Comparison of Graph Layout Algorithms for DAGS

Submitted by

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Table of Contents:

Graph Layout for DAGS

1. Introduction.

Graphs have played an important role in modeling information and data in science and engineering. Any problem that consists of entities and relationships among them can be modeled using a graph. In the modern scientific world graphs are used to model information starting from flow charts used to show the flow of data to complex networks. Most of the visualization systems that are used for presenting information use graphs in order to make the visualization more comprehensible and clear. Most of the fields in science use graph representations in some form. The importance of graphs in the evolving modern science is well recognized and considerable research has been done in areas like finding algorithms for graph related problems, (i.e. graph traversals and finding optimal ways of traversing graphs) and in the field of visual languages.

The use of graphs in the field of computer science graphs is extensive. Nearly every domain in computer science uses graphs. Graphs are used to model data and information. Flow charts are used to represent the data flow. The Objected oriented design paradigm uses graphs to show class hierarchies and relationships between objects. In computer networks graphs are used to model various kinds of network topologies, database use graphs for representing entity relationship diagraphs, artificial intelligence and computation theory use graphs in the form of state transition diagrams, and knowledge representation diagrams. Graphs also find applications in the fields of information systems, real time systems, logic circuit design, logic programming and many other fields.

Since the display of the graph conveys much information it is important to draw graphs so that the information represented by the graphs appears comprehensible, readable and pleasant to view. Thus graph drawing has developed into a major research area. Graph drawing is a field that addresses the problem of effectively representing graphs. A graph presents us with more information when represented in the form of a diagram rather than presenting it in a textual form by abstractly listing the adjacencies or in the form of a matrix. However the effectiveness in conveying the information depends upon how well the graph is represented visually. A graph drawn systematically following a standard pattern and aesthetics can provide the user with more information in an easy manner than a poorly drawn graph.

Considerable research [1] has investigated various methods to produce drawings of graphs which are more informative, clear and easy to follow. Graph drawing algorithms have been developed for different kinds of graphs. In this paper we focus on the special case of DAGS, directed acyclic graphs. DAGS are special class of graphs that have found extensive use in the field of computer science.

Due to the extensive use of DAGS, several heuristics have been proposed for drawing them. In this paper we compare the three most common types of heuristics in order to determine which approach minimizes crossings among the edges and has minimum time complexity to lay out the DAGS. We empirically investigated these three heuristics by implementing each and running them on input consisting of DAGS with different number of nodes and edge densities. From an analysis of output data we determined the effectiveness of these heuristics in laying out the DAGS and developed guidelines for when the heuristic should be used.

2. Background.

To understand the topics discussed in this paper, it is important to know the basic definitions and concepts related to graphs. This chapter presents the concepts and definitions.

2.1 Basic Definitions and Terminology

An ***undirected graph*** G= (V, E) consists of a finite set V of vertices and finite multiset E of edges, that is unordered pairs (u, v) of vertices [1]. The vertices and edges can be given different names or labels depending on the context of the problem definition.

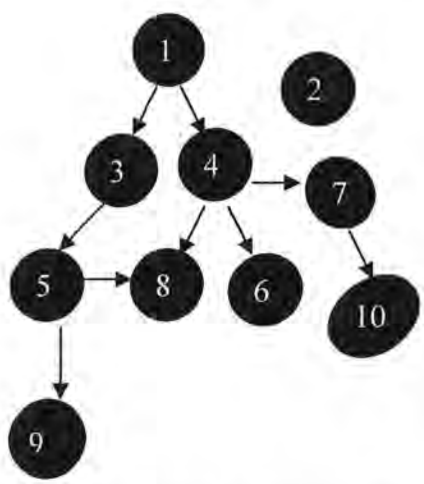

Figure 1. Directed Acyclic Graph

Graphs whose edges are ordered pairs of vertices are known as ***directed graphs*** or ***digraphs***. An edge (u, v) in a directed graph denotes that the edge is going out from vertex u and is coming into vertex v, i.e. the edge is directed from u to v. Vertices are said to be ***adjacent*** when there is an edge e between them. ***Neighbors*** of a vertex are the vertices that are adjacent to it. Since we are interested in directed graphs in this paper, from now on all graphs will be assumed to be directed graphs.

A ***directed walk*** in a graph G= (V, E) is a sequence $(v_1, v_2 \ldots.. v_k)$ of vertices of G, such that $(v_i, v_{i+1}) \in E$ for $1 \leq i \leq k-1$. A *directed walk* is a ***directed path*** if the sequences (v_1, v_2 ..... v_k) of vertices are all distinct. A *directed walk* is a ***directed cycle*** if (v_k, v_i) $\in$ E [1] and no other vertices are repeated in the walk. A directed graph is ***acyclic*** if doesn't contain any directed cycles.

In Figure 1, the edges from 1-3-5-9 form a walk; since all the vertices in it are distinct it is also a path. If we add an edge from vertex 9 to vertex 1 then the walk 1-3-5-9-1 becomes a directed cycle.

The ***indegree*** of a vertex is the number of edges directed into it from other vertices (a self loop is not being considered here) and ***outdegree*** of a vertex is the number of edges directed out from it to other vertices.

A ***bipartite digraph*** is a directed graph where vertices can be divided into two sets such that no edge connects vertices in the same set.

3. Graph Drawing Algorithms for DAGS

Many graph drawing algorithms have been developed for drawing DAGS. The drawing algorithms for DAGS involve two basic steps; the first step is to layer the graph and the second step is to arrange the vertices within the layers in order to reduce the edge crossing number. In this paper two approaches for layering the graph and three edge crossing reduction heuristics are compared.

3.1 Layer assignment

In the layering step the vertices or nodes of the graph are first labeled with distinct integers. Then the vertices are assigned to different layers so that all edges are between vertices in different layers. Thus a DAG is converted into a layered directed graph. However there are some important requirements that are to be followed in order to layer the graph. The first requirement is to keep the height and width small and the distance between the layers is constant. The second requirement is to get a proper layering (edges only between vertices in consecutive layers) which is done by introducing dummy vertices along the edges that spans more than one layer, i.e. if there is an edge between two vertices u and v which spans k+1 layers then dummy vertices $d_1, d_2 \ldots d_k$ are introduced between the layers. This is required because crossing reduction algorithms assume the digraphs to be layered properly. The third requirement is to see that the number of dummy vertices is kept as small as possible in order to reduce the computation required for various algorithms to perform crossing reduction.

Finding an optimal way of layering having minimum height and width is a NP complete problem [1]. In this paper Coffman-Graham layering algorithm [1] has been used to perform the tasks of labeling and layering the vertices of the digraph.

The Coffman-Graham layering algorithm is implemented in two phases. The first phase orders the vertices and assigns distinct integer labels to them; the second phase then scans each vertex and assigns it to a layer.

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3.1.1 Labeling

The purpose of the labeling is to derive a linear order for the vertices such that for each edge (u,v) the label of u is less than the label of v.

The first phase of the algorithm uses a topological sort [1] to assign labels from 1, 2....n to the vertices. The labeling follows the source and sink approach i.e. the source vertex (indegree 0) is given the label 1 and removed from the graph. Then a new source vertex is labeled and removed from the graph. This continues until all the vertices are labeled.

Thus in assigning the labels, only the indegrees of the vertices are taken into consideration. The vertex with zero indegree is labeled first, then that vertex and its edges are removed from the list and remaining vertices are scanned to determine a vertex with zero indegree. Then that vertex is labeled with next higher integer. If there is a tie i.e. more than vertex has an indegree zero then, the vertices are labeled on first come first serve basis. This process is followed until all the vertices are labeled. The result of the process is illustrated in figure 2b for the graph in figure 2a.

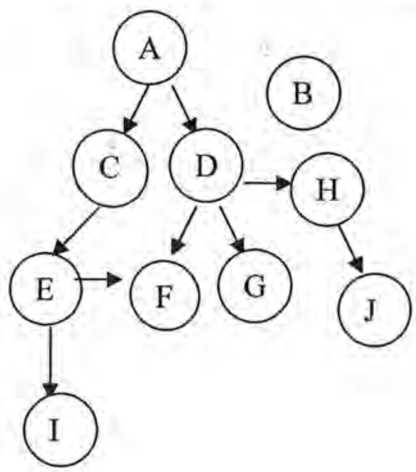

Figure 2a. Graph Before Labeling.

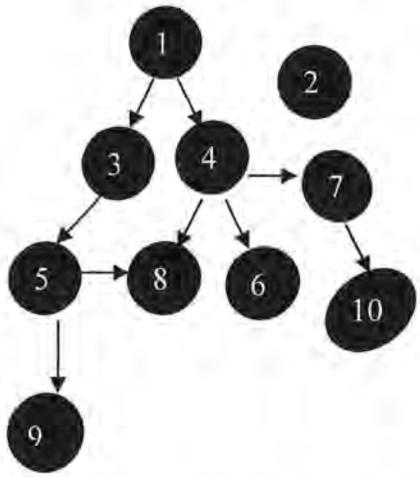

Figure 2b. Graph After Labeling.

The vertices A and B are labeled first as their indegree is 0, they are given the labels 1 and 2 respectively. After removing vertices 1 and 2 and their edges the indegree of vertices C and D will be 0 so they are given labels 3 and 4. Then the vertices 3 and 4 are removed, now the indegree of vertices E, G and H becomes 0, the vertices E, G and H are given the labels 5,6 and 7 respectively, this process is repeated until all the vertices are assigned labels. Finally vertices I and J are labeled 9 and 10.

The algorithm for the process of labeling is as follows:

1. j←1

2. Repeat until all the vertices are labeled

   2.1 Scan the vertices, calculate their indegrees and find a vertex v with indegree zero.

   2.2 Label the vertex v as j.

   2.3 Remove the vertex v and the edge from the list.

   2.4 j←j+1;

Thus the vertices from the input digraph are ordered and labeled using the above algorithm. After all the vertices are labeled the next step is to assign the vertices to different layers. The process of layering is described in the next section.

3.1.2 Layering.

The purpose of the layering step is to assign and group the vertices into layers so that all of the edges are directed from vertices in higher numbered layer into vertices in the next lower numbered layer and there are no edges between vertices in same layer. There are two steps in layering. The first step is assigning vertices to layers and the second step is to add dummy vertices such that the edges are only between vertices belonging to consecutive layers i.e. make the layering proper. The layering can be done in two ways, outlayering starts from lowest numbered layer and proceeds to higher layers, while inlayering i.e. starts from the highest numbered layer and proceeds to lower layers.

3.1.2.1 Outlayering Approach

The Outlayering approach is based on the outdegrees of the vertices. Vertices with zero outdegree are first placed in the lowest numbered layer and then these vertices are removed from the list. The outdegree of the remaining vertices are recalculated then the vertices whose outdegree is determined to be zero are assigned to the next higher layer. This is repeated until all vertices are assigned to a layer.

In the following we illustrate the layering approach starting from the labeled graph in Figure 3.

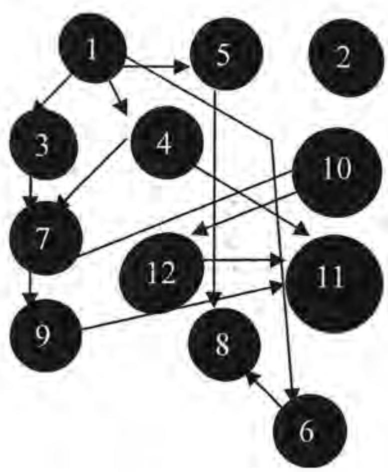

Figure 3. Graph Before Layering

The layers are numbered from 1 to n where n is the last layer i.e. after reaching the n^{th} layer all the vertices of the digraph have been assigned to different layers. The number of layers and the number of vertices in each layer varies with density of the graph and the size of the graph. The process of Outlayering layering is illustrated in the figure given below.

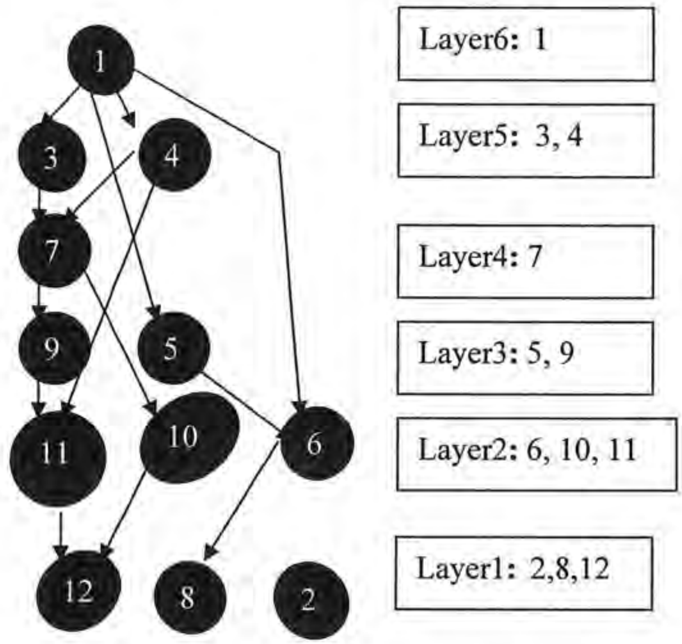

Figure 4. Graph in figure 3 After Layering.

In the Figure 4 vertices 2, 8 and 12 have an outdegree zero, thus they are assigned to the first layer. After removing these vertices from the list, the outdegree of vertices 6, 10 and 11 becomes 0 and these vertices are assigned to layer 2, following the same process 5, 9 are assigned to layer 3, vertex 7 is assigned to layer 4, vertices 3 and 4 are assigned to layer 5 and the last remaining vertex 1 is assigned to layer 6.

The algorithm for the Outlayering layering is as follow:

1. i=1
2. Repeat until all the vertices are assigned to layers.
   - 2.1. Calculate the outdegrees of all the vertices; determine the set of vertices V with outdegree zero.
   - 2.2. Assign vertices in V to layer i.
   - 2.3. i←i+1;
   - 2.4. Remove the vertices in V and their edges from the list.

Note: The number of layers is the length of the longest path in the graph.

3.1.2.2 Inlayering Approach

In the Inlayering approach the indegree of the vertices is used. The indegree of the vertices is calculated and the vertices with zero indegree are placed in the top most layer. Then these vertices and their outedges are removed from the graph and the indegrees of the remaining vertices are recalculated. Then vertices with zero indegree are assigned to the next lower layer.

The layers are numbered from 1 to n where n is the top layer. The layering starts at n^{th} layer and then proceeds to lower layers until the 1^{st} layer is reached, all the vertices will have been layered after filling the layer numbered 1. The process Inlayering is illustrated in figure 5 for the graph in Figure 3.

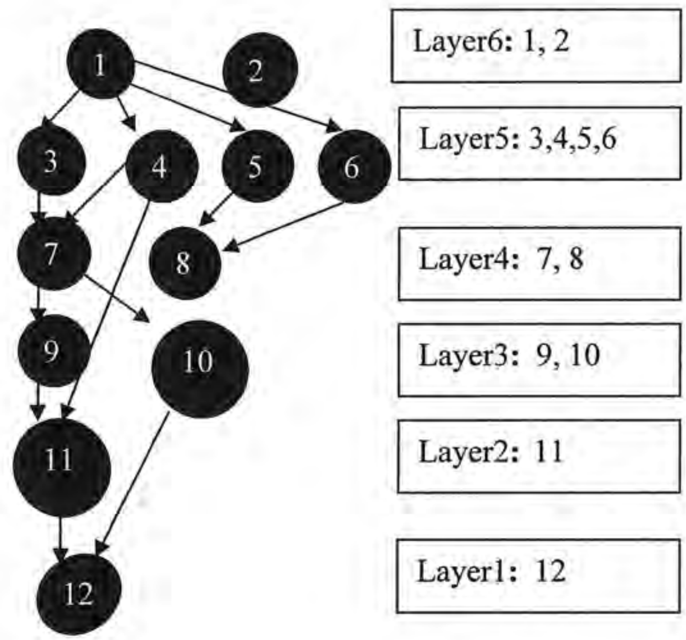

Figure 5. Graph after Layering

Note: The layers are assigned from 1-6 first and then they are reversed for further processing.

In the above figure vertices 1, 2 have an indegree zero; thus they are assigned to the first layer. After removing these vertices from the list, the indegree of vertices 3, 4, 5 and 6 becomes 0 and these vertices are assigned to layer 2, following the same process 7 and 8 are assigned to layer 3, vertex 9 and 10 are assigned to layer 4, vertex 11 is assigned to layer 5 and the last remaining vertex 12 is assigned to layer 6. After layering them in this order, the layer numbers are reversed i.e. 6 becomes 1, 5 becomes 2 and so on till layer 1 becomes layer 6. This is done so that the implementation for crossing reduction algorithms remains the same for both Inlayering and Outlayering approach. The edges go from higher numbered layers to lower numbered layer.

The algorithm for the Inlayering is as follow:

1. i=1
2. Repeat until all the vertices are assigned to layers.

   2.1. Calculate the indegrees of all the vertices and determine the set of vertices V with indegree zero.

   2.2. Assign the vertices in V to layer i.

   2.3 i←i+1;

   2.4. Remove the vertices that have been assigned to layers from the list.

After assigning the vertices to the layers in this way, the layer number are reversed in order, layer 1 becomes the highest possible layer, layer 2 next highest layer and so on; layer 1 becomes the top layer.

3.2 Dummy Vertices

In order to make the digraph properly layered (a properly layered digraph has no edges within the same layer and all edges are between consecutive layers) dummy vertices have to be inserted along the edges. This is necessary as the crossing reduction algorithms assume the digraphs to be properly labeled. We can insert the dummy vertices along the edges by replacing the edges spanning more than one layer with a path of dummy vertices e.g. If edge (u, v) where u is in layer j and v is in layer j-i when i>1, then we replace, edge (u, v) with edges (u, w_{j-1}), (w_{j-1}, w_{j-2})...... (w_{j-i+1}, v), where w_k is a dummy vertex assigned to layer k. We have to keep the number of dummy vertices very small as the crossing reduction take into consideration these dummy vertices and the computation and complexity increases as the number of dummy vertices increase.

Figure 6 illustrates the layering with dummy vertices for the graph in figure 5. The small gray circles represent the dummy vertices and the black circles represent the existing vertices. Since a dummy vertex is inserted when the edge spans more than one layer, in the figure you can see that if the edge spans two layers then one dummy is introduces , if it spans three layers then 2 dummies are introduced i.e. if the edge spans k layers where k>1 then k-1 dummy vertices are introduced.

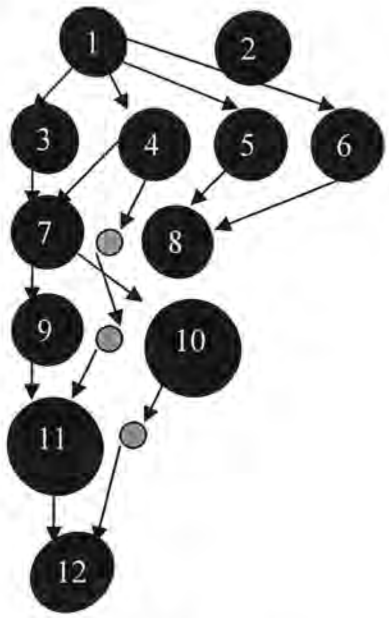

Fig 6. Introducing dummy vertices

The algorithm for computing and inserting the dummy vertices is as follow:

1. Repeat until no edges span more than one layer.

    1.1 Select edge (i, j) spanning k layers L_k, L_{k-1}, L_{k-2}... L_1 , k>1.

    1.2 Calculate the difference k in layers for vertex i and its adjacent vertex j.

    1.3 Add k-1 dummy vertices v_1, v_2, v_3, v_4 .... v_{k-1} in the layers L_k, L_{k-1}, L_{k-2}... L

    and add edges (i, v_1), (v_1,v_2), (v_2,v_3)......... (v_{k-1}, j).

