1,2,3,2,3,4,...,n-2,n-1,n] (2 points)
```

### 4. Sage symbolic calculation

*Be aware that you might need to declare variables as symbolic variables!* Let  $f$  be the following function  $f(x) = x^4 + 3x^2 + c$ . Write Sage commands that solve the following!

a) Define the  $f$  function! ( $c$  is a symbolic variable) (1 points)

b) Solve the  $f'(x) = 0$  equation (with the  $c$  as a parameter). (2 points)

c) Substitute  $c = 5$  into  $f$ . (1 points)

d) Solve the equation  $\sin(x) = \log(x)$  numerically on the interval  $[-10, 10]$ . (2 points)