Exercise Sheet 9: More Advanced LaTeX
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Academic Skills in Computer Science, 2019-06-25, Summer Term 2019

Please prepare exercise 9.4 until 2019-06-30.

Exercise 9.1. Write a paper proving the *binomial theorem*:

Let $n \in \mathbb{N}$. Then
$$(x + y)^n = \sum_{k=0}^{n} \binom{n}{k} x^k y^{n-k}.$$

You may use any sources that you need, provided that you properly cite them. Make sure your paper includes an introduction, a conclusion, and all necessary preliminaries. Try to make your paper as easy to read as possible.

Exercise 9.2. Read the introductions of the following papers and identify prince:ss, dragon, and magic sword:

1. Luigi Bellomarini, Emanuel Sallinger, and Georg Gottlob. The VadalogSystem: Datalog-based Reasoning for Knowledge Graphs. PVLDB, 11(9):975–987, 2018.

2. Georg Gottlob and Enrico Malizia. Achieving New Upper Bounds for the Hypergraph Duality Problem through Logic. SIAM J. Comput., 47(2), 456–492, 2018.

Exercise 9.3. Typeset the following set of equations, matching alignment and positioning as close as possible:

$$H_n := \begin{pmatrix} 1 & \frac{1}{2} & \frac{1}{3} & \cdots & \frac{1}{n} \\ \frac{1}{2} & \frac{1}{3} & \frac{1}{4} & \cdots & \frac{1}{n+1} \\ \frac{1}{3} & \frac{1}{4} & \frac{1}{5} & \cdots & \frac{1}{n+2} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \frac{1}{n} & \frac{1}{n+1} & \frac{1}{n+2} & \cdots & \frac{1}{2n-1} \end{pmatrix} \tag{3.1}$$

$$(H_n^{-1})_{i,j} = \frac{(-1)^{i+j}}{(i+j-1)} \frac{(n+i-1)!(n+j-1)!}{((i-1)!(j-1)!)^2}$$

$$= (-1)^{i+j)}(i+j-1)\binom{n+i-1}{n-j}\binom{n+j-1}{n-i}\binom{i+j-2}{i-1}^2 \tag{3.2}$$

$$\det H_n^{-1} = \prod_{k=1}^{n-1}(2k+1)\binom{2k}{k}^2 \tag{3.3}$$

Exercise 9.4. (Homework)
Submit a paper to the First Dresden Mock Conference on Academic Skills in Computer Science (DD-ASiCS'19). [1] The deadline for submissions is 2019-06-30 (AoE). Your paper should be two pages (excluding references) in LNCS format[2] and be anonymised for double-blind review (we expect every author to participate in the reviewing process).

Pick a foundational concept of computer science and imagine that you just invented this concept. Then write an abstract and an introduction for a paper introducing this concept (see

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[1] https://easychair.org/conferences/?conf=ddasics19
[2] https://www.springer.com/de/it-informatik/lncs/conference-proceedings-guidelines

below for a list of possible topics). You may also choose to submit a placeholder abstract; in this case a topic will be assigned to you.

Papers should consist of an abstract, an introduction, and references; no content or conclusions are required. While cited claims need not be substantiated by the sources, it should be plausible for the claim to appear therein.

Possible topics include:

- linked lists,

- hash maps,

- static typing,

- dynamic typing,

- structured programming,

- object-oriented programming,

- functional programming,

- finite automata,

- push-down automata,

- turing machines,

- logic programming,

- …