Once the graph is properly layered, the next step is to minimize the number of crossings in the digraph. The Crossing reduction is discussed in detail in the next section.

3.3 Crossing Reduction

Edge Crossings in a graph make it look more confusing and unclear; reducing the number of crossings by reordering vertices in the layers will make the graph more comprehensible. Since the number of edge crossings depends on the relative position of the vertices with in a given layer and not on the exact position of the vertex, edge crossings can be reduced by reordering the vertices within a layer. But the problem of edge crossing minimization is not a simple one to deal with and turns out to be a NP-complete problem, even in the case of two layers.

Various heuristics have been suggested for edge crossing reduction. In this paper we focus on the layer by layer sweep, the most commonly used method. The sweep method works by considering pair of consecutive layers and attempts to minimize the crossing number of these layers. The layer by layer sweeping method is explained in the next subsection.

3.3.1 Layer By Layer Sweeping

In the layer by layer sweep method the order of vertices in one layer is kept fixed while order of vertices of the second layer is reordered. If the layers are in the order i=1,2,3...k then for ordering the vertices of Layer i+1 the order of the vertices in Layer i is kept constant, The sweeping is done beginning with Layers 1 and 2. Since two layers are considered at a time this problem is known as two layer crossing problem.

A two layered digraph is a bipartite digraph G= (L_1 U L_2, E), which consists of disjoint sets L_1 and L_2 of vertices and a set $E \subseteq L_1 * L_2$ of edges [1].

For ordering the vertices in layers we initially assign unique x-coordinates to the vertices in a layer based on the order of the vertices in that layer. Consider layers 1 and 2 and let u and v be the vertices in layer 2, the crossing number C_{uv} is defined as the number of crossings that edges incident with u make with edges incident with v, when $x_2(u) < x_2(v)$ (where x_2 is the x coordinate of the vertex in layer 2) . More formally $x_2(u) < x_2(v)$, C_{uv} is defined as the number of pairs (u,w),(v,z) of edges with $x_1(z) < x_1(w)$ (where x_1 is the x coordinate of the vertex in layer 1) [1].

The example illustrating the calculation of the crossing number is shown below.

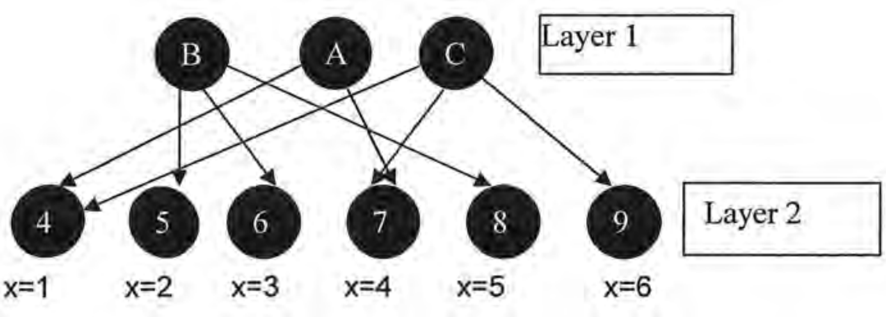

Fig 7. Two layered bipartite digraph.

The edge crossings of node A with respect to B (C_{AB}) are (A, 7), (B, 5) and (A, 7), (B, 6), therefore the edge crossings of (A, B) =2.

Similarly edge crossings of node B with respect to A (C_{BA}) are (B,5),(A,4) ; (B,6),(A,4); (B,8),(A,4) and (B,8),(A, 7); therefore the edge crossings of (B,A)=4.

In the manner explained above a crossing number matrix is created for the nodes in the upper layer. After computing the crossing matrix(shown in Table1), the crossing numbers of one vertex with respect to the other and vice versa are compared. If the edge crossings of the node at right with respect to a node at left in a layer are greater then the nodes are swapped else they remain in the same positions. In the above case the edge crossings of (B, A) =4 are greater than for (A, B) =2, thus the nodes A and B are swapped. The resulting edge crossing matrix is shown in Table 2. The total number of crossings is computed from the edge crossings matrix. The sum of the entries in the upper triangle of the matrix gives the exact number of crossings because the crossings between the edges will be considered only once this way. In the matrix given in Table 1 the exact edge crossings in the graph is equal to 9, after swapping the nodes this number reduces to 7 as seen from the matrix shown in Table 2.

	B	A	C
B	0	4	4
A	2	0	1
C	5	3	0

Table 1. Crossing number matrix for the top layer vertices in Fig [7].

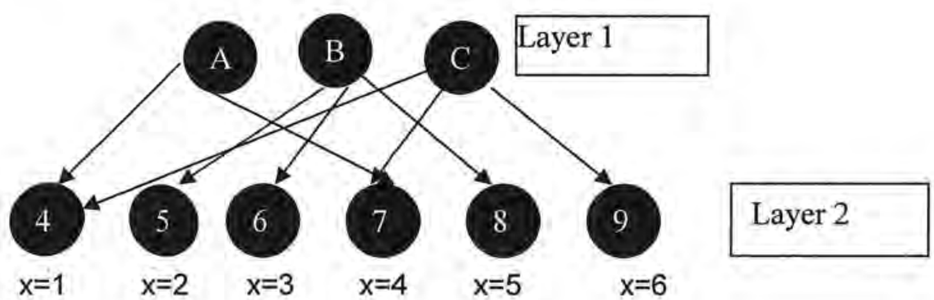

Figure 8. Two layered bipartite digraph.

	A	B	C
A	0	2	1
B	4	0	4
C	3	5	0

Table 2 Crossing number Matrix for the top layer vertices in Fig 8.

3.3.2 Algorithms for Crossing Reduction.

This paper compares three algorithms for crossing reduction have been compared. One of the algorithms is a sorting algorithm known as Adjacent-Exchange. The other two algorithms are Barrycenter and Median methods based on barrycenter (average) and median.

The sorting algorithm works on each of pair of layers L_i and L_{i-1}, and sorts the vertices in layer L_i such that the number of crossings is minimized. Thus the crossing numbers have to be computed for each vertex in layer L_i in order to rearrange the vertices in layers L_i, where i=2, 3, 4…n.

The Barrycenter and Median methods use the average of x-coordinates of the adjacent vertices of a vertex in the lower layer for ordering the vertices in higher layer.

3.3.2.1 Adjacent-Exchange Algorithm.

The Adjacent- exchange algorithm exchanges the vertices (dummy vertices are not taken into consideration) based on their crossing numbers .The Adjacent- exchange algorithm is similar to the bubble sort algorithm. The algorithm for the Adjacent-exchange is given below.

1. For i=2 to n

   1.1. Repeat for all the vertices within the layer L_i until no swapping occurs.

      1.1.1 Compare the crossing numbers of consecutive vertices u and v within Layer L_i.

      1.1.2 If the Crossing number of vertex u > crossing number of vertex v swap the positions of the vertices.

The algorithm just exchanges the vertices and doesn't change the crossing numbers in matrix; it switches rows and columns in the matrix. After all the vertices are ordered in all the layers i.e. L_i, i = 2, 3…n, the final crossing number is computed for the purpose of comparison with other algorithms.

3.3.2.2 Barry Center and Median Methods.

Most of the methods used for the two layer crossing problems are variations of the average of the x-coordinates. Both barrycenter and median are similar except that in barrycenter averages the x-coordinates of the adjacent vertices of vertex u $\in L_2$ are taken into consideration whereas in the median method the medians of x-coordinates of adjacent vertices of vertex u $\in L_2$ are used. Both the methods are described in detail in the following sections.

3.3.2.2.1 Barry Center Method

In this method the x-coordinates of each vertex v in layer L_i is computed as the average of the x-coordinates of the vertices adjacent to v in layer i-1and that value is assigned as the x-coordinate of vertex v.

The $x_2(u)$ is the computed average of the vertex u which is given by the following formula.

Avg (u) = 1/outdeg (u) $\sum_{V \in N_u} x_1(v)$,

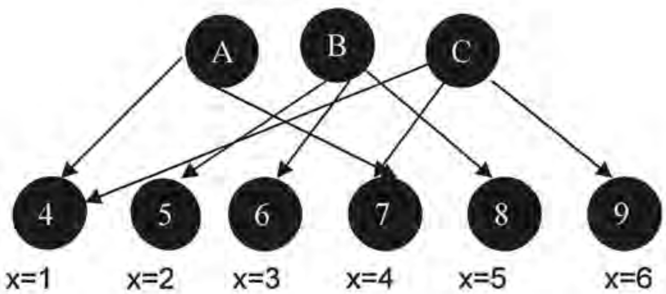

Figure 9.

In the above figure the x-coordinate of vertex A is computed by taking the sum of the x-coordinates of the vertices 4 and 7 and then divided by the outdegree of the vertex A i.e. the x-coordinate of A is (1+4)/2 = 2.5.Similarly the x-coordinate of the vertex B is computed by taking the sum of the x-coordinates of the vertices 5, 6 and 8 and then divided by the outdegree of the vertex B i.e. the x-coordinate of B is (2+3+5)/3 = 4.33.

The algorithm for implementing barrycenter method is given below:

1. For i= 2 to n do

   2. Repeat for each vertex u within the layer L_i.

      2.1 Compute the out degree of vertex u.

      2.2 Compute the sum of the x-coordinates of the vertices adjacent to vertex u.

      2.3 Divide the sum of the x-coordinates of the vertices adjacent to vertex u by the outdegree of the vertex u.

      2.4 Assign the result to the x-coordinate of vertex u.

   3. Based on the x-coordinates reorder the vertices in the layer.

3.3.2.2.2 Median Method.

Median is similar to the barrycenter method, except that instead of taking the average, the median of the x-coordinates of the adjacent vertices of each vertex belonging to layer L_2 is computed and that value is assigned as the x-coordinate of that vertex. The median for vertex u is calculated by arranging the neighbors of u, v_1, v_2, v_3 ...v_j ascending order and taking the median of the vertex u as $med(u)=x_1(v_{j/2})$.

In case u has no neighboring vertices median of that vertex is taken as 0.

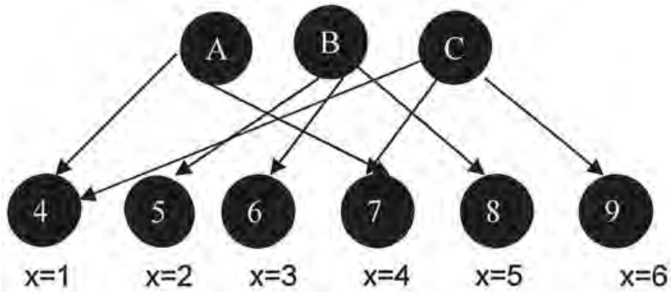

Figure 10.

In Figure 10 the x-coordinate of vertex A is the median of the x-coordinates is of the median of vertices 4 and 7, since there are even number of vertices the x-coordinate of A will be (1+4)/2 = 2.5. Similarly the x-coordinate of the vertex B is computed by computing the median among the x-coordinates of the vertices 5, 6 and 8, i.e. the x-coordinate of B will be 3.

The algorithm for implementing median method is given below:

1. For i= 2 to n do

   2. Repeat for all each vertex u within the layer L_i.

      2.1. Compute the Median of the vertices adjacent to vertex u.

      2.2. Assign the result of step 3 to the x-coordinate of vertex u.

3. Based on the x-coordinates reorder the vertices in the layer.

4 Measures of Comparison.

In this paper the main task is to compare the different algorithms for laying out DAGS. Comparison of graph layout algorithms is a difficult task; we have to be careful in choosing the metrics for comparing them. We need to know what exactly we want, what are our requirements, whether we want our graph to be drawn quickly or we want it to look more pleasant and are not constrained for time, whether we want the graph to occupy minimum area, have minimum number of crossings or should have short edges. These graph specific properties are known as aesthetics and the more of these we apply the better will be the quality of the resultant graph drawing. There are several metrics such as crossings between edges, area of graph, total edge length, total number of bend etc. In this paper the crossing number between the edges, is the aesthetic measure used to compare the different DAG layout algorithms. Since the time to layout the graph is often important, execution time is the second metric we will use.

4.1 Crossing Number as a measure.

The crossing number C_{uv} of two vertices u and v in layer L_i is defined as the number of crossings that edges incident with u make with edges incident with v, when $x_i(u)<x_i(v)$, more formally for $u \neq v \in L_2$, C_{uv} is defined as the number of pairs (u,w),(v,z) of edges with $x_{i-1}(z) < x_{i-1}(w)$[1].

If the crossing number of a graph is high then the visibility of the graph will be poor because following the relations between different vertices becomes difficult. The algorithms use crossing number as input to reorder the vertices in a layer. After laying out the DAGS, the final crossing number is calculated for the graph laid out by different algorithms.

4.2 Computational Efficiency as a measure.

Every application wants to keep the computational complexity as small as possible in order to speed up the execution and to conserve resources for other purposes. In some applications time is critical as a specific response time is required. Interactive applications are an example where the response time should be minimum. In these cases computational efficiency plays an important role. Computational efficiency was calculated using the run time required for each algorithm to execute. There may be cases where one algorithm performs better than the others and in some case it may be less efficient.

To get a general view about the performance of different algorithms, graphs of different number of nodes with different edge densities have been given as input data and the results were analyzed. The information about the program is given in chapter 5 and the information about the data gathered and its analysis can be found in chapter 6.

5 Program Design.

The algorithms were implemented using the JAVA programming language. The representation of graphs for the purpose of processing was done in the form of adjacency matrices. The whole program has designed using 5 classes. The programming was done in the java editor j++ by Microsoft.

5.1 Data structures for the graph.

Vertices were represented in a class named node, it consists of the variables for representing the co-ordinates, labels, layers and an array for representing the adjacent vertices.

An array of vertices has been created for representing different nodes. A method generatenode ( ) initializes the nodes and sets its properties. The node variable representing the labels and layers are set to -1 during initialization and are set in the labeling and layering methods respectively.

The edges from one vertex to another are stored in the array named next [ ], which stores the adjacent vertices for a particular vertex. The x and y co-ordinates are given random values initially.

```
Public class Node
{double x;
 double y;
 Int [] prev= new int [NODES];
 Int [] next= new int [NODES];
 int Node_Id;
 int lbl;
 int inlbl;
 int layer;
int inlayer;
}
```

5.2 Random Graph Generation.

For generating the various types of random graphs with different number of nodes and edge densities, a method generate graph is used. The graph is generated as an adjacency matrix; a value of 1 in the matrix indicates the presence of an edge. The density of the graph is varied by using the Math. Random () function. This function generates a number between 0.0 to 1.If the density value is set to 0.1. Then this means that whenever a number less than 0.1 is generated by the random function an edge is added in the graph. Since there is 0.1 probability of generating numbers less than 0.1 the edge density of the graph generated is approximately 0.1, similarly graphs of different edge densities are generated by changing the density value. The graph is generated is in such a way that there are no cycles in the graph, this is done by generating 1's in the upper triangle region of the matrix. Thus each edge is from a lower numbered vertex to a higher numbered vertex. After generating the adjacency matrix the node adjacencies are filled in the array next [ ] of each node.

The following piece of code is used to generate the graph by means of an adjacency graph.

```
for (i=0; i<NODES,i++)
   {for (j=0; j<NODES; j++)
```

```
                {If (j>i)
                    {if (Math. random ()>value)
                        {gmatrix[i] [j] =1 ;}
                    }
                }
        }
```

For complete code see Appendix.

5.3 Functions for labeling and layering (implementation of Coffman-Graham-Layering).

After generating the graph, the next step is to label the vertices, labeling is done by considering the indegrees of the vertices. The function labeling labels the vertices and sets the label property of each vertex in the array of vertices. The labels are computed using the indegrees of the vertices, the vertices with indegree zero are labeled first; these vertices are removed from the list and the indegrees of the remaining vertices are computed and the vertices with indegree are labeled next.

The following piece of code shows the process of labeling.

```
for (i=0; i<NODESi++)
        {if (indeg[i] ==0)
           {Count=count + 1;
             if (nodes[i].lbl==-1)
             {
           nodes[i].lbl =lbcount;
           lbcount =l bcount+1;
             }
            indeg[i] =-1;
           for (q=0; q<NODES q++)
                  {
                    rematrix[i] [q] =-1;
                    rematrix[q] [i] =-1;

                  }

           }

}
```

After labeling the vertices, the vertices are assigned to different layers. There are two approaches for layering the graph, the two approaches Outlayering and inlayering have been explained in the Chapter 3. The method - outlayering () implements the Outlayering approach. It uses the outdegree of the vertices to layer the graph. The outdegrees of all the vertices are computed and the vertices with outdegree zero are assigned to the bottom layer L_1, and these vertices are removed from the list. The outdegrees of the remaining unlayered vertices are recomputed and the vertices with outdegree are assigned to next higher layer i.e. L_2. This process is followed till all the vertices are assigned to layers.

The following piece of code shows the process of Outlayering.

```
for (i=0; i<NODES i++)
        {if (loutdeg[i] ==0)
          {
           if (newoutdeg[i]! =-1)
             layernew[i] =laycount;

             nodes[i].layer=layernew[i];
             loutdeg[i] =-1;
             newoutdeg[i] =-1;

           for (q=0; q<NODES q++)
            {
              layer[q] [i] =-1;
              layer[i][q]=-1;
            }
           }
        }
  }
```

The method - Inlayering () implements the inlayering approach, this method uses the indegree of the vertices to layer the graph. The indegrees of all the vertices are computed and the vertices with indegree zero are assigned to the bottom layer L_1 and these vertices are removed from the list. The indegrees of the remaining unlayered vertices are computed again and the vertices with indegree 0 are assigned to next higher layer i.e. L_2. This process is followed till all the vertices are assigned to layers. After this the layers are reversed making the layer L_1 as layer L_n, layer L_2 as layer L_{n-1} and so on, this is done because we want the same order of layers for the algorithms.

The following piece of code shows the process of Inlayering.

```
for (i=0;i<NODESi++)
            {if(lindeg[i]==0)
              {
                if(newindeg[i]!=-1)
                   {Inlayernew[i] =inlaycount ;}
                   nodes[i].inlayer=inlayernew[i];
                    lindeg[i] =-1;
                  newindeg[i] =-1;
             for(q=0; q<NODES;q++)
                 {
                  inlayer[i][q] =-1;
                  inlayer[q][i] =-1;
                 }
               }

}
```

5.4 Dummy vertices

In order to make the layering proper we insert the dummy vertices along the edges spanning more than one layer by replacing these edges with a path of dummy vertices e.g. If an edge (u, v) spans more than one layer then we replace it with dummy vertices d_1, d_2....d_k. The method dummyvertices () introduces the dummy vertices. Edges of each vertex are scanned to see if they span more then layer. If the length of the edge spans more than one layer, a dummy vertex is introduced at each layer which fall in between the vertices that are connected by that edge. The number of layers that are spanned by the edge are calculated and then equal numbers of dummy vertices are introduced into the graph.

After the dummy node is introduced, all its properties are initialized and the links of the nodes are changed so that a path of dummy vertices is formed along the edge that spans more than one layer.

The following piece of code shows the process of introducing dummy vertices.

```
for (i=0;i<NODES;i++)
{ ncount=0;
    for (j=0;j<NODES;j++)
            {   k=0;
                If (Inodes[i].next[j]! =-1)
                k=Inodes [Inodes[i].next[j]].inlayer-Inodes[i].inlayer;

            If (k>1)
             {
                for (p=1; p<k; p++)
                 {
                   Node n1 = new Node ();
                   ncount=Inodes[i].x+NODES
                  n1.x =ncount;
                  n1.y = ncount+NODES
                  n1.lbl= NumberofNodes+Indcount;
                  Indcount++;
                  n1.inlayer= Inodes [Inodes[i].next[j]].inlayer-p;
                  Inodes [n1.lbl] =n1;
                   for (t=0; t<NODESt++)
                         {Inodes [n1.lbl].next[t] =-1 ;}
                    Inodes [n1.lbl].next [0] =Inodes[i].next[j];
                   Inodes[i].next[j] =n1.lbl;

             }
           }
        }
    }
```

5.5 Sorting Method

5.5.1 Adjacent Exchange Method

The Adjacent exchange algorithm exchanges the vertices based on their crossing numbers. The Adjacent exchange algorithm is similar to the bubble sort algorithm.

