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**IBM** Information Management software



## **DB2 Compression Estimation Tool**

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## Introduction

As the amount of data being managed continues to rise, the cost of storage is becoming an increasing burden to CIOs and IT executives. Although the cost of disk drives as measured in dollars per gigabyte of storage continues to decline, the overall IT expense on storage infrastructure continues to climb. This is as a result of the explosive growth in storage requirements of both structured and unstructured data that needs to be managed. Looking at the cost of database storage along with the cost of backup media and disaster recovery storage, a significant amount of money can be saved if the database were to consume substantially less space.

DB2 brings to the table significant advancements in compression technology. These features allow databases to be compressed anywhere from 50% to 90%, thus reducing storage costs and improving performance in many cases. In addition, backup images are now half the size and therefore backup/restore operations now finish in almost half the time and consume half the space. Multiply that by the number of backup images you keep and the savings grow even larger. In addition, disaster recovery sites now require almost half the amount of storage as well. Looking at the cost of enclosures, controllers, power, cooling, floor space, etc., you can quickly see that DB2 Compression can save a significant amount of money for the enterprise.

## Static (Row) compression

The first type of DB2 compression is referred to as Static (or Classic) row compression. DB2 row compression uses a dictionary based Lempel-Ziv algorithm to compress data. Repeating patterns within a table are extracted from the rows and stored once in a dictionary. These patterns are then replaced with a symbol within the row itself. As shown in Figure 1, repeating column values, as well as strings that repeat across column boundaries, can be replaced.

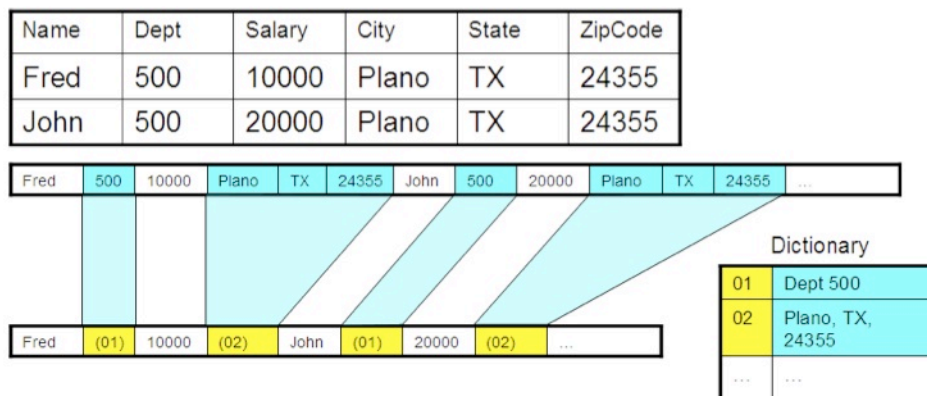


Figure 1: Compressing data in a row

Using this form of compression, DB2 can scan the entire table, find repeating strings within the data, and replace those strings with compression symbols. The amount of compression achieved in this manner on real customer data during the DB2 9 test drive has been reported at between 50% and 80%. That is, the size of the table after compression is between 50% and 80% smaller than when it started. Thus the storage consumption for these tables is significantly less. In addition, DB2 keeps this data compressed in the buffer pool so that you

effectively have twice the amount of memory available. That is, since rows remain compressed in the buffer pool, you can expect to see twice as many rows being stored in memory compared to non-compressed data. In one test of an SAP table with real customer data, the number of rows packed into the bufferpool was in fact four times the number of rows achieved without compression.

## **Adaptive Table Compression**

DB2 V10.1 introduced Adaptive table compression. Adaptive compression improves upon the compression rates that can be achieved over using classic row compression by itself. Adaptive compression incorporates classic row compression; however, it also works on a page-by-page basis to further compress data.

Adaptive compression uses two compression approaches. A Table-level compression dictionary used in classic row compression must exist in order to use Adaptive compression. Adaptive compression uses a page-level dictionary-based compression algorithm to compress data based on data repetition within each page of data. The dictionaries map repeated byte patterns to much smaller symbols; these symbols then replace the longer byte patterns in the page. The page-level compression dictionary is stored with the data in the data page, and is used to compress only the data within that page.

The significant advantage of Adaptive compression is that it can find local patterns that may not be in the global dictionary. The adaptive compression will also adjust the dictionary on a page over time, so that new patterns will continue to be compressed. Contrast this to Static compression where the dictionary is built once for the entire table, and not updated unless a reorganization command is run.

## **DB2 BLU Compression**

DB2 V10.5 introduced a new columnar table format. A columnar table contains pages that are dedicated to individual columns. In the traditional row format, a row in a table will be placed on one database page. With columnar format, each column value in a row will end up on a separate page. For instance, in an Employee table, all employee last names would end up on a database page. Similarly, the salary column would be placed on a page along with hundreds of other salary value from other employee records.

Data that is stored in columnar format can achieve much higher compression ratios because there is significantly more repeated patterns and through the use of advanced encoding techniques. The compression is done automatically by DB2 when a table is created in column format.

## **How compression works and how to use it**

Depending on which release of DB2 you currently have, there are a number of ways to compress a table:

- DB2 9.1 and higher - Manually run the reorganization command against tables that have compression enabled
- DB2 9.5 and higher - Automatically have the tables compressed as they reach a threshold size
- DB2 10.1 and higher - Automatically have tables compressed with adaptive and static compression
- DB2 10.5 - BLU Compression is automatically done for all columnar tables

In order for DB2 to compress a table, you must first make the table eligible for compression. Simply create the table or alter the table and specify either:

- COMPRESS YES (9.1, 9.5, 9.7) or COMPRESS YES STATIC (10.1+) - This tells DB2 that you want to use compression algorithms on this table at the entire table level.
- COMPRESS YES (10.1+) or COMPRESS YES ADAPTIVE (10.1+) - This tells DB2 that you want to use compression algorithms that include table level dictionaries (STATIC) and adaptive dictionaries at the page level.
- ORGANIZE BY COLUMN (10.5) - The table will be created in columnar format and compression is automatically enabled. No additional steps are required to build the dictionary since DB2 will generate it automatically when data is loaded into the table.

For STATIC and ADAPTIVE compression, a second step may be required to build a static (table) dictionary of repeating values. In DB2 9.5+, the dictionary compression is performed automatically once a table reaches a minimum size (2MB approximately). You can still perform this task manually by running the REORG command:

```
REORG TABLE table_name
```

The reorg will create the dictionary of common values (if one does not exist), and then compress those values out of the data as the table is being reorganized. Future reorgs give you the option to keep the dictionary or rebuild a new one if data patterns change. From this point onward, any insert, update, import or load of data into the table will respect the dictionary information and compress those rows as well.

