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Erratum

New clique and independent set algorithms for circle graphs

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Abstract

Apostolico, A., M.J. Atallah and S. Hambrusch, New clique and independent set algorithms for circle graphs, Discrete Applied Mathematics 41 (1993) 179–180.

The above-mentioned paper, which appeared in this Journal (36 (1992) 1–24) contains an error that is easily fixable without any damage to the claimed complexity bounds. The problem is with Substep 4.3 of algorithm BESTCHAINS described in Section 4.2 and it is fixed by modifying Substep 4.3 as follows.

Substep 4.3 (Correct version). Use matrices $RL1$ and $D2$ to obtain the $(n/2)\times n$ matrix $D3$ of the weights of heaviest chains in $P \cup \mathit{Left}(P) \cup \mathit{Middle}(P)$ that begin in B and end in $\mathit{Left}(P)$. Note that $D3$ contains half of the rows of the matrix DIST_P (the rows corresponding to heaviest chains beginning in B). We show that this substep can be done in $O(n^2)$ time. First note that:

$$D3(i,j) = \max_{1\le k\le n} (D2(i,k) + RL1(k,j)). \qquad (*')$$

Thus the problem we face is that of "multiplying" the matrix $D2$ and the matrix

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$RL1$ in the closed semiring (max,+). For every row i of $D2$ and every column j of $RL1$, let $\gamma(i,j)$ be the value of k which maximizes $(*')$, i.e., $D3(i,j)=D2(i,\gamma(i,j))+RL1(\gamma(i,j),j)$. If there is more than one value of k which maximizes $(*')$ then we break the tie by choosing $\gamma(i,j)$ to be the smallest such k. The key observation is that for every row i of $D2$ we have:

$$\gamma(i,1)\le\gamma(i,2)\le\cdots\le\gamma(i,n). \tag{$**'$}$$

The proof of $(**')$ is similar to the argument given about $(**)$ in Substep 3.3 and is therefore omitted. However, we cannot use the algorithm of Substep 3.3 in this case, since it is *not* necessarily true that

$$\gamma(1,j)\le\gamma(2,j)\le\cdots\le\gamma(n/2,j).$$

It is easy to come up with counterexamples showing that the above need not hold. However, this poses no problem, since we can use the SMAWK algorithm [1] n times, once for each value of i. Each usage of that algorithm would compute $\gamma(i,1)\cdots\gamma(i,n)$ in $O(n)$ time. That the algorithm can be used is an immediate consequence of $(**')$ and of the fact that $(**')$ holds even if γ were redefined by using a version of $(*')$ in which k (respectively, j) ranges over a subset of the rows (respectively, columns) of $RL1$. In fact Substep 3.3 of the algorithm could also have been carried out in this way. The method we gave for Substep 3.3 is another alternative for that particular substep, but its approach cannot be used for Substep 4.3.

Reference

[1] A. Aggarwal, M.M. Klawe, S. Moran, P. Shor and R. Wilber, Geometric applications of a matrix searching algorithm, Algorithmica 2 (1987) 209–233.