After calculating the crossing number in a layer, the crossing number of each vertex u is compared with crossing number of the vertex v which is next to it in that layer, if the crossing number of u is greater than that of v then u is shifted to the right of v.

The function AdjacentExchange () computes the crossing numbers for each layer by comparing the x-coordinates of the adjacent vertices and then the method ArrangeNodes () exchanges the vertices based on their crossing numbers. The vertices are exchanged so that the vertex with a higher crossing number is to the right of the vertex with a lower crossing number.

The following piece of code shows the process of exchanging adjacent vertices.

```
public void arrangelnodes (int incrnumber [][],int l,int lcrcount)
{int i, j, k, temp;
 double tempxcoor;
 for (i=0;i<NODESi++)
        for (j=0;j<NODES;j++)
        {if (j>i)
         {if (incrnumber[i][j]>incrnumber[j][i])
           {if (crlaymatrix[l][j]!=-1 && crlaymatrix[l][i]!=-1)
                  {
                          lcrcount= lcrcount-(incrnumber[i][j]-incrnumber[j][i]);
                  temp=crlaymatrix[l][j];
                  tempxcoor=lnodes[crlaymatrix[l][j]].x;
                   lnodes[crlaymatrix[l][j]].x=lnodes[crlaymatrix[l][i]].x;
             crlaymatrix[l][j]=crlaymatrix[l][i];
                  lnodes[crlaymatrix[l][i]].x=tempxcoor;
             crlaymatrix[l] [i]=temp;
                  }

           }
        }

  }
 tcrcount=lcrcount;
}
```

5.6 Methods for implementing Barry Center and Median Methods.

5.6.1 Barry Center Method.

In Barry Center method the CrossingBarrycenter () computes the x-coordinates of each vertex in layer L_i as the average of the x-coordinates of its adjacent vertices in layer i-1. Then vertices in each layer are passed as an array to the barrysort (int [ ] averages, int [ ] avgsortarr, int row) method which sorts the vertices and arranges them in the increasing order of their coordinates.

To compute the values of the x-coordinates of vertices the formula used is

Avg (u) = 1/outdeg (u) $\sum_{V \in Nu} x_1(v)$,

5.6.2 Median Method.

In the Median Method the median of the x-coordinates of the adjacent vertices of each vertex belonging to layer L_i where i=2,3...n is computed and that value is assigned as the x coordinate of that vertex.

In the CrossingMedian ( ) method the x-coordinates of the adjacent vertices of a vertex u are put into an array. That array is passed to the mediansort method for sorting in ascending order and the median of the x-coordinates in that array is computed and is assigned as the x-coordinate of the vertex u.

After the x-coordinates for all the vertices are computed, the vertices in the layers are arranged in the increasing order of their x-coordinates.

The implementation for the median method is given in the project code provided in the appendix.

6 Data Analysis.

6.1 Data Collected.

The main aim of the data analysis is to compare the performance of outlayering and inlayering, and to find which heuristic among three has a better performance in terms of crossing numbers and execution time.

For the purpose of data analysis graphs with **25, 50,100,150 and 200** nodes were used. For each graph size edge densities **0.10, 0.25, 0.50, 0.75 and 0.9** were used to generate the graphs required as input for the algorithms. However for graphs with sizes of 150 nodes data could not be collected at 0.75 and 0.9 densities and for graphs with 200 nodes data was collected only at 0.1 and 0.25 densities,` because of the large number of dummy vertices being generated. The data collected is the average of data from **50** graphs of each size and density. The 50 graphs were generated randomly for a particular size and density.

The data collected consists of the crossing numbers obtained after layering the graphs using the different layout algorithms and the execution time of each algorithm. The number of layers and dummy vertices introduced are also included.

The data in the table consists of edge density labeled as Density ,number of layers labeled as Layers, number of dummy vertices labeled as Dummy vertices, Crossing numbers obtained by the three algorithms labeled as AdjEx crno for Adjacent Exchange, Barry crno for Barry Center, Median crno for Median method respectively. The execution time required by each algorithm is given under the labels AdjEx Time for Adjacent Exchange, BarryEx Time for Barry Center and MedianEx time for Median method.

Execution time in the tables below is in MilliSeconds.

Crossing Numbers and Execution Time

Density	Layers	Dummy vertices	AdjEx Crno	Barry Crno	Median Crno	AdjEx Ex Time	Barry Ex Time	Median Ex Time
0.90	23.00	1878.80	121.24	121.24	121.24	1.00	1.00	2.00
0.75	19.78	1321.30	301.46	301.46	301.46	1.56	0.00	0.32
0.50	15.14	670.00	329.00	329.00	329.00	0.00	1.22	0.00
0.25	9.36	205.52	223.34	223.34	223.34	1.54	1.86	0.32
0.10	5.28	29.90	102.1	102.08	102.08	3.16	0.96	1.60

Table 6.1 Number of Nodes = 25 Inlayering

Crossing Numbers and Execution Time

Density	Layers	Dummy vertices	AdjEx Crno	Barry Crno	Median Crno	AdjEx Ex Time	Barry Ex Time	Median Ex Time
0.90	23.00	1878.96	149.44	149.44	149.44	2.22	0.60	0.90
0.75	19.78	1317.68	273.06	273.04	273.02	0.64	0.62	0.30
0.50	15.14	665.76	274.66	274.28	274.3	1.26	0.32	0.96
0.25	9.36	192.00	179.00	179.00	180.00	1.24	1.22	0.62
0.10	5.28	22.58	51.38	50.78	51.24	1.86	0.94	0.94

Table 6.2 Number of Nodes = 25 Outlayering

Crossing Numbers and Execution Time

Density	Layers	Dummy vertices	AdjEx Crno	Barry Crno	Median Crno	AdjEx Ex Time	Barry Ex Time	Median Ex Time
0.90	44.92	15711.90	1884.00	1884.00	1884.00	7.00	8.00	6.00
0.75	39.08	11289.88	2314.90	2314.96	2314.96	9.62	5.36	5.02
0.50	29.06	5728.84	2777.00	2777.00	2777.00	12.80	4.00	7.00
0.25	18.22	1849.42	1809.50	1809.54	1809.54	13.16	9.64	3.42
0.10	9.56	325.80	924.98	925.00	925.00	22.82	11.88	10.60

Table 6.3 Number of Nodes = 50 Inlayering

Crossing Numbers and Execution Time

Density	Layers	Dummy vertices	AdjEx Crno	Barry Crno	Median Crno	AdjEx Ex Time	Barry Ex Time	Median Ex Time
0.90	44.92	15713.34	1714.00	1714.08	1714.08	7.50	3.74	6.32
0.75	39.08	11286.70	2352.50	2352.76	2352.54	8.44	4.30	5.92
0.50	29.06	5702.52	2699.60	2699.28	2698.64	8.42	6.84	4.74
0.25	18.22	1774.22	1522.00	1514.58	1521.74	13.36	4.06	8.84
0.10	9.56	273.72	534.02	526.44	542.54	14.36	8.46	6.28

Table 6.4 Number of Nodes =50 out layering

Crossing Numbers and Execution Time

Density	Layers	Dummy vertices	AdjEx Crno	Barry Crno	Median Crno	AdjEx Ex Time	Barry Ex Time	Median Ex Time
0.90	90.98	132196.80	12952.00	12952.00	12952.00	75.00	33.00	37.00
0.75	78.48	94866.12	21813.00	21813.00	21813.00	73.00	36.00	40.00
0.50	58.16	48478.00	22846.00	22845.00	22846.00	81.54	39.48	42.50
0.25	34.72	14959.00	15225.00	15225.00	15225.00	102.00	49.00	50.10
0.10	17.52	2953.00	7363.00	7363.00	7363.00	162.00	70.96	74.70

Table 6.5 Number of Nodes =100 Inlayering

Crossing Numbers and Execution Time

Density	Layers	Dummy vertices	AdjEx Crno	Barry Crno	Median Crno	AdjEx Ex Time	Barry Ex Time	Median Ex Time
0.90	90.98	132198.00	12268.00	12268.00	12268.00	56.84	35.68	33.72
0.75	78.48	94873.70	20298.00	20299.00	20298.00	64.70	44.28	38.52
0.50	58.16	48409.40	23453.00	23446.00	23452.00	76.32	41.58	39.94
0.25	34.72	14858.90	13616.00	13575.00	13616.00	89.60	47.80	48.46
0.10	17.52	2796.20	5766.10	5630.50	5770.90	133.78	66.58	66.56

Table 6.6 Number of Nodes =100 outlayering

Crossing Numbers and Execution Time

Density	Layers	Dummy vertices	AdjEx Crno	Barry Crno	Median Crno	AdjEx Ex Time	Barry Ex Time	Median Ex Time
0.50	86.00	159631.30	74350.00	74350.00	74350.00	275.30	151.34	170.70
0.25	52.04	51747.52	47903.00	47903.00	47903.00	326.94	164.32	174.12
0.10	26.40	10437.36	22558.00	22558.00	22558.00	509.38	240.96	252.78

Table 6.7 Number of Nodes =150 Inlayering

Crossing Numbers and Execution Time

Density	Layers	Dummy vertices	AdjEx Crno	Barry Crno	Median Crno	AdjEx Ex Time	Barry Ex Time	Median Ex Time
0.50	86.00	159652.00	72383.00	72379.00	72384.00	296.28	158.02	142.26
0.25	52.04	51436.56	46842.00	46778.00	46843.00	303.00	172.82	166.26
0.10	25.00	9527.00	9276.00	9206.00	9226.00	476.00	243.00	253.00

Table 6.8 Number of Nodes =150 outlayering

Crossing Numbers and Execution Time

Density	Layers	Dummy vertices	AdjEx Crno	Barry Crno	Median Crno	AdjEx Ex Time	Barry Ex Time	Median Ex Time
0.25	69.00	122553.00	114443.00	114443.00	114443.00	761.00	400.00	412.00
0.10	34.62	24824.16	51742.00	51742.90	51742.00	1153.62	578.20	579.70

Table 6.9 Number of Nodes =200 Inlayering

Crossing Numbers and Execution Time

Density	Layers	Dummy vertices	AdjEx Crno	Barry Crno	Median Crno	AdjEx Ex Time	Barry Ex Time	Median Ex Time
0.25	68.30	121259.00	112773.00	112624.00	112768.00	798.66	402.18	587.56
0.10	34.62	24275.24	43342.92	42865.12	43339.86	1059.06	568.06	550.32

Table 6.10 Number of Nodes =200 out layering

6.2 Analysis of Data.

6.2.1 Comparison between Inlayering approach and Outlayering approach.

By examining the data for different graph sizes and densities, it appears that outlayering gives a lower crossing number and has a lower execution time when compared to inlayering. The difference is very substantial at lower densities. For example at 0.1 density the crossing number obtained from outlayering is almost half of the crossing number obtained from inlayering, at 0.25 density outlayering has 10- 20 % smaller crossing number than inlayering. At higher densities starting from 0.5 the difference is small and in few cases inlayering performs better than outlayering. Altogether in 90% of the cases outlayering gives a lower crossing number than inlayering.

In terms of execution time outlayering has a lower execution time than inlayering for all sizes and densities of graphs. We suspect that this due the difference in the number of dummy vertices as there are more dummy vertices at lower densities for inlayering than for outlayering.

6.2.2 Change in number of dummy vertices with density of graph.

After examining the data for all graph sizes and densities for both inlayering and outlayering approaches, it has been observed that there is an increase in the number of dummy vertices as the density of the graph increases. The percent of increase is larger for smaller densities. The pattern is given in the table below.

Change in Density	Approximate Increase in number of dummy vertices
0.1 - 0.25	6 – 7 times
0.25 – 0.5	3 times
0.5 – 0.75	2 times
0.75 – 0.9	40 %

Table 6.11. Approximate increase in number of dummy vertices with change in edge density.

An interesting trend has been observed. If we take the number of nodes at 0.25 as a benchmark then the numbers of dummy vertices at 0.5 are 3 times the number of dummies at 0.25, 6 times at 0.75 and 9 times at 0.9.

6.2.3 Relationship between number of dummy vertices and crossing number.

A pattern has been observed in the change of crossing number with increasing number of dummy vertices. The following table gives the relationship number of dummy vertices and crossing number.

Density	Approximate crossing number
0.1	3 times greater than number dummy vertices
0.25	10% greater than number dummy vertices
0.5	Half of the number of dummy vertices
0.75	4 times less than the number of dummy vertices
0.9	7-14% of the number of dummy vertices

Table 6.12: Approximation of crossing number in terms of dummy vertices.

6.2.4 Relationship between number of layers and density.

An investigation of a possible relationship between number of layers and density revealed a trend exists in the number of layers and the density. The observations are summarized in the following table. This provided an approximation of the number of layers in terms of the number of vertices and density.

Density	Number of layers
0.1	90 % of number of nodes
0.25	80 % of number of nodes
0.5	60 % of number of nodes
0.75	35 % of number of nodes
0.9	20 % of number of nodes

Table 6.13: Relation between edge density and the number of layers

6.3 Comparison of the three different crossing reduction algorithms:

6.3.1 Crossing Number:

All the three algorithms give approximately the same crossing number. For big graphs with more than 100 nodes there is a 2-3% difference in the crossing number which is negligible. After going through the entire crossing number data, the pattern we found was that the crossing number increases with density up to 0.5 then it gradually decreases. The reason for this might be the sizeable reduction in the number of nodes per layer at higher densities.

6.3.2 Execution Time:

In terms of execution time Barrycenter and Median methods perform better than Adjacent Exchange algorithm. Adjacent Exchange algorithm takes 1- 3 times more time than the other two methods. Barrycenter and Median methods take approximately the same time.

One special trend was observed in execution time, the execution time was greater for graphs with low density than for graphs with high density. We believe that the reason for this is the size of the crossing number matrices generated for each layer; at lower densities the number of actual vertices (excluding dummies) in each layer is high and therefore the size of the crossing number matrix generated is large and time taken for comparisons is high. Whereas for high density graphs the crossing number matrix is small as the number of non dummy vertices in each layer is very small.

6.4 Reduction in Crossing Number with increasing number of layers.

The results in section 6.3.1 suggest that reducing the number of vertices in a layer may reduce the crossing number. We increased the layers above the minimum thereby reducing the number of vertices in each layer and then ran the crossing reduction algorithms on the graphs. Each graph was split into layers based on the number of nodes per layer; the new layer is inserted between it and its succeeding layer. A layer was split if it had more than a particular number of nodes. For this investigation the layers were split if they had more than 2, 3, 4 nodes respectively resulting in the three differently layered graphs.

The data collected in the following table is generated by Graphs with 25 and 100 nodes run at different densities. 50 graphs were generated in each case.

Layers	Dummies	Number of Nodes per layer	Adjacent CrNo	Barry CrNo	Median CrNo
9.44	270.92	Out layering	393.82	382.34	388.82
17.06	619.22	2	113.46	115.10	115.42
16.04	587.58	3	137.76	136.32	134.68
14.80	535.24	4	174.34	172.34	172.22

Table 6.14 NUMBER OF NODES = 50 DENSITY =0.1

Layers	Dummies	Number of Nodes per layer	Adjacent CrNo	Barry CrNo	Median CrNo
18.24	1794.52	Out layering	651.00	637.32	635.66
27.88	3005.08	2	230.90	229.86	229.68
22.80	2382.84	3	428.08	425.48	425.80
20.00	2020.36	4	562.08	550.52	550.00

Table 6.15 NUMBER OF NODES = 50 DENSITY =0.25

Layers	Dummies	Number of Nodes per layer	Adjacent CrNo	Barry CrNo	Median CrNo
29.64	5789.86	Out layering	618.76	604.44	596.82
33.72	6704.90	2	407.00	401.06	402.14
30.04	5883.18	3	605.12	592.32	586.76
29.66	5793.46	4	614.66	599.98	591.98

Table 6.16 NUMBER OF NODES = 50 DENSITY =0.5

Layers	Dummies	Number of Nodes per layer	Adjacent CrNo	Barry CrNo	Median CrNo
17.82	2778.84	Out layering	2925.64	2896.06	2891.48
33.42	5836.48	2	550.14	550.56	548.30
31.68	5576.80	3	753.60	743.98	742.86
29.12	5110.74	4	1085.00	1078.90	1080.30

Table 6.16 NUMBER OF NODES = 100 DENSITY =0.1

Layers	Dummies	Number of Nodes per layer	Adjacent CrNo	Barry CrNo	Median CrNo
34.48	14722.12	Out layering	4834.36	4778.24	4770.68
54.82	24446.74	2	1336.9	1332.24	1330.8
44.4	19469.1	3	2778.12	2762.72	2746.2
38.18	16485.36	4	4056.22	4020.24	4015.36

Table 6.17 NUMBER OF NODES = 100 DENSITY =0.25

6.4.1 Analysis:

The tables for the split layering show that there is a considerable change in crossing number with increasing number of layers. The crossing number is reduced by a factor of 2-4 for small densities, but this reduction decreases as the density approaches 0.5. For high density graphs the decrease in crossing number is less with increase in number of layers. Also it is difficult to increase the number of layers for high density graphs since there are very few number of nodes per layer.

7. Conclusion

After a detailed analysis of inlayering and outlayering, it was found that the latter had a better performance in 90% of the cases. It was observed that the outlayering performed better than inlayering at lower edge densities, but as the density of the graphs Increased it was found that both layering methods had similar performance and in some cases inlayering performed better than outlayering.

We also found some interesting patterns. The crossing number increases with density up to 0.5 then it gradually decreases, the reason for this seems to be fewer numbers of nodes per layer at higher densities. The second pattern we found was that the execution time was greater for graphs with low density than for graphs with high density

There is a little difference between the three algorithms in minimizing the crossing number. However, the barrycenter and median methods have a better performance in terms of execution time. Hence we suggest using barrycenter and median methods for reducing crossings in graphs.

Finally we found that by adding layers by splitting existing layers can greatly reduce the crossing number for graphs with low densities.

Thus after a detailed analysis of the two layering approaches and three crossing reduction methods, we were able to come to a conclusion that Outlayering approach for layering, barrycenter and median methods for crossing reduction are the best methods.

8. References.

[1]. G. Di Battista, P. Eades, R. Tamassia, I.G. Tollis, *Graph Drawing: Algorithms for the Visualization of Graphs*, Prentice-Hall, Englewood Cliffs, NJ, 1999.

