1   Introduction

The Postgres query planner does not necessarily return the best plan even with interesting orders. As mentioned in the CORDS paper, one reason is the estimated numbers of rows returned by a scan or join can be way off [1]. For instance, imagine the estimate claiming that one row is returned from both relations in a join. The optimizer might estimate one row because of the indepedence assumption of AND clauses. The optimizer might perform a nested loop join because the single row fits in memory.

As a result, this prototype was created to explore the possibility of a database user manually manipulating the plan, or changing the estimates of the number rows returned from a base or joined relation. The primary use case is for queries that are expected to take hours or days to complete. If used in other settings, then the time spent having the user optimizing the query may exceed the time saved in query processing.

2   Features

The prototype begins by displaying the plan that the optimizer initially computes. The UI can display any number of levels of joins. From that UI, you can change which join algorithm should be applied on two relations. Lastly, the UI also allows you to modify the the estimated number of rows for each relation and then the query planner searches for a new plan using the new estimates.

3   How it Works

Here I provided a summary of the most complicated components of this project. A lot of challenges I encountered are not included here to keep the report brief.

3.1   UI

The UI was built using GTK+. The most complicated component is the display of tree. This was solved using a table like GUI abstraction, which a GUI widget can be placed at any row and column of the table. The follow diagram illustrates how the formula was derived.
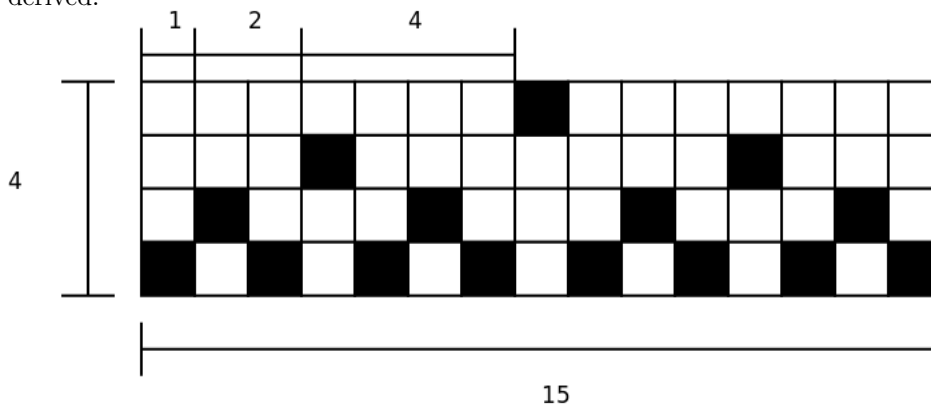
The 0th row is the top most row of the table. The 0th column is the left most column of the table. Given the above convetion, we can compute the position of all the nodes using the following recursive formulae

$$
\begin{aligned}
row_{root} &= 0 \\
colum_{root} &= 2^{TreeHeight-1} - 1 \\
row_{child} &= row_{parent} + 1 \qquad\qquad \text{for both left and right children} \\
column_{child} &= column_{parent} - 2^{height_{parent}-2} \qquad\qquad \text{for the left child} \\
column_{child} &= column_{parent} + 2^{height_{parent}-2} \qquad\qquad \text{for the right child}
\end{aligned}
$$

The number of rows is the height of the plan. The child node of a parent, is 1 row below the parent. Additionally, it is $2^{ParentHeight-2}$ units to the left or the right of the parent.

3.2 Changing Joins

We wrap the plan tree datastructure returned by query planner inside our own tree so that each node of the tree has pointers to any important GUI widgets that the user may have manipulated. When the user changes the join on the GUI, we recursively rebuild the path upwards starting from the node that was changed.

3.3 Changing a Relation's Rows Estimates

We add a hashtable to the PlannerInfo struct. The hashtable is a map from relids of the relation to the overridden number of rows. If the hashtable does not contain an entry for a given relids, then the estimate for that relation has not been overridden. Where ever the estimated number of rows was accessed in costsize.c, we prepended a lookup to the hashtable to check if it has been overridden.

4 Future Work

Firstly, in order to focus on the functionality of this prototype, the GUI runs on the database process, This avoided having to implement a communication protocol between the database and client and figuring out how to serialize that data. Secondly, currently there is no way to maniupate the structure of the tree. Thirdly, there is no way to change which scan should be performed on a based relation. Fourthly, only one pathkey is considered for the merge join. A variety of options should be presented to the user selecting merge join. Lastly, there is absolutely no validation to assist the user when he creates something that does not make sense.

References

[1] Ihab F. Ilyas, Volker Markl, Peter Haas, Paul Brown, and Ashraf Aboulnaga. Cords: Automatic discovery of correlations and soft functional dependencies. In *Proceedings of the 2004 ACM SIGMOD International Conference on Management of Data*, SIGMOD '04, pages 647–658, New York, NY, USA, 2004. ACM.