

# Tentamen Statistiek voor KI/Inf/BMT (Iacobelli and Külske)

Friday 23 January 2009

All books, written notes, and all calculators allowed.  
Cell phones and laptops not allowed.

1. For which value of  $c$  is the following function a p.d.f.

$$f(t) = \begin{cases} ct^n & \text{if } 0 \leq t \leq 2 \\ 0 & \text{else} \end{cases}$$

2. Compute the expected value and variance of the p.d.f.

$$f(t) = \begin{cases} \frac{3}{4} & \text{if } 0 \leq t \leq 1 \\ \frac{1}{4} & \text{if } 2 \leq t \leq 3 \\ 0 & \text{else} \end{cases}$$

3. Does a monkey have a better chance of rearranging

ABCEGIIIIIOOLLU into GIULIOIACOBELLI

or

CEEFHIIKKLORSSTU into CHRISTOFKUELSKE

4. The number of bike accidents of biology students at a particular university within 2 years is given by the following table, giving the number of students  $k_i$  having experienced  $i$  bike accidents.

Number of bike accidents $i$	Number Students $k_i$
0	101
1	120
2	82
3	40
4	7
5	2
	352 = $n$

**Question:** Suppose that the data follows a Poisson distribution. Estimate its parameter by the maximum-likelihood method and compare the observed and the expected frequency.

5. Assume that for data taken from a normal sample with a known variance  $\sigma = 16$  the sample mean is  $\bar{y} = 116$  and the number of observations is  $n = 30$ .

- Test the hypothesis  $H_0 : \mu = 120$  versus  $H_1 : \mu < 120$  using the critical region at the level  $\alpha = 0.05$ .
- Give the  $P$ -value.
- Give the error of the second type assuming that the true value is  $\mu = 100$ .