DB2 also has a compression estimation utility. If you are using DB2 9 and you want to know how much compression will benefit a given table you can use the INSPECT command. Running the following command will provide compression estimates for the given table:

```
INSPECT ROWCOMPESTIMATE TABLE NAME table_name  
RESULTS KEEP file_name
```

## **Estimating Compression using DB2 Compression Estimation Tool**

The most accurate way of determining the amount of compression in a table is to use the `INSPECT` command within DB2 9 or the `ADMIN_GET_INDEX_COMPRESS_INFO` and `ADMIN_GET_TAB_COMPRESS_INFO_V97` table functions. However, this technique requires that the data be transferred or migrated to a DB2 9/9.5/9.7 database. If this is not possible, then the DB2 Compression Estimator Tool may be a useful alternative.

If you are using a DB2 V10.1 database, the new command for estimating compression uses the `ADMIN_GET_TAB_COMPRESS_INFO` table function. The `ADMIN_GET_TAB_COMPRESS_INFO` table function estimates the compression savings that can be gained for the table, assuming a `REORG` with `RESETDICTIONARY` option will be performed.

```
SELECT TABSCHEMA, TABNAME, DBPARTITIONNUM, DATAPARTITIONID,  
       OBJECT_TYPE, ROWCOMPMODE, PCTPAGESSAVED_CURRENT,  
       AVGWROWSIZE_CURRENT, PCTPAGESSAVED_STATIC, AVGWROWSIZE_STATIC,  
       PCTPAGESSAVED_ADAPTIVE, AVGWROWSIZE_ADAPTIVE  
FROM TABLE (  
    SYSPROC.ADMIN_GET_TAB_COMPRESS_INFO('SCHEMA1', 'TABLE1'))
```

This table function provides a direct replacement for the `'ESTIMATE'` mode provided by the deprecated `ADMIN_GET_TAB_COMPRESS_INFO` table function in previous versions of DB2.

The DB2 Compression Estimation Tool (“Estimator”) determines the potential compression of a table or index by looking at the DDL of the object, the current statistics on the object, and then using heuristics based on extensive compression testing to determine what the potential compression could be for the object.

The tool does not read any production data within a table or index. The estimate is based solely on the statistics available to the tool. The DB2 compression algorithm can compress across (and within) columns while the Estimator can only base its results on individual column compression values. For this reason, the results determined by the tool will tend to underestimate the actual compression that can be achieved.

## **Requirements**

The DB2 Compression tool is distributed as a single executable file called DB2CompressionEstimatorInstall.exe. This file may be packaged in a zip archive, which would also include this documentation.

The requirements for this program are:

- Installation on a Windows platform (Windows XP, Windows Vista, Windows 7)
- Administrator privileges on Windows to allow the installation of the program
- DB2 CLI client code
- Access to a DB2 system

The actual database that is being analyzed can be on any of the supported DB2 platforms. The user connecting to the DB2 database must have:

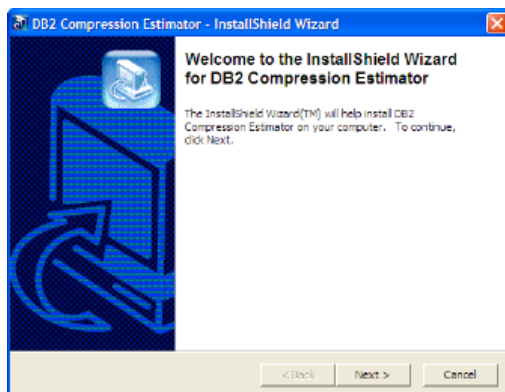
- Connect capability to the database (V8+)
- Access to SYSCAT tables

This program does not update or read any user data in the database. The only access the program has is to the SYSCAT tables described above.

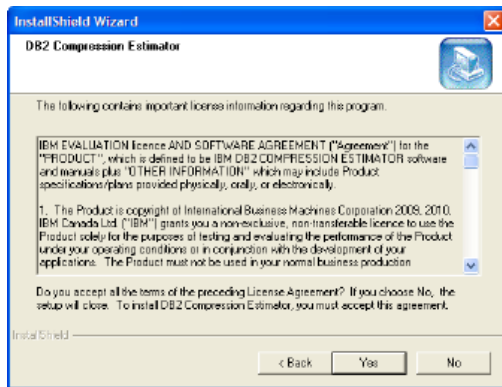
## **Installation**

To install the tool, the executable file needs to be run. If the program is being installed on Windows 7, ensure that the installation is run as an Administrator. Otherwise some of the modules may not be properly registered in the Windows.

The installation program will bring up a number of panels that will determine where the program will be installed. The first panel is just an introductory screen:

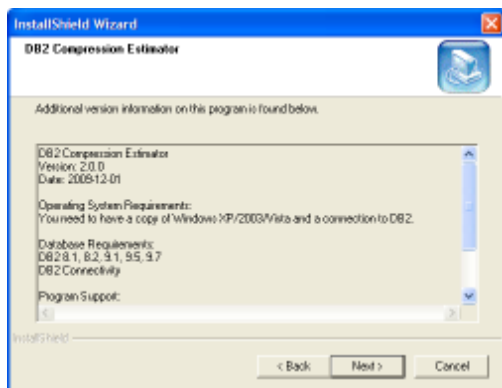


After pressing the NEXT button, the disclaimer for the program is displayed:

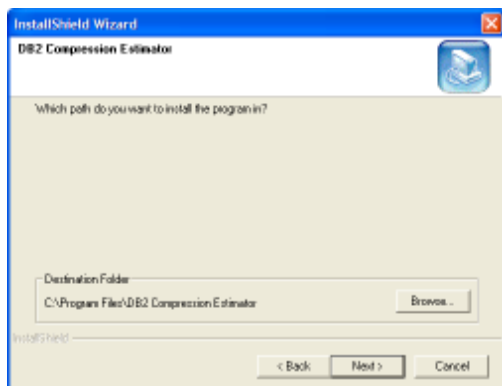


You must select YES in order for the installation to continue.

Once the YES button is pressed, information on the version and any additional requirements are shown:



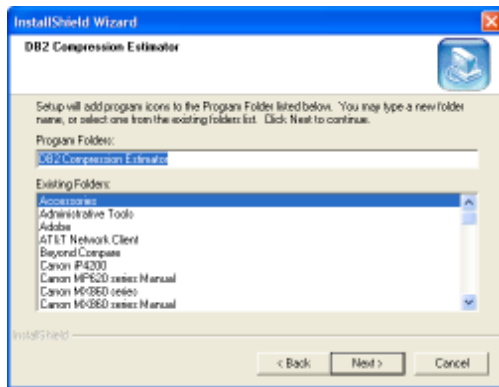
After pressing the NEXT button, the path for the program is displayed. By default, the path is in the standard Program Files directory, under the DB2 Compression Estimate folder:



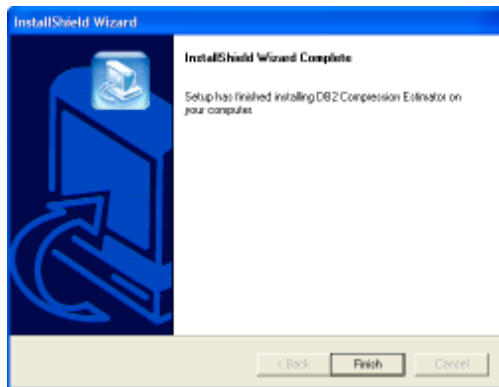
You can modify this path to any valid location on your system. Once the path has been defined and the NEXT statement pressed, the Program Folder is shown (DB2 Compression



Estimator is the default).



