COMP9120 Relational Database Systems

Tutorial Week 12: Query Optimization

Introduction

This week we will continue to examine the cost of different joins for a single query.

Exercise 1. Index Nested Loops Join

Consider the same scenario as last week. Suppose we have a schema *Rel1*(*A, B, C*) and *Rel2*(*C, D*). Each *A* field occupies 4 bytes, each *B* field occupies 12 bytes, each *C* field occupies 8 bytes, each *D* field occupies 8 bytes. *Rel1* contains 100,000 records, and *Rel2* contains 50,000 records. There are 100 different values for *A* represented in the database, 1000 different values for *B*, 50,000 different values for *C*, and 10,000 different values for *D*. *Rel1* is stored with a sparse, clustered primary B+-tree index on the pair of columns (*A, B*), and *Rel2* is stored with a sparse, clustered primary B+-tree index on *C*.

General features: assume again that each page is 4K bytes, of which 250 bytes are taken for header and array of record pointers. Assume that no record is every split across several pages. Assume that data entries in any index use the format of (*search_key, rowid*), where *rowid* uses 4 bytes.

Consider the following query:

```
SELECT Rel1.A, Rel1.B, Rel1.C
FROM Rel1, Rel2
WHERE Rel1.C = Rel2.C AND Rel2.D = 16;
```

Last week you calculated the cost (in pages of I/O, assuming a minimal buffer pool of 2 pages) of a plan in which the join of *Rel1* and *Rel2* was performed using a block nested loops join with Rel1 as the outer relation, followed by the selection and projection steps. Assuming 75% page fill, you should have calculated this plan to cost 232,407 page I/O operations.

Now consider a different query plan, where the join is processed as an index nested loop join (using the primary index on *Rel2.C*), and then each tuple of the join is filtered to check the value of *D*. How does this affect the cost?

Exercise 2. Alternative plans

Suggest any additional indices that might be helpful, and then propose a query plan to take advantage of those indices. What is the cost of the resulting plan? How much extra space is used for the extra indices?