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Data Visualization through graph drawing
Computational Statistics 16 (2001) 3, pp 435-450

APPENDIX B

25 Nodes 0-19 relaying

Layers	Dummies	AdjEX crno	Barry Crno	Median Crno	Adj exec	Barry exec	Median exec
4	21	147	147	147	16	0	0
6	37	144	144	144	0	0	16
5	11	72	72	72	15	0	0
4	13	94	94	94	0	0	0
4	8	100	100	100	0	0	0
4	21	108	108	108	0	0	0
4	15	66	66	66	0	0	0
5	40	139	139	139	0	16	0
7	31	73	73	73	0	0	0
7	64	104	104	104	0	0	0
4	18	108	108	108	0	0	0
6	21	57	57	57	0	0	0
4	7	143	143	143	0	0	0
5	42	125	125	125	0	0	0
7	45	62	62	62	15	0	0
4	10	63	63	63	16	0	0
5	21	111	111	111	0	0	0
7	37	43	43	43	0	0	0
4	18	123	123	123	0	0	0
6	22	112	112	112	0	0	0
5	26	60	60	60	0	0	16
5	22	60	60	60	0	0	0
5	21	92	92	92	0	0	0
7	55	89	89	89	0	0	0
6	36	61	61	61	16	0	0
5	31	73	73	73	0	0	0
4	22	144	144	144	0	0	0
4	14	116	116	116	0	16	0
5	35	80	80	80	0	0	0
8	61	106	106	106	0	0	0
4	15	144	144	144	16	0	0
4	3	39	39	39	0	0	0
4	25	134	134	134	0	0	0
8	52	65	65	65	16	0	0
8	54	64	64	64	0	0	0
4	12	79	79	79	0	0	0
5	29	185	185	185	16	0	0
5	30	148	148	148	0	0	0
8	55	66	66	66	0	0	0
8	80	102	102	102	0	16	0
7	69	92	92	92	0	0	0
4	19	94	94	94	0	0	0
5	23	68	68	68	0	0	16
4	16	119	119	119	16	0	0
5	24	94	94	94	0	0	0
4	23	125	125	125	0	0	16
5	39	180	180	180	0	0	0
6	41	161	161	161	0	0	0
5	30	137	137	137	0	0	16
5	32	133	133	133	16	0	0
5.28	29.92	102.08	102.08	102.08	3.16	0.96	1.6

85 nodes 0-1 on Layering

Layers	Dummies	AdjEX crno	Barry Crno	Median Crno	Adj exec	Barry exec	Median exec
4	19	59	59	59	0	0	16
6	43	54	54	54	0	0	0
5	11	21	19	21	0	0	0
4	8	64	60	60	0	16	0
4	12	39	30	37	0	0	0
4	7	47	50	49	0	0	0
4	10	40	45	39	0	0	0
5	27	76	75	84	0	0	0
7	29	42	42	41	0	0	0
7	45	51	56	54	0	0	0
4	14	66	78	69	15	0	0
6	11	28	28	29	16	0	0
4	6	60	64	62	0	0	16
5	18	45	48	48	16	0	0
7	40	13	14	16	0	0	0
4	2	14	13	13	0	0	0
5	28	44	37	37	0	0	0
7	32	17	17	16	0	0	0
4	13	55	61	56	0	16	0
6	28	40	40	40	15	0	0
5	12	40	39	39	0	0	0
5	17	43	41	40	0	0	0
5	17	46	46	43	0	0	0
7	33	25	25	25	0	0	0
6	15	26	26	26	0	0	0
5	35	148	143	153	0	0	0
4	12	87	84	80	0	0	0
4	10	96	86	96	0	0	0
5	21	29	29	29	0	0	0
8	50	29	29	34	0	0	0
4	18	54	48	60	0	0	0
4	2	8	8	8	15	0	0
4	16	107	105	95	0	0	0
8	49	23	22	22	0	0	0
8	37	44	44	49	16	0	0
4	11	34	34	33	0	0	0
5	22	42	38	42	0	0	0
5	31	56	50	53	0	0	0
8	38	44	42	40	0	0	0
8	58	67	70	62	0	0	0
7	39	45	43	43	0	0	0
4	10	54	58	52	0	0	15
5	17	37	37	37	0	0	0
4	20	51	51	51	0	0	0
5	21	61	61	66	0	0	0
4	26	164	153	164	0	0	0
5	30	31	36	35	0	0	0
6	26	47	47	47	0	15	0
5	11	64	63	63	0	0	0
5	22	92	91	91	0	0	0
5.28	22.58	51.38	50.78	51.24	1.86	0.94	0.94

25 nodes 0.25 [illegible]

Layers	Dummies	AdjEX crno	Barry Crno	Median Crno	Adj exec	Barry exec	Median exec
9	141	203	203	203	0	0	16
10	254	300	300	300	0	0	0
9	158	125	125	125	0	0	0
10	295	215	215	215	0	16	0
11	297	221	221	221	16	0	0
10	177	167	167	167	0	0	0
12	234	53	53	53	0	0	0
7	145	272	272	272	0	0	0
9	179	215	215	215	0	0	0
11	297	158	158	158	0	0	0
8	185	130	130	130	0	0	0
9	184	211	211	211	15	0	0
10	226	129	129	129	0	0	0
10	272	309	309	309	0	0	0
8	204	357	357	357	0	0	0
9	143	193	193	193	0	15	0
9	174	207	207	207	0	0	0
9	242	263	263	263	0	0	0
10	314	272	272	272	0	0	0
8	102	263	263	263	0	0	0
8	164	222	222	222	0	0	0
8	104	163	163	163	0	16	0
13	345	215	215	215	0	0	0
8	178	350	350	350	0	0	0
7	119	318	318	318	0	0	0
7	114	229	229	229	0	0	0
8	166	168	168	168	15	0	0
10	274	194	194	194	0	0	0
9	140	96	96	96	0	0	0
10	247	215	215	215	0	0	0
10	235	231	231	231	0	0	0
10	257	156	156	156	0	0	0
13	357	205	205	205	0	0	0
11	254	267	267	267	0	0	0
10	191	143	143	143	15	0	0
9	244	190	190	190	0	0	0
8	154	244	244	244	0	15	0
8	181	492	492	492	0	0	0
10	173	100	100	100	0	0	0
9	208	197	197	197	0	0	0
10	209	320	320	320	0	0	0
11	243	312	312	312	0	16	0
7	127	378	378	378	0	0	0
11	317	217	217	217	0	15	0
8	186	179	179	179	0	0	0
9	161	139	139	139	0	0	0
9	147	159	159	159	16	0	0
10	219	345	345	345	0	0	0
10	182	257	257	257	0	0	0
9	157	203	203	203	0	0	0
9.36	205.52	223.34	223.34	223.34	1.54	1.86	0.32

25 Nodes 0.25 outlayering.

Layers	Dummies	AdjEX crno	Barry Crno	Median Crno	Adj exec	Barry exec	Median exec
9	155	158	136	138	0	0	0
10	177	197	197	197	0	0	0
9	185	153	157	156	0	0	0
10	219	108	104	108	0	0	0
11	319	218	218	218	0	0	0
10	221	138	138	138	0	0	0
12	251	156	156	152	0	0	0
7	92	196	190	209	0	0	0
9	191	146	139	137	0	0	0
11	217	256	247	242	16	0	0
8	154	114	123	114	0	0	0
9	162	138	136	138	0	0	0
10	160	101	115	104	0	0	0
10	176	281	281	290	0	15	0
8	159	175	175	166	0	0	0
9	147	81	68	82	0	0	0
9	182	149	151	151	0	0	0
9	215	489	489	526	0	0	15
10	240	167	167	167	0	0	0
8	161	244	244	244	0	0	16
8	165	295	294	295	0	0	0
8	94	206	214	216	0	0	0
13	297	102	101	101	15	0	0
8	124	204	202	204	0	0	0
7	126	108	108	108	0	15	0
7	134	249	230	248	0	0	0
8	137	101	97	96	0	0	0
10	273	192	192	192	0	0	0
9	130	61	65	65	0	15	0
10	231	218	219	219	0	0	0
10	230	212	215	212	0	0	0
10	179	162	161	162	0	0	0
13	345	105	106	108	0	0	0
11	272	166	166	166	0	0	0
10	190	170	172	169	0	0	0
9	212	278	277	278	16	0	0
8	152	190	197	190	0	0	0
8	213	305	297	304	15	0	0
10	217	110	110	109	0	0	0
9	215	231	231	231	0	0	0
10	215	241	247	241	0	0	0
11	233	88	104	104	0	0	0
7	135	280	273	277	0	16	0
11	288	166	166	166	0	0	0
8	185	220	220	220	0	0	0
9	165	95	95	95	0	0	0
9	112	104	104	105	0	0	0
10	236	117	117	117	0	0	0
10	182	162	153	153	0	0	0
9	151	160	165	166	0	0	0
9.36	192.42	179.26	178.58	179.88	1.24	1.22	0.62

25 nodes 0.5 Gnlayering

Layers	Dummies	AdjEX crno	Barry Crno	Median Crno	Adj exec	Barry exec	Median exec
16	701	103	103	103	0	0	0
15	623	493	493	493	0	0	0
18	791	223	223	223	0	0	0
13	583	422	422	422	0	0	0
16	835	253	253	253	0	0	0
13	454	762	762	762	0	0	0
15	955	463	463	463	0	0	0
19	862	81	81	81	0	0	0
14	543	383	383	383	0	0	0
14	623	343	343	343	0	0	0
13	635	413	413	413	0	0	0
15	645	198	198	198	0	0	0
16	784	212	212	212	0	0	0
14	636	484	484	484	0	0	0
16	736	330	330	330	0	16	0
18	869	282	282	282	0	0	0
14	569	365	365	365	0	0	0
16	627	306	306	306	0	0	0
14	647	305	305	305	0	0	0
17	770	22	22	22	0	15	0
16	674	327	327	327	0	0	0
16	643	302	302	302	0	0	0
18	707	242	242	242	0	0	0
16	748	563	563	563	0	0	0
14	558	434	434	434	0	15	0
13	556	485	485	485	0	0	0
18	840	196	196	196	0	0	0
11	475	480	480	480	0	0	0
15	741	374	374	374	0	0	0
15	665	310	310	310	0	0	0
16	699	126	126	126	0	0	0
19	896	221	221	221	0	0	0
17	910	105	105	105	0	0	0
18	795	170	170	170	0	0	0
15	717	309	309	309	0	0	0
15	700	417	417	417	0	0	0
16	715	503	503	503	0	0	0
14	542	616	616	616	0	0	0
13	447	567	567	567	0	0	0
12	566	293	293	293	0	0	0
16	793	253	253	253	0	0	0
11	444	707	707	707	0	15	0
12	465	267	267	267	0	0	0
16	710	269	269	269	0	0	0
16	636	194	194	194	0	0	0
13	592	466	466	466	0	0	0
18	760	125	125	125	0	0	0
15	592	115	115	115	0	0	0
14	553	253	253	253	0	0	0
13	453	328	328	328	0	0	0
15.14	669.6	329.2	329.2	329.2	0	1.22	0

25 Nodes OS ordlayering

Layers	Dummies	AdjEX crno	Barry Crno	Median Crno	Adj exec	Barry exec	Median exec
16	701	114	114	117	16	0	0
15	624	446	446	446	0	0	0
18	789	61	61	61	0	0	0
13	548	446	446	446	0	0	0
16	836	265	264	265	0	0	0
13	448	227	225	225	0	0	0
15	975	580	580	580	0	0	0
19	852	27	27	27	0	0	0
14	551	403	403	403	0	0	0
14	595	110	110	110	0	0	0
13	588	450	450	450	0	0	0
15	648	77	77	77	0	0	16
16	782	636	636	636	15	0	0
14	634	390	390	390	0	0	0
16	745	243	243	243	0	0	0
18	860	215	215	215	0	0	0
14	584	448	446	448	0	0	0
16	644	173	173	174	0	0	0
14	627	306	306	306	0	0	0
17	778	197	197	197	0	0	0
16	677	296	296	296	0	0	0
16	626	215	209	215	0	0	0
18	726	94	94	94	0	16	0
16	690	411	411	411	0	0	0
14	591	158	157	157	0	0	0
13	519	163	160	160	0	0	0
18	818	191	191	191	0	0	0
11	487	532	529	529	0	0	0
15	762	170	170	170	0	0	0
15	672	334	331	333	0	0	0
16	695	240	240	239	0	0	0
19	834	204	204	204	16	0	0
17	896	210	210	210	0	0	0
18	852	120	118	118	0	0	0
15	723	235	234	234	0	0	0
15	720	481	481	481	0	0	0
16	724	415	415	410	0	0	16
14	597	202	202	202	0	0	0
13	413	369	371	371	0	0	0
12	577	333	333	333	16	0	0
16	703	229	229	230	0	0	0
11	447	270	271	270	0	0	0
12	466	446	444	446	0	0	0
16	682	236	236	236	0	0	0
16	654	181	180	181	0	0	16
13	497	396	406	396	0	0	0
18	765	49	49	49	0	0	0
15	604	261	262	261	0	0	0
14	561	170	170	170	0	0	0
13	501	308	302	302	0	0	0
15.14	665.76	274.66	274.28	274.3	1.26	0.32	0.96

3 0.75 Inlayering

Layers	Dummies	AdjEX crno	Barry Crno	Median Crno	Adj exec	Barry exec	Median exec
19	1294	453	453	453	0	0	0
18	1092	449	449	449	0	0	0
19	1396	638	638	638	0	0	16
21	1459	289	289	289	0	0	0
21	1424	288	288	288	0	0	0
19	1268	329	329	329	0	0	0
20	1442	191	191	191	15	0	0
20	1397	444	444	444	0	0	0
22	1405	190	190	190	0	0	0
19	1334	446	446	446	0	0	0
21	1408	9	9	9	0	0	0
21	1444	52	52	52	0	0	0
20	1426	319	319	319	0	0	0
20	1258	485	485	485	0	0	0
20	1198	208	208	208	0	0	0
20	1410	351	351	351	0	0	0
21	1279	18	18	18	0	0	0
21	1433	103	103	103	0	0	0
22	1572	391	391	391	0	0	0
22	1469	122	122	122	0	0	0
21	1494	364	364	364	0	0	0
19	1213	215	215	215	0	0	0
19	1195	534	534	534	0	0	0
18	1190	569	569	569	0	0	0
21	1459	355	355	355	16	0	0
19	1222	145	145	145	0	0	0
21	1412	73	73	73	0	0	0
20	1249	96	96	96	16	0	0
19	1305	704	704	704	0	0	0
20	1313	297	297	297	0	0	0
23	1478	32	32	32	0	0	0
19	1307	127	127	127	0	0	0
19	1162	159	159	159	15	0	0
18	1154	614	614	614	0	0	0
22	1584	29	29	29	0	0	0
18	1180	321	321	321	0	0	0
22	1568	198	198	198	0	0	0
18	1277	135	135	135	0	0	0
19	1275	333	333	333	0	0	0
18	1183	219	219	219	0	0	0
18	1167	55	55	55	0	0	0
19	1219	54	54	54	0	0	0
18	1223	509	509	509	0	0	0
19	1185	998	998	998	16	0	0
20	1304	337	337	337	0	0	0
21	1339	51	51	51	0	0	0
23	1638	6	6	6	0	0	0
16	998	511	511	511	0	0	0
20	1375	497	497	497	0	0	0
16	989	761	761	761	0	0	0
19.78	1321.3	301.46	301.46	301.46	1.56	0	0.32

25 nodes 0.75 ontlayering

Layers	Dummies	AdjEX crno	Barry Crno	Median Crno	Adj exec	Barry exec	Median exec
19	1291	189	189	189	0	0	0
18	1096	529	529	529	0	0	0
19	1375	586	586	586	0	0	0
21	1466	48	48	48	0	0	0
21	1394	134	134	134	0	0	0
19	1268	263	263	263	0	0	0
20	1452	46	46	46	16	0	0
20	1390	383	383	383	0	0	0
22	1405	37	37	37	0	0	0
19	1324	241	241	241	0	0	0
21	1405	13	13	13	0	15	0
21	1432	248	248	248	0	0	0
20	1417	328	328	328	0	0	0
20	1255	347	347	347	0	0	0
20	1204	223	223	223	0	0	0
20	1400	90	90	90	0	0	0
21	1269	39	39	39	0	0	0
21	1450	23	23	23	0	0	0
22	1542	29	29	29	0	0	0
22	1473	86	86	86	0	0	0
21	1470	153	153	153	0	0	0
19	1232	254	254	254	0	0	0
19	1189	59	59	59	0	0	0
18	1160	448	448	448	16	0	0
21	1449	101	101	101	0	0	0
19	1222	137	137	137	0	16	0
21	1463	30	30	30	0	0	0
20	1248	213	213	213	0	0	0
19	1283	636	636	636	0	0	0
20	1284	370	370	370	0	0	0
23	1489	28	28	28	0	0	0
19	1299	302	302	302	0	0	0
19	1184	56	56	56	0	0	0
18	1146	573	573	573	0	0	0
22	1584	285	285	285	0	0	0
18	1176	563	563	563	0	0	0
22	1568	196	196	196	0	0	0
18	1255	935	935	935	0	0	0
19	1275	382	382	382	0	0	0
18	1168	434	434	434	0	0	15
18	1146	464	464	464	0	0	0
19	1241	375	373	373	0	0	0
18	1191	840	840	840	0	0	0
19	1186	388	388	388	0	0	0
20	1285	167	167	167	0	0	0
21	1352	276	276	276	0	0	0
23	1652	49	49	49	0	0	0
16	988	234	234	234	0	0	0
20	1385	291	291	291	0	0	0
16	1006	532	533	532	0	0	0
19.78	1317.68	273.06	273.04	273.02	0.64	0.62	0.3

23 Nodes 0.9 Inlayering

Layers	Dummies	AdjEX crno	Barry Crno	Median Crn	Adj exec	Barry exec	Median exec
23	1890	156	156	156	0	0	0
23	1812	197	197	197	0	0	0
24	2007	180	180	180	0	0	16
23	1878	21	21	21	0	0	0
23	2013	3	3	3	0	0	0
22	1753	31	31	31	0	0	0
22	1743	259	259	259	0	15	0
22	1878	55	55	55	0	0	0
24	2008	240	240	240	0	0	0
24	1981	0	0	0	0	0	0
21	1581	231	231	231	0	0	0
23	1870	23	23	23	0	0	0
21	1624	194	194	194	0	0	0
21	1729	31	31	31	0	0	0
24	2030	13	13	13	0	0	16
22	1792	206	206	206	0	0	0
23	1833	42	42	42	0	0	0
22	1612	60	60	60	0	0	0
24	1888	56	56	56	0	0	0
23	1909	9	9	9	0	0	0
23	1912	11	11	11	0	0	0
24	1951	343	343	343	0	0	0
23	1971	0	0	0	0	0	15
23	1858	210	210	210	0	0	0
23	1847	74	74	74	0	0	16
24	1976	3	3	3	0	0	0
23	1893	27	27	27	0	0	0
23	1956	496	496	496	0	0	0
24	1884	14	14	14	0	0	0
22	1734	319	319	319	0	0	0
21	1691	52	52	52	0	0	0
23	1994	19	19	19	16	0	0
25	2073	0	0	0	0	0	0
24	1983	8	8	8	0	0	0
22	1753	459	459	459	0	0	0
25	2097	0	0	0	0	0	16
23	1763	3	3	3	0	0	0
25	2008	0	0	0	0	16	0
22	1780	487	487	487	0	0	0
23	1944	243	243	243	16	0	0
23	1976	356	356	356	0	0	0
23	1910	290	290	290	0	0	0
23	1833	275	275	275	0	0	0
22	1638	30	30	30	0	0	0
23	1902	128	128	128	0	0	0
24	1982	0	0	0	0	0	0
23	1828	15	15	15	0	0	0
23	2017	0	0	0	0	0	16
23	1959	182	182	182	0	16	0
24	1996	11	11	11	0	0	0
23	1878.8	121.24	121.24	121.24	0.64	0.94	1.9