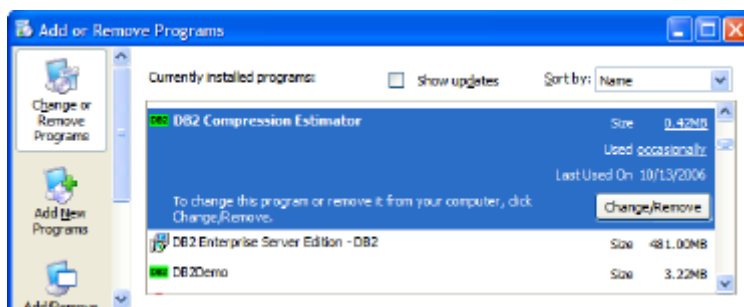
After pressing the NEXT button, the program installation continues until the final screen is displayed:



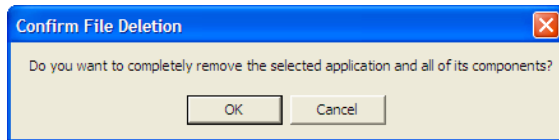
The program is now installed on the workstation.

## Removing the Program

Running the installation program again, or using the Add or Remove Program option in the System Folder will uninstall the program:



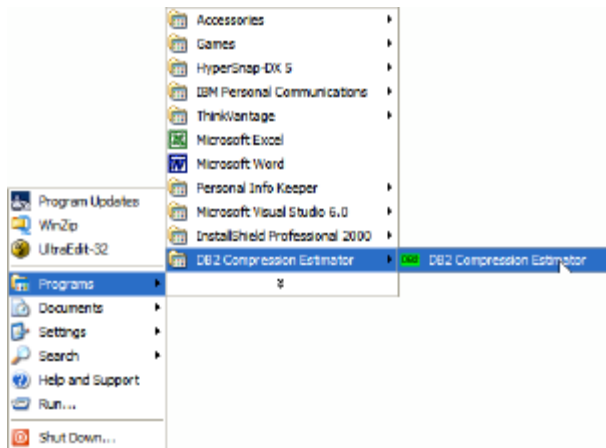
The uninstaller will give you the option to keep it or remove it:



If you have already installed the program and do a subsequent installation, the program will remove itself.

## **Running the Program**

To run the program, select the DB2 Compression Estimator icon in the DB2 Compression Estimator folder:



There is also an icon on the desktop that can be used to start the program:



The panels and options are described on the next page.

## **Program Flow**

The program will take you through five distinct steps in the estimation process. These steps include:

1. Introduction and Disclaimer

These two panels are shown whenever the program is started. You must page through these two panels before starting any of the compression analysis. Once you have read the disclaimer you will not be able to go back to view it during the session.

2. Database Selection

The two panels that follow the disclaimer allow you to enter the name of the database directly, or select it using the DB2 CLI/ODBC selection applet. Once a successful connection is made to the database, you can refine your analysis by entering certain schemas or tables that you want to analyze.

You can always go back to a previous panel by using the BACK button found in the bottom right-hand corner of any panel. Pressing the forward arrow will cause the program to start its analysis.

3. Table Results

A graph that displays the numbers of tables analyzed, and their compression ratio, will dynamically update as the program analyzes your database. Once the analysis is complete you can click the forward arrow to see a detailed view of all of the tables.

4. Index Results

Pressing the forward arrow on the table details screen will cause the program to analyze the indexes in the database. Note that the indexes that are analyzed are based on the same criteria as the tables. A graph similar to that for tables is shown during index analysis. Pressing the forward key on the index graph will then display more details on the indexes that were analyzed.

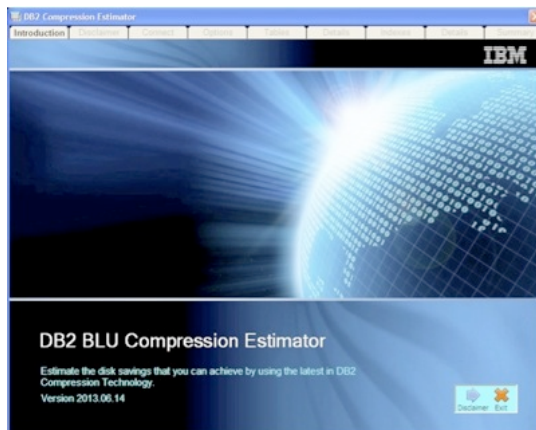
5. Final Totals and Export

Pressing the final forward key on the index graph will display the compression summary for tables and indexes. You have the option on this screen to export the results to a file for further analysis.

If you need to go back to a previous panel, you can always click on the back arrow found on any panel, or use the tabs that are found at the top of the screen. Note that some tabs will be grayed out if they are currently not available or the analysis has not been completed.

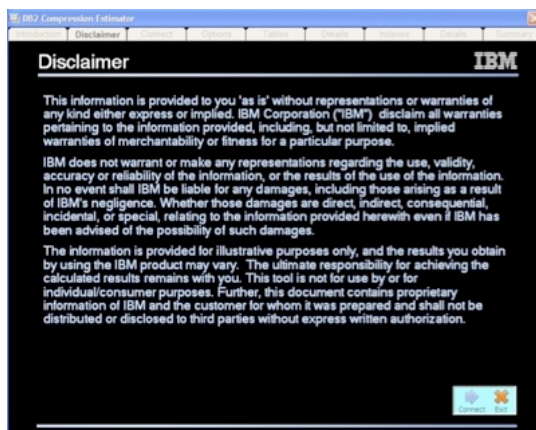
The next section will take you into more details on each one of these panels.

## Initial Panel



The first panel gives you the current version of the program. Clicking the Disclaimer button will take you to the legal page. The Exit button will close the program.

## Disclaimer



Remember that this tool does estimates and that the values could differ significantly from what you get in production. Click on the CONNECT button to connect to a database.

