Chip Design
Summer term 2010

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Exercises 9

1) Given an instance of the Multisection Problem with m regions and a feasible fractional partition. Prove that there is an integral partition violating no capacity constraint by more than $\frac{m-1}{m} \max\{\text{size}(C) : C \in \mathcal{C}\}$.

(4 points)

2) Find a polynomial-time algorithm that solves the Placement Legalization Problem in the special case that $w(C) = 1$ for all $C \in \mathcal{C}$.

(4 points)

3) Implement the Single Row Algorithm for the special case of minimizing total squared movement. The input consists of $n \in \mathbb{N}$, widths $w_1, \ldots, w_n \in \mathbb{R}_+$, positions $\tilde{x}_1, \ldots, \tilde{x}_n \in \mathbb{R}$, weights $c_1, \ldots, c_n \in \mathbb{R}_+$ and $x_{\max}, x_{\min} \in \mathbb{R}$ with $x_{\max} - x_{\min} \geq w_1 + \ldots + w_n$. The task is to compute positions $x_1, \ldots, x_n$ with $x_{\min} \leq x_1, x_i + w_i \leq x_{i+1}$ for $i = 1, \ldots, n-1$, $x_n + w_n \leq x_{\max}$ and $\sum_{i=1}^{n} c_i(\tilde{x}_i - x_i)^2$ minimum.
The implementation must be done either in the C++ or C programming language respecting the C/C++ standard from 1999. You can easily achieve this by using the GNU-compiler (gcc or g++) and by including only standard headers (including the STL).
The input should be read either from an input pipe or directly from a file. The input format is as follows. The first line contains n, $x_{\min}$ and $x_{\max}$. The following n lines contain the width w_i, the original position $\tilde{x}_i$ and the cost c_i for each circuit $i = 1, \ldots, n$. In the following example we have $n = 3$, $x_{\min} = 0.0, x_{\max} = 10.0$. The three circuits have widths $2.0, 3.0$ and 2.0, original positions $3.5, 3.0$ and 5.1, and weights $1.0, 2.0$ and 1.0:

```
3 0.0 10.0
2.0 3.5 1.0
3.0 3.0 2.0
2.0 5.1 1.0
```

The program should write the result (the computed positions x_1 to x_n and the total cost) to the standard output. Here for example:

```
Positions: 1.4 3.4 6.4
Total cost: 6.42
```

More examples can be found on the web page of the exercises class.

(16 points)

Deadline for exercises 1-2: June 22 before the lecture (12.15 pm).
Deadline for exercise 3: July 4 (by e-mail to `massberg@or.uni-bonn.de`).

Die Mentorengruppe des Forschungsinstituts für Diskrete Mathematik lädt zu folgenden Vortrag ein:
Datum: Dienstag 22. 06. 2010, 18 Uhr s.t. im Hörsaal
Thema: 'Diskrete Mathematik jenseits der Uni'
Referent: Johannes Zühlke, Fraunhofer Institut für Algorithmen und wissenschaftliches Rechnen
Johannes Zühlke, der am Forschungsinstitut für Diskrete Mathematik seine Diplomarbeit geschrieben hat, wird einen Einblick in seine derzeitige Arbeit geben und darauf eingehen, in wieweit ihn sein Studium bei der Arbeit noch beeinflusst.