25 nodes 0.9 withlayering

Layers	Dummies	Adjacent Crn	Barry Crno	Median Crno	Adj exec	Barry exec	Median exec
23	1890	12	12	12	16	0	0
23	1826	172	172	172	0	0	15
24	2007	180	180	180	0	0	0
23	1882	407	407	407	0	0	0
23	2013	3	3	3	0	0	0
22	1750	194	194	194	0	0	0
22	1743	59	59	59	0	0	0
22	1878	523	523	523	0	0	0
24	2008	240	240	240	0	0	0
24	2000	0	0	0	0	0	0
21	1581	105	105	105	0	15	0
23	1880	281	281	281	0	0	15
21	1624	181	181	181	0	0	0
21	1724	418	418	418	0	0	0
24	2041	3	3	3	0	0	0
22	1792	272	272	272	16	0	0
23	1833	42	42	42	16	0	0
22	1612	290	290	290	0	0	0
24	1888	7	7	7	0	0	0
23	1909	9	9	9	0	0	0
23	1912	154	154	154	0	0	0
24	1951	19	19	19	0	0	0
23	1957	16	16	16	0	0	0
23	1858	210	210	210	0	0	0
23	1847	74	74	74	0	0	0
24	1976	15	15	15	16	0	0
23	1893	463	463	463	0	0	0
23	1956	496	496	496	0	0	0
24	1876	195	195	195	0	0	0
22	1734	54	54	54	0	0	0
21	1691	710	710	710	0	0	0
23	1994	18	18	18	0	0	0
25	2073	0	0	0	0	0	0
24	1983	8	8	8	0	0	0
22	1753	531	531	531	15	0	0
25	2097	0	0	0	0	0	0
23	1754	14	14	14	0	0	0
25	2008	0	0	0	0	0	0
22	1780	303	303	303	0	0	0
23	1944	24	24	24	0	0	0
23	1950	227	227	227	0	0	0
23	1895	30	30	30	0	0	0
23	1833	22	22	22	16	0	0
22	1638	234	234	234	0	0	15
23	1902	128	128	128	0	15	0
24	1999	0	0	0	0	0	0
23	1828	82	82	82	16	0	0
23	2009	23	23	23	0	0	0
23	1980	13	13	13	0	0	0
24	1996	11	11	11	0	0	0
23	1878.96	149.44	149.44	149.44	2.22	0.6	0.9

50 Nodes 0.1 Inlayering

Layers	Dummies	Adj Crno	Barry Crn(	Median Crn	Adj exec	Barry exec	Median exec
8	279	1111	1111	1111	16	15	16
8	300	1102	1102	1102	16	15	0
9	372	918	918	918	32	0	15
8	242	883	883	883	31	0	16
11	419	637	637	637	15	0	16
11	430	650	650	650	15	16	0
8	204	956	956	956	31	16	15
9	223	875	875	875	31	16	0
9	307	1140	1140	1140	31	16	15
9	256	1056	1056	1056	16	15	16
9	342	1418	1418	1418	32	0	15
8	227	968	968	968	15	16	16
10	438	781	781	781	31	0	16
11	414	982	982	982	16	15	0
12	455	716	716	716	16	0	16
8	200	620	620	620	31	16	0
8	301	1201	1201	1201	31	16	16
9	216	834	834	834	16	15	16
11	364	1067	1067	1067	31	15	0
9	312	905	905	905	31	0	16
10	311	1085	1085	1085	32	15	0
7	223	1284	1284	1284	16	16	15
11	358	787	787	787	16	16	15
8	181	715	715	715	15	16	0
11	371	661	661	661	31	0	16
9	304	1033	1033	1033	16	16	15
9	276	930	930	930	31	16	15
9	185	742	742	742	15	16	16
9	310	628	628	628	31	16	0
13	506	809	809	809	16	15	0
8	198	756	756	756	31	16	15
11	436	753	753	753	16	15	0
11	359	774	774	774	32	0	15
9	221	566	566	566	16	16	0
11	397	893	893	893	15	16	16
10	379	1220	1220	1220	16	15	0
14	755	754	754	754	16	16	15
8	305	1465	1465	1465	31	16	0
9	370	943	943	943	16	15	0
8	236	950	950	950	15	16	15
13	380	538	538	538	31	0	16
10	369	827	827	827	16	16	15
10	446	1036	1036	1036	31	0	16
8	279	1178	1178	1178	31	0	16
9	295	999	999	999	32	15	16
11	349	939	939	939	16	16	0
12	320	719	719	719	15	16	16
8	264	1006	1006	1006	16	15	16
9	418	1414	1414	1414	31	15	16
8	189	1025	1025	1025	15	16	15
9.56	325.82	924.98	924.98	924.98	22.82	11.88	10.6

50 Nodes 0.1 outlayering

Layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median exec
8	235	578	608	588	15	16	0
8	251	534	599	561	16	15	0
9	246	516	516	573	16	16	0
8	177	648	646	684	16	0	16
11	331	393	426	391	0	15	0
11	212	544	493	571	16	16	0
8	143	575	568	587	32	0	15
9	284	645	647	661	16	0	16
9	222	404	402	433	16	16	0
9	255	523	468	523	15	0	16
9	288	784	708	781	15	0	16
8	219	678	600	679	15	16	0
10	236	661	677	735	15	16	0
11	328	506	505	508	16	0	0
12	320	328	313	328	0	16	0
8	178	565	538	561	15	16	0
8	246	486	500	487	0	16	0
9	208	405	427	398	16	15	0
11	400	672	633	662	16	0	15
9	299	492	507	528	15	0	16
10	345	473	459	495	15	0	16
7	156	877	849	865	16	15	16
11	270	265	275	271	16	15	0
8	146	397	382	394	15	16	0
11	307	545	516	546	15	0	16
9	345	597	590	597	16	16	0
9	232	487	496	501	16	16	0
9	173	370	368	368	15	16	0
9	207	772	676	782	15	16	0
13	478	292	275	307	0	16	0
8	183	443	452	446	16	16	0
11	366	473	473	479	15	0	16
11	304	336	332	333	15	0	16
9	146	441	441	434	16	0	15
11	288	374	378	374	15	0	16
10	286	362	361	375	16	0	15
14	625	510	514	506	16	0	16
8	280	640	650	640	15	0	0
9	295	679	628	685	16	0	15
8	208	677	650	668	16	0	16
13	447	370	395	370	0	16	0
10	244	548	540	562	16	15	0
10	408	909	942	924	16	0	0
8	268	898	841	921	15	0	0
9	247	520	522	547	16	15	0
11	292	391	419	391	16	0	16
12	453	335	347	335	15	16	0
8	198	472	469	465	16	15	0
9	221	640	675	638	16	15	0
8	190	671	626	669	16	0	15
9.56	273.72	534.02	526.44	542.54	14.36	8.46	6.28

50 nodes 0.25 Inlayering

Layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median exec
21	2314	1360	1360	1360	16	0	15
16	1709	1768	1768	1768	16	0	16
19	1955	1784	1784	1784	16	15	0
16	1396	1926	1926	1926	15	16	0
14	1219	1879	1879	1879	0	16	0
15	1333	1990	1990	1990	16	15	0
21	2816	2158	2158	2158	16	0	16
15	1410	2039	2039	2039	15	16	0
24	2647	917	917	917	16	0	0
15	1095	1626	1626	1626	16	15	0
15	1405	1823	1823	1823	16	15	0
17	1725	1398	1398	1398	15	16	0
20	2177	1561	1561	1561	16	16	0
16	1570	2045	2045	2045	16	15	0
17	1796	1737	1737	1737	0	15	16
19	1662	1576	1576	1576	0	16	0
19	2164	1804	1804	1804	16	15	0
17	1642	2493	2493	2493	15	16	0
18	2022	1859	1859	1859	16	0	15
17	1493	1792	1792	1792	16	0	0
18	1697	1518	1518	1518	15	0	16
15	1398	1586	1586	1586	16	0	16
21	2014	2763	2763	2763	16	0	15
21	2254	1834	1834	1834	16	15	0
19	2046	1400	1400	1400	0	16	0
24	2597	1628	1628	1628	0	16	0
20	2150	1961	1961	1961	15	0	0
16	1480	1849	1849	1849	0	15	0
19	1920	2384	2384	2384	16	0	0
15	1520	3257	3257	3257	16	16	0
22	2463	1863	1863	1863	15	0	16
16	1627	2135	2135	2135	0	15	0
21	2374	770	770	770	16	0	0
13	1145	2261	2261	2261	32	0	15
17	1295	1006	1006	1006	0	16	0
18	1825	1656	1656	1656	15	16	0
19	2301	2918	2918	2918	16	0	0
17	2104	2590	2590	2590	15	16	0
20	2038	1348	1348	1348	0	16	0
24	2427	965	965	965	0	15	0
18	1865	2707	2707	2707	31	0	0
16	1423	1068	1068	1068	15	16	0
22	2202	1118	1118	1118	16	0	15
17	1848	1674	1674	1674	31	0	0
18	1701	2323	2323	2323	16	15	0
21	2174	1582	1582	1582	15	16	0
19	1765	1392	1392	1392	0	16	0
20	1911	1556	1556	1556	0	15	0
16	1516	2312	2312	2312	16	15	0
18	1841	1518	1518	1518	31	0	0
18.22	1849.42	1809.54	1809.54	1809.54	13.16	9.64	3.42

50 Nodes 0.25 outlayering

Layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median exec
21	2009	984	982	989	16	0	16
16	1667	1326	1290	1319	0	16	0
19	1704	1705	1712	1706	16	0	15
16	1408	1519	1520	1518	16	0	0
14	1171	1173	1151	1166	16	15	0
15	1330	1804	1811	1800	16	0	16
21	2709	1890	1890	1889	15	0	0
15	1363	2389	2371	2389	15	0	16
24	2615	928	941	926	16	0	16
15	1121	1067	1044	1072	16	0	15
15	1482	1385	1391	1385	0	16	0
17	1526	929	914	942	15	0	0
20	2055	1225	1244	1224	16	0	16
16	1500	1930	1887	1930	16	0	15
17	1743	1865	1869	1850	0	16	0
19	1688	1477	1484	1477	15	0	16
19	2020	1559	1554	1561	16	0	15
17	1703	1439	1442	1446	15	0	16
18	1859	997	995	1001	0	16	0
17	1358	1513	1528	1517	16	15	0
18	1749	1881	1885	1881	15	0	0
15	1337	1671	1650	1671	0	16	0
21	2070	1895	1897	1895	16	0	0
21	2127	1031	1032	1031	0	15	0
19	1737	1501	1492	1507	15	0	16
24	2442	1626	1619	1636	16	0	16
20	2060	1651	1648	1653	16	15	0
16	1416	1811	1833	1785	15	0	16
19	2030	1096	1095	1096	15	0	16
15	1629	2149	2141	2153	16	16	0
22	2362	1192	1189	1188	0	15	0
16	1591	922	932	922	15	0	16
21	2106	1369	1352	1369	15	0	16
13	1046	2909	2920	2921	16	0	15
17	1298	834	822	820	15	16	0
18	1679	1570	1559	1574	16	0	0
19	2380	2269	2262	2268	31	0	0
17	1744	2885	2858	2866	15	0	16
20	2023	1505	1503	1509	16	0	16
24	2449	418	418	418	16	0	0
18	1691	2354	2351	2363	15	0	16
16	1393	1579	1582	1566	15	0	16
22	2138	1291	1268	1283	0	16	0
17	1761	1605	1602	1608	16	0	15
18	1487	1277	1254	1277	15	0	16
21	1973	771	769	792	15	0	16
19	1703	1470	1406	1460	16	0	16
20	1724	1460	1417	1466	16	0	0
16	1517	955	906	955	15	0	16
18	2018	2049	2047	2047	15	0	16
18.22	1774.22	1522	1514.58	1521.74	13.36	4.06	8.84

50 Nodes 0.5 Enlayering

Layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median exec
29	5845	4822	4822	4822	16	0	15
28	5865	2760	2760	2760	16	0	15
34	6335	1127	1127	1127	15	16	0
30	5858	2625	2625	2625	16	0	0
31	5845	1374	1374	1374	15	0	16
29	5336	1388	1388	1388	0	0	16
27	5115	3406	3406	3406	16	0	31
26	5139	3241	3241	3241	0	15	0
30	6152	2388	2388	2388	16	0	15
32	6356	2843	2843	2843	16	0	0
25	5403	2413	2413	2413	15	0	0
26	4674	3410	3410	3410	16	0	0
31	5467	2963	2963	2963	15	0	16
31	5798	1820	1820	1820	16	0	16
30	5747	3513	3513	3513	15	16	0
26	5177	1793	1793	1793	15	0	16
23	4732	4885	4885	4885	16	0	15
27	5373	3807	3807	3807	15	0	16
32	6382	2457	2457	2457	47	0	0
30	6237	3449	3449	3449	0	16	0
29	6232	1809	1809	1809	16	0	16
23	4091	3158	3158	3158	15	16	0
30	5424	2007	2007	2007	16	0	0
32	7056	4372	4372	4372	0	16	0
30	6213	2686	2686	2686	16	0	0
28	5110	2006	2006	2006	0	16	0
25	5085	4914	4914	4914	0	16	0
30	5673	2482	2482	2482	16	0	15
32	6507	1659	1659	1659	0	0	16
27	5723	2533	2533	2533	0	16	0
33	6647	1107	1107	1107	15	0	0
27	5352	4126	4126	4126	16	0	15
26	5194	4588	4588	4588	16	0	15
31	6389	1471	1471	1471	16	0	0
27	4537	3526	3526	3526	16	0	0
34	7637	3282	3282	3282	16	0	0
28	5469	2443	2443	2443	0	16	0
26	4481	1958	1958	1958	0	16	0
30	6236	2346	2346	2346	16	0	0
28	5222	3842	3842	3842	16	0	15
25	5158	4992	4992	4992	15	0	0
29	6000	1678	1678	1678	0	15	0
31	6786	2349	2349	2349	16	0	15
30	5853	2402	2402	2402	15	0	0
33	6605	1503	1503	1503	15	0	0
33	5940	2668	2668	2668	15	0	16
29	5957	3685	3685	3685	15	0	0
31	6098	2605	2605	2605	16	0	31
27	5149	2880	2880	2880	15	0	0
32	5782	1293	1293	1293	16	0	15
29.06	5728.84	2777.08	2777.08	2777.08	12.8	3.8	7.12

50 nodes @ .5 out layering

Layers	Dummies	AdjEX crn	Barry crno	Median Cr	Adj exec	barry exec	median exec
29	5849	4396	4396	4396	16	0	15
28	5784	3492	3492	3492	0	15	0
34	6263	833	833	833	0	16	0
30	5893	2042	2042	2042	15	0	0
31	5737	1826	1826	1827	16	0	0
29	5155	1940	1940	1936	16	0	0
27	5029	2120	2119	2120	0	16	0
26	5190	4632	4632	4612	16	0	16
30	6159	1639	1639	1639	15	0	16
32	6261	1663	1663	1664	0	0	16
25	5284	2797	2797	2797	0	16	0
26	4769	4052	4052	4052	0	15	0
31	5492	2167	2160	2164	0	16	0
31	5724	2101	2096	2095	0	16	0
30	5792	2888	2888	2862	0	31	0
26	5028	2989	2986	2987	16	0	16
23	4708	5116	5116	5108	0	15	0
27	5365	3661	3661	3661	15	0	0
32	6424	2177	2177	2177	16	0	15
30	6238	2695	2695	2699	0	15	0
29	6258	2960	2960	2960	16	0	16
23	4092	4227	4213	4230	0	15	0
30	5546	3157	3157	3157	15	0	0
32	7185	1781	1781	1779	16	0	0
30	6090	2942	2936	2939	15	0	0
28	5072	2383	2399	2386	0	16	0
25	5035	2132	2132	2131	0	16	0
30	5653	2845	2845	2845	16	15	0
32	6366	1879	1878	1879	16	0	0
27	5580	3546	3546	3541	15	0	16
33	6709	1376	1376	1376	16	0	0
27	5081	4393	4393	4395	16	0	16
26	5205	2670	2670	2670	15	0	16
31	6291	1205	1205	1205	0	16	0
27	4669	2453	2453	2453	16	0	0
34	7650	2981	2981	2981	15	0	16
28	5462	2888	2877	2888	16	0	16
26	4340	2944	2943	2944	15	0	0
30	6253	3728	3728	3728	0	16	0
28	5150	3055	3055	3055	0	15	0
25	5117	3124	3124	3124	0	15	0
29	5963	2160	2167	2168	0	0	16
31	6804	2833	2833	2833	0	15	0
30	5846	3532	3532	3532	16	0	16
33	6732	2085	2085	2085	15	0	0
33	5942	1813	1813	1813	0	16	0
29	5831	2140	2140	2140	15	0	0
31	6151	2885	2885	2885	16	0	0
27	5199	2227	2227	2227	0	16	0
32	5710	1410	1420	1420	0	0	15
29.06	5702.52	2699.6	2699.28	2698.64	8.42	6.84	4.74

50 nodes 0.75 Sdlayering

Layers	Dummies	AdjEX crno	Barry crno	Median Cr	Adj exec	barry exec	median exec
42	11602	1365	1365	1365	15	0	16
41	11524	1317	1317	1317	0	15	0
42	12250	1961	1961	1961	16	0	0
42	12534	1170	1170	1170	16	0	15
43	12175	1577	1577	1577	16	0	15
39	11556	3203	3203	3203	0	16	0
35	10266	3311	3311	3311	15	0	16
43	12275	1134	1134	1134	0	31	0
36	10016	4048	4048	4048	16	0	15
38	11126	2326	2326	2326	16	0	0
41	11463	848	848	848	0	16	0
37	10901	1339	1339	1339	16	0	16
37	11038	1370	1370	1370	15	0	0
40	11764	1704	1704	1704	15	0	0
37	10645	2560	2560	2560	0	16	0
36	10424	3397	3397	3397	15	0	16
42	12244	1340	1340	1340	15	0	0
38	10276	663	663	663	0	16	0
36	10384	3464	3464	3464	16	0	0
36	11040	2580	2580	2580	0	0	16
34	9698	1517	1517	1517	16	0	0
43	12401	2269	2269	2269	0	16	0
42	11870	1221	1221	1221	0	15	0
44	12617	2070	2070	2070	15	0	0
41	12130	2700	2700	2700	0	16	0
38	11023	3453	3453	3453	0	0	16
39	11479	3275	3275	3275	15	0	16
39	10567	2293	2293	2293	15	0	16
38	10777	4582	4582	4582	15	0	0
38	11357	1413	1413	1413	0	15	0
35	9421	3738	3738	3738	16	0	0
37	10814	1533	1533	1533	16	0	15
38	10776	3708	3708	3708	0	0	16
38	10679	2354	2354	2354	16	0	0
39	11846	2294	2294	2294	15	0	16
39	10841	1656	1656	1656	15	0	16
44	12745	2466	2466	2466	16	0	15
39	11341	2603	2603	2603	16	0	0
43	12767	3375	3375	3375	0	16	0
37	10202	2692	2692	2692	15	0	0
35	10203	3344	3344	3344	0	16	0
42	12572	108	108	108	15	0	0
41	12039	621	621	621	15	0	0
40	11799	3287	3287	3287	16	0	0
42	12158	3391	3391	3391	16	0	0
39	11055	1415	1415	1415	0	16	0
36	10159	3626	3626	3626	0	16	0
38	10601	2678	2678	2678	0	16	0
36	11573	2543	2543	2543	0	16	0
39	11481	2846	2846	2846	16	0	0
39.08	11289.88	2314.96	2314.96	2314.96	9.62	5.36	5.02