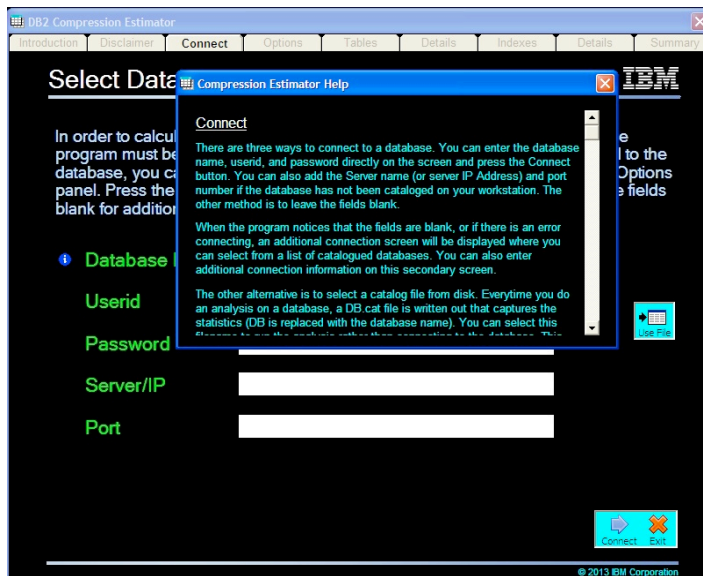
## Connection Panel

The screenshot shows the 'Select Database' window of the DB2 Compression Estimator. The window has a blue title bar with the text 'DB2 Compression Estimator' and a standard Windows window control set. Below the title bar is a tabbed interface with tabs for 'Introduction', 'Disclaimer', 'Connect', 'Options', 'Tables', 'Details', 'Indexes', 'Details', and 'Summary'. The 'Connect' tab is currently selected. The main content area has a dark background with the IBM logo in the top right corner. It contains a paragraph of instructions: 'In order to calculate the potential compression of tables within this system, the program must be connected to a database. Once the program has connected to the database, you can refine the tables and schemas that will be selected in the Options panel. Press the Connect arrow to connect to a specific database or leave the fields blank for additional connection options.' Below this text are five input fields, each with a green label and an information icon (a blue circle with a white 'i') to its left: 'Database Name', 'Userid', 'Password', 'Server/IP', and 'Port'. To the right of the 'Password' field is a small blue button with a white document icon and the text 'Use File'. At the bottom right of the input fields is a blue button with a white 'Connect' label and a red 'X' icon. The bottom of the window features a copyright notice: '© 2013 IBM Corporation'.

The Estimator needs to connect to a DB2 database on one of the supported platforms. There are five fields that can be filled in:

- **Database** – This is the name of the database that you want to analyze. The database must be catalogued and available to the client that you are connecting from. If it is not catalogued then you need to supply the Server/IP address (see below) or use the Connection dialog to catalogue it.
- **Userid** – This is the userid that you will be using to connect to the database. If this value is left blank, it will use your local userid on Windows as the connected user.
- **Password** – This is the password associated with the userid. If this value is left blank, it will use the local userid information to perform the connection.
- **Server/IP** - If the database is not cataloged on your local machine, you can access it directly by supplying the IP address or the symbolic name of the server. If the Server/IP address and port are not supplied then the program will attempt to find the database in the local directory.
- **Port** - Port number to connect to (usually 50000)

On most of the screens you will see information icons beside input fields. Pressing the information icon will display additional information related to that field or screen.



This program does not require any temporary tables in order to analyze the database. All select statements are done against the SYSCAT tables.

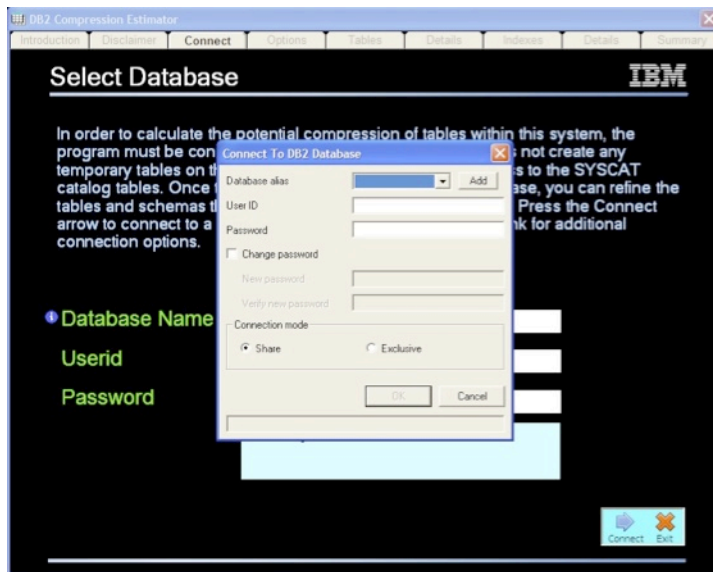
Pressing the Connect button will cause the program to connect to the database. If there is any error in the connection, a message will be displayed and any corrections will need to be made. Aside from invalid passwords, userids, and database names, the only other error that you may receive is a DB2CLI library or DB2 Allocation error.

Both of these problems are related to the DB2CLI library either being unavailable or the library being at an incorrect level. This could be caused by:

- The DB2 client code not being installed on your system
- The DB2 client is from a very old version of DB2 (prior to DB2 Version 8)

The program cannot continue with these errors since it uses the library to communicate with the DB2 database. You can test whether or not your client is working by issuing the DB2CMD command in a CMD shell on Windows, and then if successful, the DB2 command. If a command line environment for DB2 successfully starts then there may be a problem with the program.

If you left the connection fields blank, a CLI connection panel will be displayed where you can select from a database in the list, or specify details on which database to connect to.

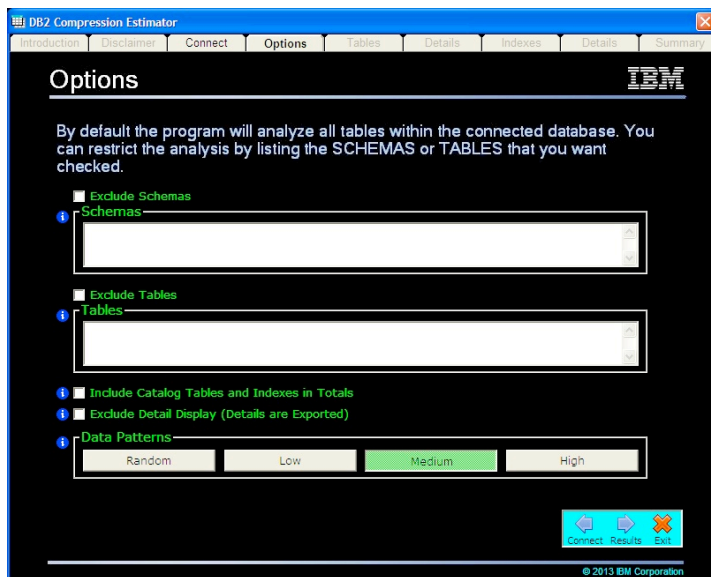


Pressing OK will then cause the program to connect to the database you want to analyze.

The other option that is available on this screen is the “Use File” button. Whenever you analyze a database (through a normal connection to the database), the program will write a catalog file to disk. This file (DB.CAT where DB is the name of your database) contains the DB2 release that the database was created on. Two additional files (DB.tab, DB.idx) contain table and index information that was analyzed. Instead of re-connecting to the database to do additional testing, you can select the name of the database catalog that is already on disk and the program will use this instead of connecting to the database.

