Abstract

In this thesis investigations have been carried out on the design and analysis of sequential and parallel algorithms for some problems on interval graphs. The parallel algorithms are designed on an EREW PRAM of an SIMD computer.

Three basic technique, viz., interval tree approach, endpoints scanning approach and directed acyclic graph approach, have been used to design the algorithms presented in the thesis.

For an interval graph with n vertices and m edges, the following problems are solved in the thesis.

An $O(\log n + n/P)$ time and $O(nP)$ processors parallel algorithm is designed to solve the all pairs shortest paths problem on an interval graph. A parallel algorithm is also designed to compute the average distance of an interval graph using the same time and processor complexity.

An $O(n)$ time sequential algorithm and $O(n/p + \log n)$ time parallel algorithm using P processors are designed to find the diameter and the centre of an interval graph.

To generate all maximal cliques of an interval graph with output size γ an $O(n+\gamma)$ time sequential algorithm and an $O(\frac{n+\gamma}{P} + \log n)$ time parallel algorithm using P processors are designed. An $O(n/P+\log n)$ time and P processors parallel algorithm is presented for computing a maximum clique on weighted as well as unweighted interval graphs. Algorithms for computations of treewidth and pathwidth for an interval graph and of the minimum bandwidth for a proper interval graph are given. These algorithms require $O(n/P + \log n)$ time and P processors.

An $O(n)$ time sequential algorithm and $O(n/P + \log n)$ time parallel algorithm using P processors are presented for colouring an interval graph.

For computing k-connected Steiner subgraph on an interval graph an $O(n + m)$ time sequential algorithm is designed.

A sequential algorithm is presented for finding the maximum weight k-independent set, which takes $O(kn\sqrt{\log W_L} + \gamma)$ time where W_L is the length of a longest path of the interval graph and γ is the size of all maximal cliques.

An $O(n+m)$ time sequential algorithm is designed to find an edge packing (EP) on an interval graph. A parallel algorithm for finding an EP on a weighted interval graph is presented. The algorithm takes $O(\log^2 n)$ time and uses $O(n^3/\log n)$ processors. For an unweighted interval graph another parallel algorithm is given. The algorithm takes only $O(\log n)$ time with $O(n+m)$ processors. To find an efficient edge dominating set on an unweighted interval graph an $O(n+m)$ time sequential algorithm and an $O(\log n)$ time and $O(n+m)$ processors parallel algorithm are also designed.