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FACULTY OF ENGINEERING - ALEXANDRIA UNIVERSITY

EFFICIENT OBJECT-ORIENTED DATABASE MANAGEMENT SYSTEMS

A thesis submitted to the

DEPARTMENT OF COMPUTER SCIENCE & AUTOMATIC CONTROL

in partial fulfillment of the requirements for the degree of

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in

COMPUTER SCIENCE

by

AMANI ANWAR AHMED SAAD

M.Sc. Computer Science (1990)

ALEXANDRIA

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We certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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TO MY FATHER
&
THE MEMORY OF MY MOTHER

Summary

Object-oriented database systems were introduced to meet the needs of new advanced applications which require high data modelling power and new management requirements which can not be met by the relational data model. The performance of these systems is critical since they are charaterized by data intensive applications. This thesis is concerned with enhancing the performance of object-oriented database systems. The work in this thesis belongs to two major areas. The first area is query processing and optimization techniques for object-oriented databases. An analytical cost model which calculates the cost of processing the query using several query processing techniques and takes the clustering factor into account is presented. Furthermore, heuristics are proposed for the query optimizer in order to cut the search space of possible query evaluation plans.

The second area is solving the physical database design problem by the efficient structuring of objects in physical storage. Extensions to current clustering techniques for objects are presented. The clustering configuration definition is introduced and two different approaches are developed in order to generate one for a specific object base. The first approach is based on the information about the queries conducted upon the objects in the system. It partitions the object base into highly correlated partitions where each presents a logical cluster and assigns a clustering technique for each.

On the other hand, the second approach generates the optimal clustering configuration for a certain path in the object base schema graph based on the analytical model presented. The algorithm splits the path into several paths and allocates for each path the best clustering technique and consequently the suitable query processing strategy. The idea of combined query processing strategies based on the heuristics validation results is introduced.

Two hierarchical clustering techniques are presented which deal with the value-based clustering problem. The first algorithm is suitable for object bases with a maximum of several hundreds objects. On the other hand, the second algorithm is a dynamic algorithm that exploits the first algorithm to cluster an initial set of objects then it allowes the insertion of objects in their suitable place in the hierarchical structure built in physical storage. Thus it builds the hierarchical structure incrementally and is suitable for object bases characterized by large data sets due to its lower complexity.

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