Rather than analyzing multiple SCHEMAs (and running multiple SELECT statements against a database), it may be more efficient to have the program analyze the entire database in one step, and then go back and use the catalog file to test individual SCHEMAs.

## Options



The options screen allows you to modify the types of tables and schemas that are analyzed. The options that are available are described below. If you have a large number of tables in your database, you may want to restrict them by SCHEMA or table name attribute before analyzing the results. Note that selecting “Exclude” (for either Schemas or Tables) will remove tables from the result.

The compression estimator will list all schemas available in the selected database. If this results in too many schemas, you can list the schemas in this input box. Type in each schema name separated by a comma. For instance, the following list will only show the schemas SYSCAT and BAKLARZ:



Note that the schema name can include the SQL "%" character to represent any combination of characters. The following list would find any schema that starts with the letters "SYS" or ends with "CAT":



Any schema name that does not include this special character will need to be exactly matched, so "syscat" by itself will only match SYSCAT.

Schemas that include special characters or lowercase letters need to be placed in double quotes. The program will fold all table names to uppercase, except for those in quotes:





The table input box behaves in exactly the same manner as the schema box. You can limit the tables that are retrieved by using patterns. Note that the pattern is applied to all tables that are retrieved from all of the schemas. This means that if you type in "EMPLOYEE" in the table box, and various schemas in the schema box, you will get the EMPLOYEE table from all schemas that contain that table.

#### Using Schemas and Tables with Catalog Files

If you use a CATALOG file (instead of connecting to the database directly), the SCHEMA/TABLE patterns are restricted to full name (baklarz) and leading/trailing patterns (%baklarz, baklarz%, %bak%). Imbedded patterns are not supported (bak%rz).

#### Include Catalog Tables and Indexes in Totals

The estimator does not include SYSTEM catalog tables and indexes in the compression estimates. The compression algorithms that DB2 uses are not applied to the catalog tables, so no compression would be shown for these tables.

If you select this option, the graphs produced by the program will still exclude the system tables and indexes, but the final object count and table/index size will include them.

#### Exclude Detailed Display

The compression estimator will normally display a listing of all tables and indexes that were analyzed. This list includes the name of the object, the current (and uncompressed) size of the object, and the potential compression that can be applied to the object.

If you are analyzing databases that have 10,000's of objects, it is possible that Windows may run out of virtual memory when attempting to display this list. While it is unlikely to occur in practice, in the event you receive an out-of-memory condition, select this option to bypass detailed object display.

There are other methods that can help reduce the amount of output displayed during processing. One is to try and reduce the amount of SCHEMAS/TABLEs that are analyzed by entering the ones you want in SCHEMA and TABLE boxes.

If you do want to get a rough estimate of the total size of all regular objects in the database then just select this box to reduce the memory overhead. Whether you display the results or not, the results of the analysis are always written to disk as three files: DATABASENAME-TABLES/INDEXES/SUMMARY.

#### Adjusting Compression Estimates

You have the option of adjusting some of the settings that are used by the program to determine the level of compression applied to a table.



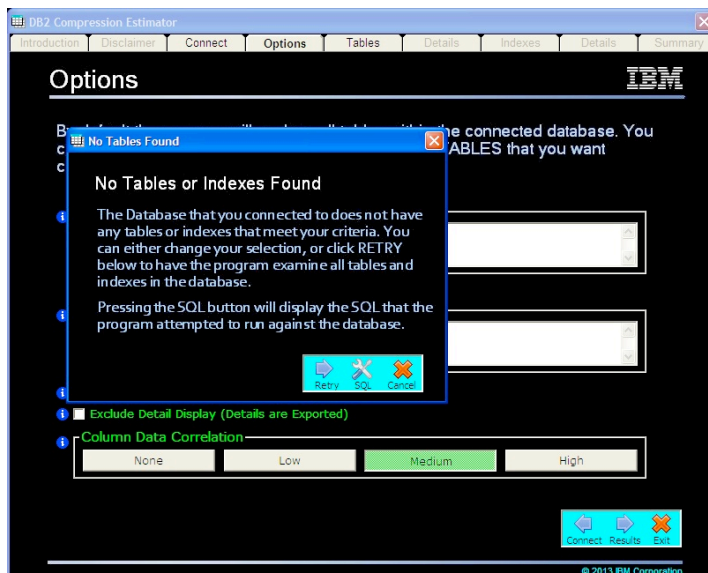
There are four possible settings for Data Patterns. Think of a data pattern as a string, date, or numeric value. These settings affect the potential compression that the estimator determines for a table. The system catalog doesn't tell us everything about the patterns in a column or whether there are patterns that go between columns. This setting gives the estimator a hint about potential data patterns and adjusts the compression ratios according to these hints.

You should choose a setting that reflects the majority of tables in the database. While the estimator could be more accurate if each table had its own correlation setting, this would take considerable effort on the part of the user!

If the tables in your database do not have many correlated columns then using "Low" or "Medium" would result in more accurate results. A setting of "Random" would be used only if most of the tables have random or uncorrelated columns. By default the Compression Estimator uses a Medium setting.

## Table Results

In the event that your table or schema selection does not result in any tables, you will see the following panel displayed.



Pressing the RETRY button will have the program examine all tables in the current database and ignore your original settings. Pressing CANCEL will return you to the TABLE and SCHEMA selection screen. In addition there is the option of pressing the SQL button. This button will display the SQL that the program attempted to run. This will give you the chance to copy the SQL and try it manually using a different SQL interface to see if any results are returned. This is sometimes useful when debugging connection issues.

You can return to the option panel at any time to modify the tables that are returned. If any of the options are modified, the results panel will be automatically updated when you return to that panel. If no changes are made, the results do not get updated.

## Results (Tables)



As the program runs it will display a graph that represents the number of tables and the levels of compression achieved. The bars represent the number of tables that have been found in the system that have a certain percentage of compression. For instance, the red bar represents 5 tables that have less than 10% compression, while the largest bar represents 1 table that has a compression rate of between 70-79%. The left side of the display shows the total number of tables, the total size, the potential compressed size, and a final compression percentage.

Three of the graphs represent different levels of potential compression you could achieve:

1. Static Compression

This graph represents Static (table level) or classic row compression after a full reorg is done on the table. The dictionary is recreated after the table has been loaded so that there are more patterns for the algorithm to find.

2. Adaptive Compression

Adaptive compression builds on top of Static Compression. A static dictionary gets built once the 2M threshold is met, and then additional page-level dictionaries are built as necessary. Adaptive compression is typically better than Static compression and maintains or improves the compression ratio as data changes in the table.

3. BLU (Columnar) Compression

The final chart shows the columnar compression that DB2 can achieve on the tables. Note that this compression is automatic and no utilities are involved in the dictionary creation.

The final graph shows the space savings of the three compression techniques as ratios to the original database size.