50 Nodes 0.75 onlLayering

Layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median exec
42	11602	1857	1857	1857	15	0	16
41	11509	2536	2536	2536	0	0	15
42	12241	2351	2351	2351	15	0	0
42	12554	533	533	533	15	0	0
43	12119	2068	2068	2068	0	16	0
39	11484	981	981	981	16	0	16
35	10317	4591	4604	4591	16	0	0
43	12320	1346	1346	1346	16	0	0
36	10028	3253	3253	3253	0	15	0
38	11136	1368	1368	1368	15	0	0
41	11454	2658	2658	2658	0	0	15
37	11081	613	613	613	16	0	0
37	10982	1319	1319	1319	0	0	15
40	11778	2068	2068	2068	16	0	0
37	10612	3397	3397	3397	16	0	16
36	10372	2398	2398	2398	0	0	16
42	12300	1797	1797	1797	0	15	0
38	10280	1014	1014	1014	16	0	16
36	10230	2695	2695	2695	15	0	0
36	11063	1950	1947	1950	16	0	0
34	9666	1439	1439	1439	15	0	0
43	12390	3714	3714	3714	16	0	0
42	11957	2641	2641	2641	15	0	16
44	12606	1530	1530	1530	0	15	0
41	12001	1331	1331	1331	16	0	15
38	11005	2930	2930	2929	16	0	0
39	11368	2328	2328	2328	16	0	15
39	10578	2792	2793	2792	0	0	16
38	10811	3537	3537	3537	0	16	0
38	11399	3343	3343	3344	0	16	0
35	9445	3894	3894	3894	0	15	0
37	10794	4222	4222	4222	0	16	0
38	10866	2301	2301	2301	0	16	0
38	10765	2273	2273	2273	16	0	0
39	11807	4294	4294	4294	0	15	0
39	10845	1978	1978	1978	0	15	0
44	12712	2788	2788	2788	0	0	16
39	11456	1672	1672	1672	16	0	15
43	12725	1664	1664	1664	0	0	16
37	10273	1097	1097	1097	15	0	16
35	10082	3940	3940	3940	16	0	0
42	12646	620	620	620	16	0	0
41	12005	1424	1424	1424	0	0	15
40	11758	3931	3931	3931	0	15	0
42	12146	1753	1753	1753	15	0	0
39	11170	497	497	497	0	0	16
36	10054	3514	3514	3514	0	15	0
38	10595	2340	2340	2340	16	0	15
36	11469	4365	4365	4365	0	15	0
39	11478	2682	2682	2682	15	0	0
39.08	11286.7	2352.54	2352.76	2352.54	8.44	4.3	5.92

50 Nodes 0.9 Inlayering

Layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median ex
46	16636	1918	1918	1918	15	0	0
46	15863	788	788	788	16	0	0
48	16920	206	206	206	16	0	16
47	16499	1320	1320	1320	0	16	0
44	15755	3121	3121	3121	0	0	16
46	16235	352	352	352	16	0	0
43	15433	1028	1028	1028	15	0	0
47	16963	130	130	130	16	0	0
47	16609	414	414	414	16	0	15
46	16508	563	563	563	0	16	0
44	15239	2375	2375	2375	0	0	16
45	16015	657	657	657	0	0	16
46	15838	332	332	332	16	0	16
47	16658	99	99	99	16	0	15
43	15114	2948	2948	2948	0	16	0
46	16082	1879	1879	1879	0	15	0
44	15579	299	299	299	0	16	0
44	15323	3289	3289	3289	0	0	16
47	16547	2154	2154	2154	0	16	0
40	14081	4779	4779	4779	16	0	0
46	15474	1148	1148	1148	16	0	0
43	15163	2545	2545	2545	16	0	0
41	14302	6054	6054	6054	15	0	0
45	15199	2865	2865	2865	0	16	0
46	15958	1085	1085	1085	0	0	16
45	15980	2026	2026	2026	0	63	16
47	15904	610	610	610	16	0	0
46	16083	2053	2053	2053	0	0	16
47	16579	1901	1901	1901	15	0	0
44	15676	2970	2970	2970	0	16	0
44	15182	670	670	670	0	0	16
41	14182	2040	2040	2040	0	0	16
45	15365	3019	3019	3019	0	0	16
46	16193	752	752	752	16	0	16
44	15812	4497	4497	4497	0	0	15
44	14763	864	864	864	0	16	0
42	15293	4571	4571	4571	0	0	16
44	16239	4823	4823	4823	0	16	0
44	15268	1030	1030	1030	15	16	0
43	14843	1987	1987	1987	16	0	16
45	15379	2906	2906	2906	0	15	0
46	15681	1711	1711	1711	16	0	0
46	15423	1482	1482	1482	15	0	0
47	16356	1821	1821	1821	16	0	0
48	17246	1153	1153	1153	15	0	0
46	15684	1266	1266	1266	0	16	0
46	16045	117	117	117	0	15	0
43	14858	2946	2946	2946	0	0	16
42	14383	4109	4109	4109	0	15	0
44	15185	521	521	521	0	78	0
44.92	15711.9	1883.86	1883.86	1883.86	6.9	7.54	6.02

50 Nodes 0-9 outlayering

Layers	Dummies	AdjEX crnc	Barry crno	Median Cr	Adj exec	barry exec	median exec
46	16646	1918	1918	1918	16	0	0
46	15864	1000	1000	1000	16	0	0
48	16883	205	205	205	0	0	15
47	16510	776	776	776	0	16	0
44	15745	3281	3281	3281	0	0	16
46	16250	352	352	352	0	15	0
43	15405	1448	1448	1448	0	15	0
47	16963	1742	1742	1742	0	16	0
47	16572	1284	1284	1284	0	0	16
46	16530	452	452	452	16	0	0
44	15213	2217	2217	2217	16	0	0
45	16052	504	504	504	0	16	0
46	15814	1183	1183	1183	0	0	15
47	16658	2999	2999	2999	0	0	16
43	15085	824	824	824	0	0	15
46	16052	1698	1698	1698	16	0	0
44	15579	1963	1963	1963	16	0	0
44	15252	3753	3753	3753	15	0	16
47	16547	1600	1600	1600	16	0	0
40	14151	4144	4144	4144	16	0	16
46	15490	1934	1934	1934	0	0	16
43	15174	856	856	856	15	0	0
41	14311	4671	4671	4671	0	16	0
45	15199	2234	2234	2234	0	16	0
46	15973	1057	1057	1057	0	0	16
45	16022	852	852	852	16	0	16
47	15904	81	81	81	15	0	0
46	16063	1509	1509	1509	15	0	0
47	16579	67	67	67	15	0	16
44	15684	3106	3106	3106	15	0	16
44	15193	463	463	463	0	0	16
41	14182	4742	4742	4742	16	0	0
45	15348	984	984	984	0	0	16
46	16182	533	533	533	16	0	0
44	15891	2736	2736	2736	16	0	16
44	14783	1576	1576	1576	0	0	16
42	15284	1681	1681	1681	0	15	0
44	16164	1623	1623	1623	0	0	16
44	15347	1186	1186	1186	16	0	0
43	14856	2469	2469	2469	15	0	0
45	15379	3103	3103	3103	16	0	0
46	15683	1716	1716	1716	0	0	15
46	15444	1080	1080	1080	0	16	0
47	16332	64	64	64	0	15	0
48	17225	1027	1027	1027	16	0	0
46	15684	1791	1791	1791	15	0	0
46	16101	185	185	185	15	0	0
43	14888	3478	3478	3478	0	15	0
42	14346	3161	3161	3161	0	16	0
44	15185	2396	2396	2396	0	0	16
44.92	15713.34	1714.08	1714.08	1714.08	7.5	3.74	6.32

100 Nodes 0.1 Inlayering

Layers	Dummies	AdjEX crnc	Barry crnc	Median Cr	Adj exec	barry exec	median exec
17	2407	8363	8363	8363	141	78	78
15	2259	8328	8328	8328	171	79	78
18	2921	8700	8700	8700	156	63	78
16	2704	7219	7219	7219	156	63	78
20	3224	4972	4972	4972	156	62	63
21	3872	9721	9721	9721	156	63	78
20	3411	6216	6216	6216	125	79	62
18	3162	6929	6929	6929	360	62	78
17	3426	9769	9769	9769	172	78	62
17	2517	6221	6221	6221	156	63	78
17	2816	6651	6651	6651	156	62	79
15	2504	8141	8141	8141	157	78	78
14	2472	5832	5832	5832	187	78	79
16	3068	8866	8866	8866	172	78	78
20	3418	8125	8125	8125	141	78	62
16	2675	8459	8459	8459	156	78	78
18	2889	7385	7385	7385	156	63	78
15	2510	7601	7601	7601	172	63	93
20	3177	5764	5764	5764	140	63	62
19	2518	8908	8908	8908	171	79	93
18	3062	4820	4820	4820	156	63	62
15	2410	8667	8667	8667	172	63	78
20	3710	7346	7346	7346	125	78	63
22	3305	4671	4671	4671	140	63	62
20	3441	6544	6544	6544	125	78	63
19	3558	9256	9256	9256	141	78	63
15	2440	9284	9284	9284	156	78	94
16	2549	6301	6301	6301	140	79	78
20	3798	7924	7924	7924	157	62	78
20	3684	5991	5991	5991	125	62	79
18	3347	6649	6649	6649	156	63	78
18	3436	10241	10241	10241	188	62	78
25	4419	3961	3961	3961	156	47	62
12	1946	10669	10669	10669	188	93	94
15	2785	7421	7421	7421	157	78	78
20	3486	6644	6644	6644	125	62	63
17	2767	6180	6180	6180	141	62	79
16	2728	7249	7249	7249	141	78	78
15	2138	6804	6804	6804	172	78	78
13	1877	9225	9225	9225	187	94	78
19	3083	5578	5578	5578	125	62	63
16	2460	7768	7768	7768	156	94	78
18	2916	6524	6524	6524	156	62	94
16	2873	7199	7199	7199	156	63	78
17	3153	8659	8659	8659	188	78	63
17	3014	7497	7497	7497	141	78	63
21	3846	6368	6368	6368	125	62	63
17	2997	5767	5767	5767	141	62	79
17	2463	7751	7751	7751	141	78	62
15	2009	7046	7046	7046	344	78	93
17.52	2953	7363.48	7363.48	7363.48	161.56	70.96	74.7

100 Nodes 0.1 adlayering

Layers	Dummies	AdjEX crnc	Barry crno	Median Cr	Adj exec	barry exec	median exec
17	2441	5660	5716	5660	140	63	78
15	2251	6456	6558	6459	141	62	63
18	3114	5679	5576	5686	140	63	62
16	2310	5083	5194	5088	140	94	78
20	3256	4611	4427	4616	110	62	63
21	3981	4332	4300	4329	110	62	63
20	3301	4210	4068	4210	125	47	140
18	3228	5340	5240	5354	125	63	47
17	2996	5655	5411	5664	125	62	78
17	2661	4673	4447	4676	125	62	78
17	2430	4829	4635	4860	125	63	62
15	2279	5364	5241	5426	141	78	78
14	2299	6808	6762	6806	141	62	78
16	2748	6710	6619	6721	125	63	78
20	3669	7626	7645	7641	110	62	63
16	2690	5962	5818	6036	140	79	78
18	2573	6304	6237	6347	125	63	62
15	2462	5979	5784	5974	125	78	63
20	2820	4036	3925	4022	125	47	62
19	2814	6078	5844	6055	110	62	63
18	2890	5671	5438	5675	140	47	63
15	1986	7589	7242	7505	141	78	63
20	3181	5176	4980	5156	110	62	47
22	3525	3608	3592	3605	110	62	47
20	3423	5695	5561	5695	109	63	47
19	3762	7298	7247	7305	109	63	62
15	2425	6576	6335	6597	141	62	78
16	2669	7288	7132	7288	140	63	62
20	3582	3860	3832	3854	296	63	47
20	3485	3927	3788	3927	94	62	63
18	2592	6298	5913	6314	125	63	62
18	2964	5120	4962	5129	125	47	62
25	3772	3929	3912	3944	109	63	47
12	1971	7883	7709	7879	156	78	63
15	1936	6191	6067	6217	140	78	79
20	3281	5566	5325	5547	109	63	47
17	2470	6504	6227	6498	234	125	125
16	2295	5128	4955	5127	141	62	78
15	2012	6033	5907	6060	140	78	63
13	2019	5669	5531	5681	141	78	62
19	2911	4791	4626	4798	141	62	63
16	2572	5855	5786	5857	125	63	78
18	2811	7250	7012	7247	141	62	63
16	2476	7299	7083	7297	141	63	62
17	2892	4994	4987	5006	125	63	62
17	2686	7179	6963	7231	125	63	62
21	3810	4407	4288	4420	110	62	47
17	2649	7651	7596	7640	141	62	63
17	2504	5674	5430	5670	125	94	62
15	1939	6802	6656	6747	157	78	62
17.52	2796.26	5766.12	5630.58	5770.92	133.78	66.58	66.56

100 Nodes 0.25 Inlayering

Layers	Dummies	AdjEX crn	Barry crno	Median Crn	Adj exec	barry exe	median exec
39	17906	12761	12761	12761	94	46	47
29	12757	14051	14051	14051	94	62	63
29	12011	24177	24177	24177	125	62	47
31	13302	15346	15346	15346	93	47	47
34	15117	13926	13926	13926	110	47	46
40	16386	10877	10877	10877	93	47	47
37	15896	12079	12079	12079	94	47	47
34	13616	13624	13624	13624	94	47	47
34	15589	13497	13497	13497	94	46	63
34	13785	15548	15548	15548	94	47	78
37	16714	8125	8125	8125	94	46	47
31	12320	16244	16244	16244	109	47	47
35	14547	15543	15543	15543	94	47	78
31	12357	17433	17433	17433	110	46	63
42	18976	15752	15752	15752	94	46	47
40	18264	20077	20077	20077	94	47	47
33	15984	20220	20220	20220	172	62	47
29	12155	20427	20427	20427	110	47	62
34	15383	19549	19549	19549	94	47	63
38	15544	13690	13690	13690	93	47	47
35	14251	12919	12919	12919	78	47	47
30	12120	13407	13407	13407	110	62	47
32	13090	16106	16106	16106	110	46	47
32	12715	15573	15573	15573	93	47	47
32	13558	20580	20580	20580	110	47	47
35	14062	18535	18535	18535	109	47	63
36	15305	11574	11574	11574	94	47	47
40	18213	13161	13161	13161	94	47	46
34	16412	15094	15094	15094	172	47	47
42	19177	15270	15270	15270	93	47	47
35	15330	16348	16348	16348	94	47	47
36	15510	13537	13537	13537	94	47	47
35	12874	11306	11306	11306	94	46	47
34	14119	14033	14033	14033	125	47	47
37	15828	14735	14735	14735	109	47	47
35	14936	15605	15605	15605	94	62	47
34	14427	13823	13823	13823	94	47	47
33	13444	15207	15207	15207	94	47	47
40	19725	12611	12611	12611	125	47	47
34	14599	15998	15998	15998	94	47	47
37	16609	13972	13972	13972	93	47	47
32	13486	19643	19643	19643	110	62	47
30	13732	17537	17537	17537	110	46	47
30	12591	10884	10884	10884	109	47	47
30	12987	18523	18523	18523	110	46	47
38	15765	14477	14477	14477	94	47	47
38	16711	15242	15242	15242	93	47	47
37	16132	13100	13100	13100	78	62	47
39	18265	11064	11064	11064	78	47	47
33	13364	18433	18433	18433	94	62	47
34.72	14958.92	15224.86	15224.86	15224.86	101.96	49.22	50.1

100 nodes 0.25 Critlayering

layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median exec
39	17391	13050	12996	13048	78	47	47
29	12788	16953	16809	16953	109	47	47
29	11459	18995	18950	18995	94	62	47
31	12978	14620	14549	14620	94	62	47
34	14654	12541	12465	12525	93	47	47
40	16148	15816	15797	15806	78	47	47
37	15587	9859	9819	9832	78	47	46
34	13687	13645	13655	13649	94	46	47
34	15103	10617	10567	10617	78	63	31
34	13576	10793	10791	10792	94	46	47
37	16442	12845	12816	12846	78	63	46
31	12393	12388	12331	12388	94	47	47
35	14967	13251	13317	13235	79	62	47
31	12656	15465	15315	15450	93	47	47
42	19012	13399	13382	13392	94	31	47
40	18596	17486	17482	17485	78	47	47
33	15550	17854	17873	17854	94	47	47
29	12173	17797	17796	17794	110	46	63
34	15333	14886	14829	14884	78	47	63
38	15623	11015	10944	11015	78	47	47
35	14013	11764	11738	11762	94	47	47
30	12143	17033	16919	17037	94	62	47
32	13391	14264	14195	14279	78	62	47
32	13133	11330	11269	11315	93	47	47
32	13765	17226	17222	17226	94	47	47
35	14286	13536	13438	13536	109	47	47
36	15399	13864	13849	13855	93	63	47
40	18026	16625	16229	16625	94	47	47
34	15914	12800	12727	12796	94	47	46
42	18771	9765	9762	9764	78	31	47
35	14899	18040	17939	18030	93	47	47
36	15379	12123	12086	12146	93	47	32
35	13104	10372	10363	10372	93	47	47
34	13770	11008	10857	11013	93	47	47
37	15697	12615	12594	12615	78	47	46
35	14902	11794	11855	11795	94	31	47
34	14385	11998	11913	12005	78	47	47
33	13179	15803	15824	15803	94	47	47
40	19112	11146	11149	11160	78	32	47
34	14103	8494	8425	8510	78	47	46
37	16481	11239	11237	11229	78	47	47
32	13582	15265	15311	15267	94	46	47
30	13354	15558	15519	15558	94	47	47
30	12305	12384	12367	12383	109	47	47
30	13233	16230	16238	16232	109	47	47
38	15846	8652	8705	8686	78	47	47
38	16490	11573	11559	11573	93	32	46
37	16237	14002	14052	14005	78	47	47
39	18253	12461	12455	12469	94	47	47
33	13678	18584	18496	18580	94	46	125
34.72	14858.9	13616.46	13575.5	13616.12	89.6	47.8	48.46

100 Nodes 0.5 Dlayering

Layers	Dummies	AdjEX crno	Barry crno	Median Crr	Adj exec	barry exec	median exec
60	52397	21681	21681	21681	78	47	47
58	49387	26897	26897	26897	94	31	47
61	50467	15205	15205	15205	78	32	46
61	51754	19872	19872	19872	63	47	47
49	36955	24344	24344	24344	78	47	47
60	50253	20903	20903	20903	78	32	46
55	45684	31251	31251	31251	78	32	47
62	52242	14615	14615	14615	62	47	31
55	46385	27156	27156	27156	78	47	31
60	50826	18461	18461	18461	78	31	47
59	50937	29794	29794	29794	78	47	31
51	41049	18139	18139	18139	94	31	47
57	45885	18994	18994	18994	78	31	47
59	51131	40186	40186	40186	93	32	47
61	48264	23618	23618	23618	78	32	46
60	50929	15623	15623	15623	79	31	47
60	53520	24225	24225	24225	78	32	47
65	52069	17630	17630	17630	78	47	31
52	44205	30634	30634	30634	94	31	63
54	45608	26486	26486	26486	93	32	47
61	50158	21410	21410	21410	79	46	32
52	41261	29450	29450	29450	94	47	47
59	46526	20588	20588	20588	109	32	47
59	50236	21316	21316	21316	78	47	31
58	46347	27423	27423	27423	78	31	47
55	45509	22328	22328	22328	79	46	32
60	48980	24249	24249	24249	78	47	31
57	44955	15212	15212	15212	78	47	47
56	44442	20960	20960	20960	78	47	47
55	46590	28848	28848	28848	78	47	46
62	52015	13315	13315	13315	78	32	47
60	48163	22927	22927	22927	78	31	47
61	49865	28662	28662	28662	93	32	47
56	46166	34263	34263	34263	78	47	47
65	56790	14857	14857	14857	78	32	46
52	42027	30105	30105	30105	78	47	31
60	52713	11022	11022	11022	79	46	32
58	50365	21422	21422	21422	93	32	31
56	44591	15012	15012	15012	78	47	47
56	44984	23851	23851	23851	63	47	47
57	45387	22400	22400	22400	78	31	47
55	43937	25857	25857	25857	78	31	47
62	51813	18274	18274	18274	78	31	47
60	51711	31731	31731	31731	141	46	47
65	57271	27968	27968	27968	78	47	31
55	47913	16953	16953	16953	78	47	31
59	52036	28802	28802	28802	78	47	47
59	49830	23410	23410	23410	78	47	31
62	55221	18547	18547	18547	78	47	31
57	46168	15422	15422	15422	79	31	47
58.16	48478.34	22845.96	22845.96	22845.96	81.54	39.48	42.48

