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Algorithms Theory, Assignment 7

http://lak.informatik.uni-freiburg.de/lak_teaching/ws09_10/algo0910.php

Submission: Monday 15. Feb. 2010, 4 p.m.

- The solutions can be submitted in English or German
- You are required to submit your own solution.
- You are allowed to discuss your solutions with each other. Nevertheless, you are required to write down the answers in your own words.

Exercise 7.1 - Bin packing

[Points: 3+2]

Consider the following sequence I of items:

$$\underbrace{\frac{1}{31}+\epsilon,\ldots,\frac{1}{31}+\epsilon}_{32m},\underbrace{\frac{1}{9}+\epsilon,\ldots,\frac{1}{9}+\epsilon}_{32m},\underbrace{\frac{1}{3}+\epsilon,\ldots,\frac{1}{3}+\epsilon}_{32m},\underbrace{\frac{1}{2}+\epsilon,\ldots,\frac{1}{2}+\epsilon}_{32m} \quad (m\in\mathbb{N})$$

- Construct an optimal packing and the packing which results after applying the First Fit method. Provide $\mathsf{OPT}(I)$ and $\mathsf{FF}(I)$.
- Apply the offline strategy First Fit Decreasing to I. Construct the resulting packing and provide $\mathsf{FFD}(I)$.

Exercise 7.2 - Matrix-chain Multiplication

[Points: 5]

Find the optimal parenthesization of a matrix-chain product whose sequence P of dimensions is $\langle 44, 43, 3, 29, 35, 19\rangle$. Specify all values $m[i,j]$ and $s[i,j]$. Finally, provide the optimal parenthesization for $A_1 \cdot A_2 \cdot A_3 \cdot A_4 \cdot A_5$.

Exercise 7.3 - Optimal search trees

[Points: 5]

Let keys k_1, k_2, k_3, k_4, k_5 be given the following query frequencies:

$(-\infty,k_1)$	k_1	(k_1,k_2)	k_2	(k_2,k_3)	k_3	(k_3,k_4)	k_4	(k_4,k_5)	k_5	(k_5,∞)
4	5	3	3	2	7	1	6	4	5	3

Compute an optimal search tree, use the method presented in the lecture. For every optimal search tree $T(i,j)$, give the values $W(i,j), P(i,j)$ and $r(i,j)$.

Exercise 7.4 - Edit distance

[Points: 3+1+1]

Consider two strings $A = ARDUOUS$ and $B = ABSTRUSE$.

- Show the corresponding trace graph for transforming A into B. For each node draw only the feasible edges (i.e. edges that lead to the corresponding minimum value of the node).
- Mark an optimal trace (i.e. an optimal path in the trace graph).
- Specify the corresponding sequence of edit operations and $D(A,B)$.

Exercise 7.5 - Text search (Ukkonen)

[Points: 5 bonus points]

By using the Ukkonen algorithm, construct the explicit suffix-tree for the string $t = BAGGAGE$. For each phase $i = 1,\ldots,|t|$, draw the implicit suffix-tree T_i and specify the applied rules. Finally, draw the explicit suffix-tree T and insert all suffix links.