Pressing the forward arrow (details) will display a list of all tables found and their estimated compression (Note: These details will be hidden if you selected to exclude detailed display).

Schema	Table	Info	Original(K)	Current(K)	Static(K)	%Static	%Adapt	%BLU
C	CHAR_NLXC1		16008	16008	2728	17	83	30
C	CHAR_NLXC9		14296	14296	2576	18	82	30
C	CHAR_NLXC8		12912	12912	2328	18	82	30
GBFLOAT	TESTREORG	A	11610	4520	5224	45	55	61
C	CHAR_NLXC7		11432	11432	2288	20	80	30
GBFLOAT	TEST	U	10760	10760	4848	45	55	56
C	CHAR_NLXC5		9080	9080	1976	22	78	30
C	CHAR_NLXC5		8432	8432	1856	22	78	30
COMP	EMPLOYEE	A	7152	3576	4224	59	41	50
C	CHAR_NLXC4		6904	6904	1728	25	75	30
C	CHAR_NLXC3		5448	5448	1640	30	70	30
C	CHAR_NLXC2		3944	3944	1656	42	58	30
DB2INST1	WITH_COMPRESSION	A	3171	880	1592	50	50	75
DB2INST1	WITHOUT_COMPRESSION		2864	2864	1432	50	50	75
C	CHAR_NLXC1		2472	2472	1608	65	35	30
C	CHAR_NLXC1		1976	1976	1976	100	0	30
C	CHAR_NLXC9		1880	1880	1880	100	0	30
C	CHAR_NLXC8		1776	1776	1776	100	0	30
C	CHAR_NLXC7		1680	1680	1680	100	0	30
C	CHAR_NLXC6		1584	1584	1584	100	0	30
C	CHAR_NLXC5		1480	1480	1480	100	0	30
C	CHAR_NLXC1		1384	1384	1384	100	0	30
C	CHAR_NLXC2		1384	1384	1384	100	0	30
C	CHAR_NLXC3		1384	1384	1384	100	0	30

You can sort the list by any one of the first 7 columns (Schema, Table Name, Info, BLU Info, Original Size, Current Size, and Compressed Size) by clicking on the title of the column. For instance, the following screen was sorted by Table Name:


Schema	Table	Info	Original(K)	Current(K)	Static(K)	%Static	%Adapt	%BLU
DB2INST1	ACCOUNTS	S	8	8	24	300	0	30
DB2INST1	ACT	U	0	0	0	28	37	30
DB2INST1	ADEFUSR	T	8	8	8	100	0	30
DB2INST1	ADS	U	0	0	0	39	49	30
DB2INST1	ADVISE_INDEX	T	8	8	8	100	0	17
DB2INST1	ADVISE_INSTANCE	T	8	8	8	100	0	30
DB2INST1	ADVISE_IHQ	T	8	8	8	100	0	18
DB2INST1	ADVISE_PARTITION	T	8	8	8	100	0	22
DB2INST1	ADVISE_TABLE	T	8	8	8	100	0	30
DB2INST1	ADVISE_WORKLOAD	T	8	8	8	100	0	28
DB2INST1	AUDIT_MARKS	U	0	0	0	30	35	30
RANGE	BADRANGE	U	0	0	0	12	19	30
RANGE	BADRECORDS	U	0	0	0	12	19	30
DB2INST1	BASE_STUDENT_LIST	U	0	0	0	16	23	30
DB2INST1	BIG	T	8	8	8	100	0	30
DB2INST1	BOOKS	U	0	0	0	18	18	30
DB2INST1	CARPPOOL	U	0	0	0	13	41	30
DB2INST1	CASENULL	U	0	0	0	48	18	79
DB2INST1	CATALOG	U	0	0	0	40	50	50
DB2INST1	CHAR_ALO1C01	A	144	144	144	100	0	30
DB2INST1	CHAR_ALO1C02	A	144	144	144	100	0	30
DB2INST1	CHAR_ALO1C03	A	144	144	144	100	0	30
DB2INST1	CHAR_ALO1C04	A	144	144	144	100	0	30
DB2INST1	CHAR_ALO1C05	A	144	144	144	100	0	30

When this screen is initially displayed, the compressed column size is based on Static compression. If you want to see what the table sizes would be based on other compression algorithms, click on column title (Static, Adaptive, BLU) to have the compression value recomputed (Adaptive Example):

**DB2 Compression Estimator**

Introduction | Disclaimer | Connect | Options | Tables | **Details** | Indexes | Details | Summary

## ④ Data Compression Details



Schema	Table	Original[K]	Current[K]	Adapt[K]	%Static	%Adapt	%BU
ATT	TRAVEL	8	8	8	42	44	77
C	CHAR_NILXC3	5446	5446	1594	70	71	99
C	CHAR_NILXC4	6904	6904	1664	76	76	99
C	CHAR_NILXC2	3944	3944	1464	59	63	90
C	CHAR_NILXC5	8432	8432	1856	78	78	99
C	CHAR_NILXC7	11432	11432	2288	89	90	99
C	CHAR_NILC12	1384	1384	1384	0	0	35
C	CHAR_NILXC6	9880	9880	1976	80	80	99
C	CHAR_NILXC9	14296	14296	2576	83	82	99
C	CHAR_NILXC1	2472	2472	1440	35	42	99
C	CHAR_NILC19	1880	1880	1880	0	0	35
C	CHAR_NILC3	1384	1384	1384	0	0	35
C	CHAR_NILC4	1384	1384	1384	0	0	35
C	CHAR_NILCX	1976	1976	1976	0	0	35
C	CHAR_NILC15	1480	1480	1480	0	0	35
C	CHAR_NILC17	1680	1680	1664	0	0	35
C	CHAR_NILC8	1776	1776	1776	0	0	35
C	CHAR_NILC6	1584	1584	1584	0	0	35
C	CHAR_NILC8	12912	12912	2328	92	93	99
C	CHAR_NILC11	1384	1384	1384	0	0	35
C	STAT5	8	8	8	47	50	99
C	CHAR_NILXCX	16008	16008	2568	55	59	99
CHLOE	PRICES	0	0	0	22	28	35
TOTAL	TOTAL	0	0	0	0	0	35

Summary Indexes Exit

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If you want to see what the compression values would be for an individual table, click on the row that the table name is on. For instance, the following screen shows details on the WITHOUT COMPRESSION table:

**Data Compression Details**

Object	Name	Current	Estimated	%BLU
Schema	DB2INST1			61
Table	WITHOUT_COMPRESSION			56
Compression Info				56
BLU Eligible				56
Compression Type	Percentage Savings	Table Size(K)		
Uncompressed	0	2864		50
Current	0	2864		56
Static	50	1432		56
Adaptive	54	1320		56
BLU	75	720		75
Column	Type	Range	Unique	Length
A	CHARACTER	50000	1	20
B	CHARACTER	50000	1	20
C	INTEGER	50000	4	4
D	INTEGER	50000	50000	4

The information column is either blank (a good table for compression) or may contain one of the following codes:

- A/B/S - Table is already compressed using Adaptive/BLU/Static Compression

The table is already compressed so the program will use the current compression value for the results. The original size of the table is computed by taking the current size of the table and the percentage savings found in the system catalog tables.