100 Nodes 0.5 outlayering

Layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median exec
60	52318	12560	12513	12560	62	47	47
58	49554	14951	14951	14951	63	47	31
61	50437	13041	13041	13041	62	31	47
61	51882	18264	18252	18264	78	32	46
49	37595	24988	24988	24988	125	31	47
60	49963	26071	26071	26071	78	31	31
55	45375	26549	26549	26545	78	32	47
62	51941	23197	23197	23197	78	47	31
55	46523	23246	23246	23245	78	47	31
60	50678	19240	19243	19243	62	47	32
59	50890	22414	22414	22414	62	47	31
51	41284	20199	20199	20199	63	46	47
57	45525	25022	25022	25021	266	31	47
59	51314	28274	28274	28274	63	47	31
61	48173	23645	23645	23645	63	47	47
60	50815	21266	21238	21260	78	32	46
60	53358	25569	25569	25569	78	47	31
65	51761	17749	17749	17749	63	31	47
52	44181	28167	28166	28168	78	32	46
54	45509	23594	23594	23594	78	47	31
61	50426	30697	30697	30697	63	31	47
52	41849	27358	27358	27358	78	47	47
59	46534	24465	24465	24465	63	47	31
59	49894	28187	28011	28187	62	47	31
58	46313	24463	24463	24463	94	31	47
55	45983	19645	19659	19645	63	47	47
60	49200	27762	27762	27762	78	31	47
57	45012	21127	21139	21127	78	47	31
56	44724	27617	27605	27617	78	31	47
55	46101	22361	22361	22361	78	47	31
62	51830	19280	19284	19280	125	47	31
60	48101	25380	25385	25380	62	31	47
61	50030	15813	15813	15813	63	46	32
56	45977	38594	38590	38590	63	47	46
65	56465	19034	19034	19034	62	47	47
52	42250	33949	33900	33949	62	47	47
60	52607	13222	13223	13221	62	32	46
58	50029	21657	21657	21657	63	31	47
56	44093	27130	27129	27130	78	63	47
56	44751	12529	12529	12528	78	47	31
57	45448	24022	24022	24022	79	46	32
55	43682	17701	17701	17701	78	47	32
62	51573	25415	25415	25415	63	47	31
60	51392	33259	33259	33259	79	31	47
65	56805	23468	23468	23468	79	31	47
55	47411	26371	26371	26374	78	47	31
59	51879	27720	27727	27720	63	46	47
59	49882	29381	29381	29381	63	47	47
62	55240	23003	22962	23003	63	47	31
57	45911	24038	24038	24028	62	47	31
58.16	48409.4	23453.08	23446.58	23452.66	76.32	41.58	39.94

100 Nodes 0.75 Inlayering

Layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median exec
74	87795	22014	22014	22014	63	47	31
80	100190	28696	28696	28696	78	32	46
81	97837	12877	12877	12877	63	31	47
80	95832	22798	22798	22798	63	47	31
77	93513	19733	19733	19733	63	47	31
82	100079	14358	14358	14358	63	31	31
77	94929	17789	17789	17789	79	31	31
80	97276	18457	18457	18457	63	47	31
82	96041	14954	14954	14954	62	32	47
79	93896	16077	16077	16077	79	31	31
74	89031	35218	35218	35218	78	31	47
77	90694	15879	15879	15879	63	31	47
75	89580	29882	29882	29882	78	32	47
79	97958	40842	40842	40842	78	47	31
79	96775	17989	17989	17989	62	32	46
82	98621	7650	7650	7650	63	31	31
80	97512	16257	16257	16257	78	31	47
82	98036	6030	6030	6030	62	47	31
76	90363	45164	45164	45164	78	31	47
79	92540	34817	34817	34817	234	47	47
79	98287	13223	13223	13223	63	31	47
81	94226	22805	22805	22805	78	32	46
76	89132	27682	27682	27682	62	31	47
82	96986	9723	9723	9723	63	31	47
80	98753	34901	34901	34901	63	31	47
78	95757	22391	22391	22391	63	47	31
79	96633	24126	24126	24126	62	32	47
77	93042	22097	22097	22097	78	32	46
74	88618	20801	20801	20801	63	47	31
78	94039	24753	24753	24753	63	47	31
78	95644	11223	11223	11223	78	32	31
83	102371	16236	16236	16236	79	31	31
75	89498	23183	23183	23183	79	31	47
78	92371	14262	14262	14262	78	32	47
76	92548	23027	23027	23027	79	46	32
80	98591	20464	20464	20464	78	31	47
79	96763	17245	17245	17245	62	31	47
77	93313	25479	25479	25479	79	46	32
82	98251	31172	31172	31172	63	31	31
79	95209	21801	21801	21801	78	31	31
78	92976	13518	13518	13518	78	32	46
80	96043	5061	5061	5061	62	31	47
71	87196	26354	26354	26354	62	47	32
76	96403	33337	33337	33337	79	31	47
80	99552	20185	20185	20185	78	32	31
82	97684	21455	21455	21455	78	31	47
80	97017	25331	25331	25331	63	31	47
78	92381	29030	29030	29030	63	46	47
76	89936	25367	25367	25367	62	47	32
77	95588	26928	26928	26928	63	47	47
78.48	94866.12	21812.82	21812.82	21812.82	72.98	36.28	39.94

100 nodes 0.75 onlayering

Layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median exec
74	87792	31257	31257	31257	78	31	47
80	100243	9589	9589	9589	62	31	47
81	97735	22424	22424	22424	63	31	47
80	95908	16373	16373	16373	63	31	47
77	93444	18932	18932	18932	62	47	32
82	100198	12602	12602	12602	47	31	47
77	95091	19063	19063	19063	63	31	47
80	97191	16034	16034	16034	63	47	31
82	96352	17291	17291	17291	62	31	32
79	93713	21066	21066	21066	46	47	32
74	88610	18685	18685	18685	78	31	47
77	91078	15719	15764	15719	47	47	31
75	89552	37381	37381	37381	78	31	32
79	97933	24511	24511	24511	63	47	31
79	97187	17334	17334	17334	63	31	31
82	98604	12042	12042	12042	63	31	31
80	97320	22406	22406	22406	63	47	31
82	97776	28469	28469	28469	140	47	31
76	90391	32178	32178	32178	63	46	32
79	92379	31839	31839	31839	62	31	47
79	97926	12891	12891	12891	62	31	47
81	93969	22452	22452	22452	63	31	47
76	88916	15581	15581	15581	63	31	47
82	96929	18740	18740	18740	47	47	31
80	98662	14568	14568	14568	63	31	47
78	95772	17905	17905	17905	63	47	31
79	96571	13292	13292	13292	140	31	47
77	93263	8787	8787	8787	47	46	32
74	88714	26031	26031	26030	62	47	47
78	93908	16210	16210	16210	47	47	31
78	95651	19047	19047	19047	63	31	31
83	102455	9387	9387	9387	63	31	31
75	89280	35235	35235	35235	63	31	47
78	92478	24163	24163	24163	62	32	47
76	92443	28978	28978	28978	62	78	31
80	98641	14653	14653	14653	62	31	32
79	96772	18367	18367	18367	63	31	47
77	93023	20884	20884	20884	78	31	32
82	98281	14011	14011	14011	62	47	31
79	95234	26302	26302	26302	62	31	47
78	93119	24106	24106	24106	78	32	62
80	96259	14032	14032	14032	63	31	31
71	87289	27693	27695	27695	62	47	31
76	96388	28439	28439	28439	62	47	47
80	99158	20961	20961	20961	62	31	47
82	98020	11567	11567	11567	63	31	31
80	97441	13682	13682	13682	47	46	32
78	92457	22977	22977	22977	47	360	31
76	90248	30688	30688	30688	62	32	47
77	95923	18098	18098	18098	63	47	31
78.48	94873.7	20298.44	20299.38	20298.46	64.7	44.28	38.52

100 Nodes 0.9 Dolayering

Layers	Dummies	AdjEX crno	Barry crno	Median Cr	Adj exec	barry exe(	median exec
94	134875	2209	2209	2209	62	31	32
91	134537	17776	17776	17776	63	31	47
92	134665	24191	24191	24191	62	47	31
88	127350	19756	19756	19756	62	32	47
89	127396	12281	12281	12281	63	46	32
93	134436	17717	17717	17717	78	31	31
95	140662	195	195	195	63	31	31
89	128302	16688	16688	16688	62	32	47
89	130063	10027	10027	10027	297	63	31
90	133007	13828	13828	13828	63	31	47
94	137022	7432	7432	7432	63	31	31
91	132854	16987	16987	16987	62	32	46
95	135788	4466	4466	4466	62	32	31
91	132897	1929	1929	1929	62	32	47
92	136964	735	735	735	62	31	47
89	129486	19598	19598	19598	63	31	47
90	134733	21394	21394	21394	62	32	46
93	136335	9548	9548	9548	63	31	31
90	131601	17360	17360	17360	63	31	47
94	136222	7597	7597	7597	62	32	46
93	133736	17934	17934	17934	62	31	32
88	130022	23861	23861	23861	79	31	31
89	129301	16894	16894	16894	78	31	32
94	135516	9546	9546	9546	63	31	31
92	133797	11526	11526	11526	78	31	31
96	138030	2055	2055	2055	62	32	31
90	131749	17196	17196	17196	63	31	31
86	126072	23013	23013	23013	79	31	31
94	137022	9846	9846	9846	63	31	31
94	136507	11243	11243	11243	62	32	31
88	123931	13085	13085	13085	78	31	31
91	133081	12490	12490	12490	63	31	47
95	139244	9789	9789	9789	62	32	31
90	126618	16417	16417	16417	62	32	31
88	128889	18168	18168	18168	78	31	47
92	131463	7280	7280	7280	78	16	47
95	136910	14010	14010	14010	63	31	31
85	122734	23691	23691	23691	78	31	47
88	123382	15757	15757	15757	62	31	47
91	127856	9820	9820	9820	62	32	31
92	133751	12486	12486	12486	63	31	31
92	132117	19312	19312	19312	46	47	32
87	129648	15753	15753	15753	297	62	31
88	128081	20559	20559	20559	62	31	47
92	133114	2063	2063	2063	62	32	31
91	138009	16017	16017	16017	63	31	47
89	128176	16155	16155	16155	62	32	31
92	133972	1784	1784	1784	62	31	32
91	131910	11486	11486	11486	62	31	32
87	126009	6641	6641	6641	78	31	32
90.98	132196.84	12951.82	12951.82	12951.82	74.62	33.18	36.86

100 Nody 0.9 antlayering

Layers	Dummies	AdjEX crnc	Barry crno	Median Cr	Adj exec	barry exec	median exec
94	134868	3209	3209	3209	46	47	32
91	134329	14339	14339	14339	63	31	31
92	134591	16665	16665	16665	47	47	31
88	127394	11010	11010	11010	47	47	31
89	127439	26726	26726	26726	62	31	32
93	134436	9078	9078	9078	62	32	31
95	140662	1375	1375	1375	47	32	31
89	128292	15240	15240	15240	62	47	31
89	129962	16474	16474	16474	47	32	46
90	132980	19329	19329	19329	62	31	47
94	137014	3458	3458	3458	47	31	31
91	132691	25956	25956	25956	47	47	31
95	135775	5206	5206	5206	47	31	31
91	132867	12663	12663	12663	47	31	31
92	136968	4552	4552	4552	47	31	32
89	129544	14676	14676	14676	47	46	32
90	134873	18469	18469	18469	63	31	31
93	136215	18201	18201	18201	62	31	32
90	131770	17844	17844	17844	63	31	31
94	136170	5340	5340	5340	47	31	31
93	133584	12096	12096	12096	47	47	31
88	130012	17206	17206	17206	47	47	31
89	129204	9866	9866	9866	62	31	32
94	135516	11434	11434	11434	47	47	31
92	133757	11127	11127	11127	46	32	47
96	138025	4983	4983	4983	47	31	47
90	131684	12898	12898	12898	62	32	31
86	126028	9643	9643	9643	47	47	31
94	137042	8528	8528	8528	62	31	32
94	136460	2941	2941	2941	46	32	31
88	123722	13762	13762	13762	62	31	47
91	133130	8638	8638	8638	63	31	47
95	139299	10029	10029	10029	63	31	31
90	126519	22110	22110	22110	63	31	31
88	129088	14115	14115	14115	63	31	31
92	131545	4312	4312	4312	125	63	62
95	136962	2118	2118	2118	62	32	31
85	122845	18215	18215	18215	62	47	32
88	123497	14648	14648	14648	62	31	32
91	127989	2197	2197	2197	63	31	31
92	133743	9111	9111	9111	63	31	31
92	132055	23570	23570	23570	63	31	31
87	129862	16661	16661	16661	63	31	31
88	127990	17978	17978	17978	62	32	31
92	132987	6551	6551	6551	47	32	31
91	137980	7954	7954	7954	62	32	31
89	128490	11074	11074	11074	47	46	32
92	134120	15331	15331	15331	63	31	31
91	131922	20599	20599	20599	62	32	31
87	126048	13924	13924	13924	47	32	31
90.98	132198.9	12268.58	12268.58	12268.58	56.84	35.68	33.72

Nodes 150 0.1 Inlayering

Layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median exec
30	14039	19209	19209	19209	438	219	203
27	10948	18896	18896	18896	438	234	234
32	13011	17314	17314	17314	515	204	218
28	9314	14674	14674	14674	469	234	250
27	11161	22869	22869	22869	469	234	266
25	10095	27904	27904	27904	516	234	250
34	14421	15683	15683	15683	406	219	219
23	9769	26125	26125	26125	531	250	282
27	10741	20474	20474	20474	438	234	219
25	10491	29525	29525	29525	500	234	266
28	9853	21765	21765	21765	484	235	250
27	9982	22780	22780	22780	500	219	250
25	9696	24040	24040	24040	500	234	266
26	10322	24194	24194	24194	500	235	250
26	10337	24081	24081	24081	578	234	266
21	7926	26517	26517	26517	578	297	281
21	8178	24262	24262	24262	578	281	297
24	8752	24679	24679	24679	515	250	250
22	8780	27328	27328	27328	516	250	265
28	13134	20563	20563	20563	641	219	234
24	9331	20641	20641	20641	515	250	266
24	10123	26539	26539	26539	922	234	250
29	11584	23568	23568	23568	437	203	250
28	11357	20094	20094	20094	453	219	234
26	10372	18923	18923	18923	453	234	219
28	10783	24961	24961	24961	484	235	250
27	10554	24862	24862	24862	672	219	250
27	11892	22630	22630	22630	453	328	328
25	10726	26974	26974	26974	484	250	266
25	9916	25419	25419	25419	500	250	266
31	12648	15190	15190	15190	516	203	250
30	11881	19134	19134	19134	437	234	219
27	10775	19531	19531	19531	500	250	250
25	7973	26832	26832	26832	547	266	343
26	10282	26236	26236	26236	500	234	250
27	9977	18285	18285	18285	469	234	219
22	7839	35669	35669	35669	563	281	297
22	7657	26079	26079	26079	547	250	296
27	9883	18096	18096	18096	437	235	218
25	8328	23388	23388	23388	532	250	250
23	8865	32867	32867	32867	563	265	297
32	13211	17191	17191	17191	438	203	219
22	8275	20780	20780	20780	547	266	266
24	8960	21231	21231	21231	516	250	250
22	7164	23170	23170	23170	547	281	297
33	13825	17078	17078	17078	469	203	203
30	12329	17102	17102	17102	438	219	218
27	11768	18730	18730	18730	468	235	250
28	11380	23024	23024	23024	484	235	234
28	11260	20799	20799	20799	468	282	218
26.4	10437.36	22558.1	22558.1	22558.1	509.38	240.96	252.78

Nodes 150 0.1 outlaying

Layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median exec
20	7854	12391	12200	12350	484	266	281
25	9931	9451	9443	9475	406	235	203
24	9092	9651	9823	9645	718	235	234
23	7438	11276	10885	11212	516	281	281
24	8818	9794	9773	9792	750	265	250
20	6989	10245	10078	10066	532	281	281
23	8337	8403	8208	8292	750	250	265
32	13084	5303	5148	5142	359	203	204
27	10019	6933	7083	7071	422	219	219
27	11002	6945	6956	7030	390	219	203
25	8680	13439	13407	13269	469	250	234
28	11126	9974	10024	10101	421	235	203
25	8713	8652	8584	8785	516	234	250
27	10986	6235	5935	6239	390	219	219
26	9085	8134	8119	8100	422	235	218
23	7819	8217	7891	7998	500	265	250
27	11389	8998	9123	9002	422	203	218
23	9623	10501	10512	10437	500	266	250
21	8027	11793	11690	11650	469	250	265
27	9426	11337	11068	11035	422	218	219
26	9902	9309	9270	9341	437	235	234
26	9659	11022	10944	10864	438	234	234
24	8209	8523	8603	8587	469	250	234
28	11199	4648	4457	4514	406	203	219
23	8602	12682	12543	12667	469	250	250
24	9131	9586	9394	9441	453	250	250
22	8531	9121	9303	9410	500	250	250
25	9073	9631	9739	9635	500	265	235
29	10842	5998	5994	5967	391	203	219
30	12583	10468	10358	10403	421	235	219
24	8793	9408	9258	9332	469	265	250
21	7767	10093	9998	10011	547	250	281
27	10246	6310	6240	6365	437	235	218
25	9330	10174	10120	10088	437	250	313
23	8868	9037	8810	8839	484	250	250
26	11440	13110	12962	13065	500	265	266
23	7328	11011	10742	10847	500	266	265
28	10331	10065	10020	9967	421	235	219
25	9113	8237	8093	8143	437	235	250
23	9242	8156	8131	8181	532	265	282
22	8005	12157	12020	11905	485	250	265
25	9586	7934	7858	7925	469	266	234
27	9911	5729	5668	5735	500	219	235
29	10421	6176	6045	6088	406	219	219
24	9946	8937	8990	9001	484	250	235
30	11124	9415	9536	9440	406	203	219
24	8450	11142	11058	11077	469	250	250
27	10487	9389	9633	9445	484	250	250
25	10164	10157	10070	10084	515	250	250
24	8974	11554	11421	11281	500	282	828
25.12	9493.9	9337.02	9264.56	9286.78	476.48	243.18	253.4

Nodes 150 0.25 Inlayering

Layers	Dummies	AdjEX crnc	Barry crno	Median Cr	Adj exec	barry exec	median exec
58	60681	52811	52811	52811	281	156	157
48	48288	44512	44512	44512	359	172	172
55	55742	36555	36555	36555	313	172	156
44	41079	56710	56710	56710	344	156	188
51	52034	55461	55461	55461	343	172	172
51	49820	61094	61094	61094	453	172	172
52	52292	51204	51204	51204	297	156	187
51	47755	48490	48490	48490	328	172	172
49	46185	46797	46797	46797	328	172	172
48	49587	46898	46898	46898	453	172	188
50	50897	39924	39924	39924	313	156	172
59	57904	43476	43476	43476	297	156	172
45	42472	46556	46556	46556	344	171	172
51	49635	43045	43045	43045	422	156	172
55	55098	38214	38214	38214	282	156	156
55	55193	55642	55642	55642	312	172	172
52	47131	53863	53863	53863	312	156	188
53	52163	51398	51398	51398	312	172	172
50	48288	53278	53278	53278	328	172	172
51	52350	39517	39517	39517	313	156	172
52	49927	52911	52911	52911	313	156	172
49	46990	49768	49768	49768	313	171	188
58	58864	42661	42661	42661	312	141	156
61	63361	34390	34390	34390	282	156	172
56	60467	58985	58985	58985	313	156	172
56	54578	42667	42667	42667	297	171	157
59	62810	43863	43863	43863	297	156	172
45	41838	51925	51925	51925	343	188	187
48	43123	55163	55163	55163	344	171	188
53	57445	54224	54224	54224	312	172	156
53	56386	42124	42124	42124	313	172	156
62	60611	32598	32598	32598	282	140	157
55	53463	49005	49005	49005	297	157	156
56	60854	47290	47290	47290	297	156	157
48	50124	51252	51252	51252	343	157	171
49	47351	49514	49514	49514	328	172	172
47	44355	50732	50732	50732	344	156	172
57	55847	39597	39597	39597	297	156	156
52	51050	39027	39027	39027	312	172	156
49	49841	46574	46574	46574	469	172	172
45	44559	50331	50331	50331	344	172	187
51	48636	50479	50479	50479	312	172	172
42	39934	52744	52744	52744	344	188	172
53	55098	58899	58899	58899	328	156	188
52	52913	58373	58373	58373	297	172	172
53	51320	44879	44879	44879	328	157	171
60	61794	37880	37880	37880	282	172	312
53	53067	43112	43112	43112	313	172	171
52	50774	43778	43778	43778	313	156	172
48	45402	54966	54966	54966	344	156	188
52.04	51747.52	47903.12	47903.12	47903.12	326.94	164.32	174.12