- C - Catalog table

If you requested that Catalog tables (SYSTEM) be included in any of the totals, these

tables would be flagged with a "C" in the list. SYSTEM tables cannot be compressed and will be excluded from any compression calculations. However, System tables and indexes will be included in the overall totals.

- U - Statistics are missing

Statistics are critical to computing the potential compression of a table. In the event that statistics are not available, the compression estimator will base the calculations on the "worst" case scenario. For instance, if there are no distribution statistics available for a numeric column, the estimator must assume that the data has a random distribution. Tables that contain zero rows will still have compression estimates computed based on these random distribution values.

- T - Tiny table

In order for automatic compression to occur, the table must be at least 2M in size. If the table is less than 2M then it will be flagged with this code. The other reason for this warning is for tables that still use the old page format in DB2. A page in DB2 can contain no more than 255 entries in the old format, so compressing rows on a page may not result in any savings because the empty space can't be filled up with more rows.

There is an additional column that gives more details if the table cannot be converted to columnar format. The column marked "B" can have one of three values:

- P - This is a range-partitioned table that must be combined into a single table. When it is combined into one, it will be eligible for BLU compression.
- U - The table contains a data type that BLU currently does not support. This could be XML, LONG VARCHAR, BLOB, CLOB, DBCLOB, DECFLOAT or any Oracle compatibility data types. Refer to the DB2 reference manuals for more details on these restrictions.
- Blank - The table is eligible for BLU compression.

Below the table summary information is a grid that displays the columns that make up that particular table.

Column	Type	Rows	Unique	Length	Average
A	CHARACTER	50000	1	20	20
B	CHARACTER	50000	1	20	20
C	INTEGER	50000	4	4	4
D	INTEGER	50000	50000	4	4

This information may be useful in determining whether or not low, medium, or high data patterns should be used in the compression estimates. Pressing the next arrow (Indexes) will display a similar graph but based on potential index compression.

## Results (Indexes)



The program will do a similar analysis on the Indexes in the database. As the program runs it will display a graph that represents the number of indexes and the levels of compression achieved. The left side of the display shows the total number of indexes, the total index size, the potential compressed size, and a final compression percentage. Note that index compression uses a different algorithm from table compression. Index compression was designed to save space but not at the expense of index performance. This results in much smaller savings as compared to tables (typically <30%).

This particular database did not have many indexes so that is why there are very few bars highlighted in the graph.

The three graphs represent different levels of potential index compression you could achieve:

1. Static Compression/Adaptive

The compression algorithm is identical for all indexes whether or not Static or Adaptive compression was used. Since Index compression was only introduced in DB2 9.7, any prior releases will not see any of these savings.

2. BLU Compression

BLU compression for indexes is really just the elimination of the index! DB2 BLU tables do not use indexes, nor are you able to create them. For this reason, any indexes against a table are dropped if the table is in columnar format. However, there are some index types (and associated tables) that BLU cannot drop or use. These are any objects that contain XML, Long Fields, Oracle data types (NUMBER, VARCHAR2) and DECFLOAT. For these tables, the Static Index compression values are used.



The database that this estimate was done against had very few user indexes. Pressing the next arrow (Results) will give more detailed information on the indexes. (Note: These details will be hidden if you selected to exclude detailed display).

Schema	Table	Index	Comment	BLU Comment	Original Size	Current Size	Static Size	%Static	%BLU
COMP	EMPLOYEE	IDXSALARY			1286	1080	1080	84	100
COMP	EMPLOYEE	IDN			723	224	224	31	100
COMP	EMPLOYEE	IDNDEPTID			720	216	216	30	100
DBZINST1	STUDENTS	SQL121020104111450			64	64	64	100	100
RANGE	TOTALSALES	IDXTOTALSALES[0]			32	32	24	75	100
RANGE	TOTALSALES	IDXTOTALSALES[2]			32	32	24	75	100
RANGE	TOTALSALES	IDXTOTALSALES[1]			24	24	24	100	100
DBZINST1	EMPLOYEE	SQL12102010535670			8	8	8	100	100
DBZINST1	EMPLOYEE	SQL12102010535650			8	8	8	100	100
DBZINST1	EMPLOYEE	IXEMP2			8	8	8	100	100
DBZINST1	EMPLOYEE	IX1			8	8	8	100	100
DBZINST1	EMPLOYEE	IX_EMPLOYEE			8	8	8	100	100
DBZINST1	DEPARTMENT	XDEPT2			8	8	8	100	100
DBZINST1	DEPARTMENT	XDEPT3			8	8	8	100	100
DBZINST1	DISTRICT	SQL121020102850540			8	8	8	100	100
DBZINST1	EMPLOYEE	PK_EMPLOYEE			8	8	8	100	100
ATT	TRAVEL	SQL130321044005480			8	8	8	100	100
DBZINST1	EXPLAIN_ARGUMENT	ARG_11			8	8	8	100	100
DBZINST1	DEPARTMENT	PK_DEPARTMENT			8	8	8	100	100
DBZINST1	EXPLAIN_STATEMENT	STMT_11			8	8	8	100	100
DBZINST1	EXPLAIN_STREAM	STM_11			8	8	8	100	100
DBZINST1	OBJECT_METRICS	SQL121015094642100			8	8	8	100	100
DBZINST1	EXPLAIN_STATEMENT	SQL121015095144140			8	8	8	100	100
DBZINST1	EMPLOYEE	SQL121015103110535650			8	8	8	100	100

You can sort the list by any one of the first 8 columns (Schema, Table Name, Index Name, Comment, BLU Comment, Original Size, Current Size, and Compressed Size) by clicking on the title of the column. To recompute the compression using one of the other algorithms (Static or BLU), click on the title with the compression format. This will recompute the index savings. Note: Static and Adaptive compression use the same index compression algorithms so the results are found under Static compression.

Compression estimates on an individual index can be computed by clicking on the index name.