Nodes 150 0.25 outlayering

Layers	Dummies	AdjEX crno	Barry crno	Median Cr	Adj exec	barry exec	median exec
58	60783	50679	50566	50677	297	156	172
48	47538	37052	37187	37061	313	187	156
55	55771	31273	31212	31277	281	141	156
44	40633	57879	57636	57887	312	188	172
51	51495	50831	50785	50831	281	172	156
51	50549	59253	59197	59251	532	187	156
52	53672	40744	40652	40735	328	156	157
51	47831	47558	47501	47558	297	188	156
49	45723	53618	53553	53606	297	172	156
48	47449	41452	41270	41474	297	187	156
50	50187	46274	46347	46275	437	156	172
59	57471	45413	45414	45444	266	156	156
45	40752	47887	47836	47892	344	172	172
51	49395	33396	33329	33396	312	172	157
55	54819	43530	43475	43530	281	157	156
55	55026	44599	44629	44589	281	156	156
52	47296	52617	52478	52617	297	156	172
53	52131	39013	38939	39044	312	172	156
50	47887	37815	37748	37815	282	156	156
51	50863	34430	34380	34410	282	156	140
52	50084	50285	50250	50280	281	172	156
49	47630	50038	50044	50017	297	172	187
58	58183	44205	44198	44209	265	156	157
61	62471	44111	43930	44111	266	156	141
56	60055	47319	47289	47315	265	157	156
56	53489	47077	46893	47077	281	172	141
59	63431	42652	42720	42637	297	422	172
45	41413	58778	58455	58772	343	188	187
48	43205	44541	44489	44541	296	172	172
53	57082	55567	55531	55562	297	171	172
53	56502	53768	53337	53773	297	171	157
62	60146	42956	42754	42955	281	157	156
55	52268	51919	51943	51981	297	172	156
56	60471	33981	33922	34007	250	172	141
48	49367	44427	44337	44436	297	172	406
49	47598	47327	47455	47331	313	172	187
47	44364	45939	45629	45870	297	172	172
57	54609	49055	48922	49054	297	156	156
52	51235	58229	58262	58228	297	172	172
49	48563	48466	48489	48467	312	172	157
45	44304	61349	61313	61349	328	172	172
51	48314	46259	46352	46259	313	172	156
42	40242	51869	51665	51869	328	188	172
53	55127	55066	55060	55062	282	172	171
52	52540	46547	46832	46547	281	172	157
53	51642	42982	42927	42980	297	172	156
60	61292	41105	41078	41103	266	140	157
53	53904	48613	48596	48604	297	156	172
52	49687	39438	39253	39438	296	157	156
48	45339	52964	52859	52972	297	171	157
52.04	51436.56	46842.9	46778.36	46843.5	302.8	172.82	166.26

Nodes 150 0.5 Ordering

Layers	Dummies	AdjEX crnc	Barry crno	Median Cr	Adj exec	barry exec	median exec
82	151065	75925	75925	75925	250	140	157
87	165738	99419	99419	99419	250	469	172
86	160358	55301	55301	55301	250	157	172
79	149594	77425	77425	77425	313	141	156
89	169100	59711	59711	59711	250	140	141
84	165201	78767	78767	78767	265	141	484
88	166632	63465	63465	63465	250	125	157
83	143382	80402	80402	80402	296	141	172
79	138478	76505	76505	76505	265	156	157
86	160872	53184	53184	53184	250	141	141
85	157729	60946	60946	60946	250	125	141
81	148318	80737	80737	80737	297	141	156
94	176310	53055	53055	53055	266	156	172
80	143286	88135	88135	88135	313	156	203
93	174969	81653	81653	81653	235	140	141
90	172703	62187	62187	62187	250	140	157
86	154259	80779	80779	80779	281	141	141
84	164025	82906	82906	82906	266	141	625
86	161132	91318	91318	91318	250	141	140
81	150862	63500	63500	63500	297	125	156
87	158039	79950	79950	79950	406	203	219
87	158744	79294	79294	79294	281	297	141
81	148013	76997	76997	76997	266	141	156
92	169457	57732	57732	57732	234	125	141
86	156724	69548	69548	69548	250	141	156
82	154873	85107	85107	85107	265	156	157
83	150890	63653	63653	63653	250	141	172
89	158751	59805	59805	59805	234	141	125
85	153999	85614	85614	85614	265	157	156
87	149325	65881	65881	65881	250	141	141
88	157427	60056	60056	60056	250	141	140
85	156958	93745	93745	93745	266	125	140
95	179437	55334	55334	55334	250	141	140
93	174797	73431	73431	73431	359	125	188
90	174613	93313	93313	93313	282	140	141
83	149405	83447	83447	83447	297	141	172
90	167345	67566	67566	67566	250	141	140
84	156624	87019	87019	87019	266	141	140
92	170957	75695	75695	75695	250	125	157
89	167866	63569	63569	63569	250	141	156
80	150510	95141	95141	95141	266	140	156
90	170853	54252	54252	54252	250	141	141
91	174468	73349	73349	73349	250	140	141
81	148733	91100	91100	91100	297	156	187
83	154926	55487	55487	55487	266	125	141
81	146705	100630	100630	100630	265	125	172
85	162869	92608	92608	92608	266	141	156
87	165949	67619	67619	67619	640	141	141
82	150885	56188	56188	56188	265	141	140
89	167412	89057	89057	89057	235	156	141
86	159631.3	74350.14	74350.14	74350.14	275.3	151.34	170.7

Nodes 150 0.5 ordlayering

layers	Dummies	AdjEX cr	Barry crno	Median Crno	Adj exec	barry exe	median exec
82	151157	54874	54854	54874	437	172	156
87	164981	96069	96075	96069	735	312	172
86	160050	81437	81437	81437	266	140	141
79	150130	81902	81889	81902	266	156	140
89	168567	59078	59078	59078	734	141	125
84	164856	90853	90854	90853	297	156	157
88	167111	87140	87120	87140	250	125	140
83	144240	73967	73969	73969	250	141	140
79	138143	80510	80455	80510	250	156	141
86	161167	65883	65864	65886	234	141	125
85	157651	68914	68904	68914	235	140	125
81	147926	119465	119458	119463	266	140	157
94	176353	73205	73205	73205	328	140	125
80	144143	76722	76719	76725	250	140	141
93	174668	63137	63111	63137	281	125	141
90	172851	57696	57696	57696	250	125	141
86	153776	56133	56133	56133	234	141	125
84	164357	85916	85916	85916	234	141	203
86	162166	64674	64676	64674	235	140	141
81	150548	66893	66892	66893	250	234	125
87	158057	49854	49932	49854	234	141	141
87	158248	72402	72401	72402	234	141	141
81	147988	83842	83820	83887	234	156	141
92	170128	64753	64753	64753	235	125	125
86	157072	95920	95912	95920	234	156	141
82	155181	63722	63693	63718	235	140	156
83	150898	58698	58695	58701	250	141	140
89	158178	54797	54772	54797	235	125	140
85	154302	69962	69955	69962	250	140	141
87	150279	59551	59551	59551	235	140	141
88	157582	95946	95946	95946	235	140	141
85	155823	86707	86702	86702	250	140	157
95	179665	64455	64455	64455	375	157	156
93	175092	52675	52675	52677	250	156	125
90	174216	82264	82199	82264	1282	515	172
83	149207	80561	80580	80561	265	141	141
90	167359	78476	78476	78476	218	141	141
84	156421	65482	65483	65482	265	141	141
92	170249	72498	72497	72498	219	156	140
89	167776	78065	77913	78065	235	140	125
80	149794	68378	68378	68378	250	156	141
90	171145	61894	61893	61894	312	141	125
91	174440	58883	58882	58882	313	141	156
81	148369	63365	63509	63365	250	265	141
83	155552	85938	85938	85938	250	141	141
81	146564	79096	79096	79096	235	156	156
85	163237	72115	72115	72115	234	141	141
87	166396	58857	58859	58855	250	125	140
82	150820	68023	68025	68023	234	141	140
89	167708	67528	67534	67528	234	156	125
86	159651.7	72383.5	72378.88	72384.38	296.28	158.02	142.26

Nodes 200 0.1 Inlayering

Layers	Dummies	AdjEX crnc	Barry crno	Median Cr	Adj exec	barry exec	median exec
35	25947	45990	45585	45992	1172	531	531
37	28435	45382	44817	45359	985	515	500
34	23513	44262	43693	44252	1016	547	531
37	26041	36509	36210	36517	969	516	515
36	25614	38041	37505	38056	1062	547	563
35	24229	41565	41386	41563	1015	532	547
39	25612	35164	35023	35160	969	500	515
32	24464	46853	45834	46862	1031	547	562
32	23511	47534	46649	47519	1156	594	594
36	25596	36894	36242	36895	1016	515	516
29	18879	57824	56898	57833	1219	641	625
34	21817	42892	41502	42847	1047	563	531
37	26001	37338	37070	37341	1078	578	547
43	31307	45324	44808	45322	953	516	500
31	22028	43376	42681	43398	1093	719	562
40	25676	35739	35228	35690	1015	516	687
34	23435	45991	45375	45994	1047	563	547
33	23086	33783	33694	33780	1015	547	547
35	23150	43053	43095	43093	1047	578	547
35	24623	43677	43163	43690	1047	516	531
30	20245	41432	41054	41425	1172	609	625
39	29433	38763	38278	38740	938	500	484
36	23526	37171	36455	37116	1015	563	547
35	24094	42626	42291	42621	1203	625	563
35	24705	51293	50746	51353	1047	562	563
33	23488	37256	37100	37160	1047	562	563
35	24214	39029	38206	38960	1016	546	516
36	26290	41099	40653	41097	969	531	500
33	22811	37663	37015	37664	1062	547	516
34	25432	42742	42878	42752	969	531	516
38	27848	40184	39863	40176	969	500	515
33	23196	44864	44135	44877	1047	828	578
38	25080	34450	34379	34444	1047	546	547
37	27440	46443	45937	46471	1047	547	531
32	24113	57477	56822	57411	1125	640	578
29	21080	44026	44016	44019	1109	578	563
34	21978	41439	40876	41456	1078	562	547
37	23284	39946	39102	39992	1063	562	531
42	29504	50043	49304	50042	985	515	516
29	19215	52042	51399	52078	1188	640	625
29	19544	53190	53113	53190	1188	625	593
36	26240	56031	55058	56021	1078	562	563
33	22154	50352	49860	50356	1109	594	578
37	24805	36685	36322	36678	937	500	516
40	31872	33161	33033	33138	1015	516	531
26	17473	65430	65255	65433	1281	797	672
36	25013	34712	34297	34705	1000	485	484
33	23972	45003	44502	44982	1031	562	547
32	22430	35879	35833	35868	1141	562	547
30	20319	49524	49016	49605	1125	625	563
34.62	24275.24	43342.92	42865.12	43339.86	1059.06	568.06	550.32

Nodes 200 0·1 outlayering

Layers	Dummies	AdjEX crnc	Barry crno	Median Cr	Adj exec	barry exec	median exec
35	25947	45990	45585	45992	1172	531	531
37	28435	45382	44817	45359	985	515	500
34	23513	44262	43693	44252	1016	547	531
37	26041	36509	36210	36517	969	516	515
36	25614	38041	37505	38056	1062	547	563
35	24229	41565	41386	41563	1015	532	547
39	25612	35164	35023	35160	969	500	515
32	24464	46853	45834	46862	1031	547	562
32	23511	47534	46649	47519	1156	594	594
36	25596	36894	36242	36895	1016	515	516
29	18879	57824	56898	57833	1219	641	625
34	21817	42892	41502	42847	1047	563	531
37	26001	37338	37070	37341	1078	578	547
43	31307	45324	44808	45322	953	516	500
31	22028	43376	42681	43398	1093	719	562
40	25676	35739	35228	35690	1015	516	687
34	23435	45991	45375	45994	1047	563	547
33	23086	33783	33694	33780	1015	547	547
35	23150	43053	43095	43093	1047	578	547
35	24623	43677	43163	43690	1047	516	531
30	20245	41432	41054	41425	1172	609	625
39	29433	38763	38278	38740	938	500	484
36	23526	37171	36455	37116	1015	563	547
35	24094	42626	42291	42621	1203	625	563
35	24705	51293	50746	51353	1047	562	563
33	23488	37256	37100	37160	1047	562	563
35	24214	39029	38206	38960	1016	546	516
36	26290	41099	40653	41097	969	531	500
33	22811	37663	37015	37664	1062	547	516
34	25432	42742	42878	42752	969	531	516
38	27848	40184	39863	40176	969	500	515
33	23196	44864	44135	44877	1047	828	578
38	25080	34450	34379	34444	1047	546	547
37	27440	46443	45937	46471	1047	547	531
32	24113	57477	56822	57411	1125	640	578
29	21080	44026	44016	44019	1109	578	563
34	21978	41439	40876	41456	1078	562	547
37	23284	39946	39102	39992	1063	562	531
42	29504	50043	49304	50042	985	515	516
29	19215	52042	51399	52078	1188	640	625
29	19544	53190	53113	53190	1188	625	593
36	26240	56031	55058	56021	1078	562	563
33	22154	50352	49860	50356	1109	594	578
37	24805	36685	36322	36678	937	500	516
40	31872	33161	33033	33138	1015	516	531
26	17473	65430	65255	65433	1281	797	672
36	25013	34712	34297	34705	1000	485	484
33	23972	45003	44502	44982	1031	562	547
32	22430	35879	35833	35868	1141	562	547
30	20319	49524	49016	49605	1125	625	563

Nodes 200 0.25 Inlaying

Layers	Dummies	AdjEX crno	Barry crno	Median Crno	Adj exec	barry exec	median exec
67	117894	93086	93086	93086	734	391	390
67	117105	99079	99079	99079	734	375	391
66	122090	114742	114742	114742	766	390	407
72	122663	89669	89669	89669	688	375	374
68	126566	126097	126097	126097	718	360	390
69	116672	116528	116528	116528	765	391	469
70	125044	137875	137875	137875	719	718	391
74	123698	104698	104698	104698	704	343	391
61	109848	111866	111866	111866	765	406	407
75	140045	121822	121822	121822	703	360	390
70	120167	118277	118277	118277	719	359	437
66	114591	106934	106934	106934	734	375	688
73	132794	107938	107938	107938	750	359	391
71	124061	116876	116876	116876	734	344	391
68	116630	109692	109692	109692	719	375	375
63	116207	122882	122882	122882	796	391	391
69	129797	111666	111666	111666	734	359	375
66	114701	110614	110614	110614	796	391	687
69	119435	125869	125869	125869	750	375	406
63	114669	115062	115062	115062	765	375	688
70	120933	83552	83552	83552	703	375	406
69	117179	82189	82189	82189	719	359	375
75	132446	86652	86652	86652	656	360	375
76	133639	82164	82164	82164	687	438	421
63	110728	138318	138318	138318	750	391	390
62	110556	131734	131734	131734	766	390	407
69	130381	149570	149570	149570	703	375	390
76	136511	74686	74686	74686	656	406	360
72	135901	111992	111992	111992	750	359	375
74	134727	107158	107158	107158	703	657	422
70	124522	133900	133900	133900	719	359	391
66	120341	120647	120647	120647	844	390	422
67	116199	120385	120385	120385	734	375	391
68	121765	88492	88492	88492	719	391	406
66	117236	135159	135159	135159	734	375	391
67	114148	114353	114353	114353	703	391	359
68	123241	113889	113889	113889	718	375	375
78	142962	105508	105508	105508	734	344	422
64	113668	143180	143180	143180	750	406	406
61	111790	162389	162389	162389	797	422	422
69	125083	125377	125377	125377	969	359	375
68	122056	123267	123267	123267	719	390	391
60	110894	141365	141365	141365	813	422	422
67	117439	111380	111380	111380	750	375	390
69	129520	98068	98068	98068	687	375	375
66	116857	162971	162971	162971	781	406	422
78	134479	102410	102410	102410	688	640	344
74	132139	74556	74556	74556	1907	359	375
67	118332	117540	117540	117540	703	375	407
70	127300	118035	118035	118035	719	531	375

Nodes 200 0.25 outlayering

Layers	Dummie	AdjEX c	Barry cr	Median	Adj exec	barry exec	median exec
67	118469	124016	124109	124011	1844	422	391
67	116259	135928	135876	135923	718	391	391
66	121781	112585	112177	112587	703	407	406
72	121635	91854	91947	91853	687	375	375
68	126003	129279	129233	129279	672	359	375
69	116249	87521	87555	87521	719	437	391
70	123611	126488	126325	126487	719	391	406
74	123744	105097	105106	105097	672	359	360
61	108776	119441	119292	119443	734	422	391
75	139162	115220	114826	115220	1531	703	453
70	121708	125287	125116	125269	1156	375	375
66	115551	108863	108987	108855	703	407	375
73	132090	103356	103455	103356	672	391	390
71	124272	103976	103818	103959	641	375	375
68	117465	109491	109059	109491	688	609	359
63	114742	109795	109579	109792	688	390	391
69	127829	95607	95543	95606	656	375	359
66	114809	108629	108802	108628	688	375	391
69	118158	122556	122440	122556	687	422	375
63	115242	103858	103977	103858	703	422	375
70	119062	109016	108972	109027	687	391	359
69	116332	94105	93734	94104	813	359	359
75	132380	109799	109683	109801	812	375	360
63	110146	113809	113287	113811	703	406	391
62	111159	127561	127590	127564	734	406	391
69	130870	117538	117316	117537	2078	390	375
76	134200	76337	76253	76316	734	422	10266
72	134564	108113	107732	108112	890	406	454
74	133218	88306	87958	88306	1047	359	375
70	125020	126179	125994	126178	672	375	390
66	118528	123717	123476	123708	734	391	359
67	116375	124819	124848	124816	734	406	375
68	120611	93816	93799	93821	656	359	360
66	116586	105729	105590	105726	672	390	375
67	113426	116659	116786	116659	734	375	391
68	122073	100655	100502	100521	687	375	360
64	113197	138771	138479	138768	703	391	375
61	110647	148090	147801	148090	1140	453	407
69	125574	118538	118285	118538	703	375	375
68	122543	136736	136389	136780	688	391	375
60	111223	138824	138613	138822	750	406	828
67	116784	109013	108812	108975	719	406	391
69	127091	100215	100066	100230	734	422	406
66	116097	130810	130665	130802	703	391	390
78	134239	113751	113631	113753	765	407	359
74	131542	106379	106315	106406	656	359	375
67	118768	120690	120386	120690	687	391	375
70	128344	106277	106190	106287	657	375	359
69	125688	108106	107670	108106	672	375	344
64	109097	87458	87143	87376	688	375	375
68.3	121259	112773	112624	112768	798.66	402.18	587.56