Schema	Table	Index	Comment	BLU Comment	Original Size	Current Size	Static Size	%Static	%BLU
COMP	EMPLOYEE	IDXSALARY			1286	1080	1080	84	100
COMP	EMPLOYEE	IDN			723	224	224	31	100
COMP	EMPLOYEE	IDNDEPTID			720	216	216	30	100
DBZINST1	STUDENTS	SQL121020104111450			64	64	64	100	100
RANGE	TOTALSALES	IDXTOTALSALES[0]			32	32	24	75	100
RANGE	TOTALSALES	IDXTOTALSALES[2]			32	32	24	75	100
RANGE	TOTALSALES	IDXTOTALSALES[1]			24	24	24	100	100
DBZINST1	EMPLOYEE	SQL12102010535670			8	8	8	100	100
DBZINST1	EMPLOYEE	SQL12102010535650			8	8	8	100	100
DBZINST1	EMPLOYEE	IXEMP2			8	8	8	100	100
DBZINST1	EMPLOYEE	IX1			8	8	8	100	100
DBZINST1	EMPLOYEE	IX_EMPLOYEE			8	8	8	100	100
DBZINST1	DEPARTMENT	XDEPT2			8	8	8	100	100
DBZINST1	DEPARTMENT	XDEPT3			8	8	8	100	100
DBZINST1	DISTRICT	SQL121020102850540			8	8	8	100	100
DBZINST1	EMPLOYEE	PK_EMPLOYEE			8	8	8	100	100
ATT	TRAVEL	SQL130321044005480			8	8	8	100	100
DBZINST1	EXPLAIN_ARGUMENT	ARG_11			8	8	8	100	100
DBZINST1	DEPARTMENT	PK_DEPARTMENT			8	8	8	100	100
DBZINST1	EXPLAIN_STATEMENT	STMT_11			8	8	8	100	100
DBZINST1	EXPLAIN_STREAM	STM_11			8	8	8	100	100
DBZINST1	OBJECT_METRICS	SQL121015094642100			8	8	8	100	100
DBZINST1	EXPLAIN_STATEMENT	SQL121015095144140			8	8	8	100	100
DBZINST1	EMPLOYEE	SQL121015103110535650			8	8	8	100	100



The information column is either blank (a good index for compression) or may contain one of the following code:

- C - Catalog Index

If you requested that Catalog Indexes (SYSTEM) be included in any of the totals, these indexes would be flagged with a "C" in the list. SYSTEM indexes cannot be compressed and will be excluded from any compression calculations. However, System tables and indexes will be included in the overall totals.

- U - Statistics are missing

Statistics are critical to computing the potential compression of an index. In the event that statistics are not available, the compression estimator will base the calculations on the "worst" case scenario. For instance, if there are no distribution statistics available for a index column, the estimator must assume that the data has a random distribution. Indexes that contain zero rows will still have compression estimates computed based on these random distribution values.

Columnar tables will ignore these indexes.

- T - Tiny Index

In order for automatic compression to occur, the index must be at least 2M in size. If the index is less than 2M then it will be flagged with this code. Columnar tables will ignore these indexes.

- B - Block Indexes

Block indexes are used for MDC tables and are already highly compressed. These indexes are ignored when using columnar tables (DB2 BLU).

- X - XML Index not compressed

This program does not compute XML index compression, so any XML indexes are ignored. The XML data type is currently not supported by DB2 BLU so you must use ROW format for the table. In this case the index cannot be dropped when using DB2 BLU.

- x - XML Index compressed

This is an XML index that has already been compressed. DB2 BLU cannot use XML data types, so the table and index must be used in ROW format and cannot be converted to COLUMNAR format.

- 0 - Zero cardinality

Statistics are present for the index, but no rows exist. This could happen when you create a table and an index for it, but haven't loaded any data. DB2 BLU would ignore these indexes.

- N - No compression

The reason for this warning is for indexes that end up being larger because of compression overhead. In this case index compression will not take effect. DB2 BLU would ignore these indexes.

- ? - Unknown

An unrecognized index format (used for future compatibility).

- Z - Index already compressed

DB2 has already compressed the index so there is no need to calculate the compression rate. From a DB2 BLU perspective this index could be dropped. The percent savings for this index are found in the system catalog and is used to compute what the original index size would have been.

- z - Index already compressed but no statistics

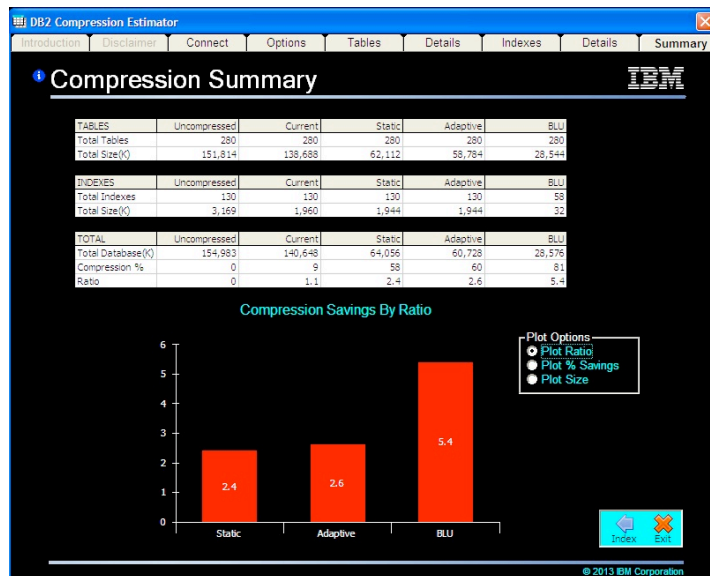
DB2 has already compressed the index but the statistics are missing so the program can't determine what the current size of the index is.

There is an additional field that gives more details if the index cannot be dropped when converting to columnar format. The column marked "B" can have one of three values:

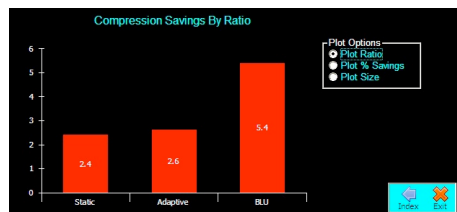
- P - This is a primary key index on the table and BLU will continue to maintain and use this index. When the table is converted to columnar format, the primary index will remain in place so the index will continue to occupy space in the database.
- U - This is an XML index that BLU currently does not support. The base table would not be converted to columnar format so this index must remain in place.
- Blank - The index can be dropped when converting to columnar format.

After viewing the Index Details page, you can get an entire summary of all of the tables and indexes by pressing the Summary button.

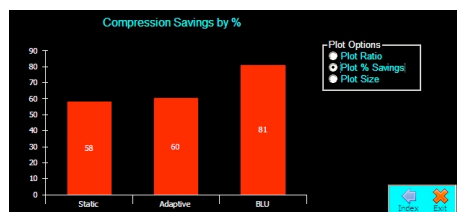
# Summary



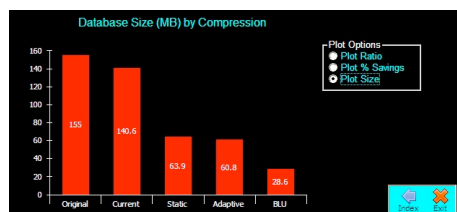
The summary page breaks down the compression results by compression algorithm (Static, Adaptive, and BLU). The graph below the summary gives a visual representation of the savings ratio between the three different compression algorithms.



You can change the graph to display the savings as a percentage by selecting the Plot % Savings button:



You can also graph the size of the database:



The results of the current session are saved into three separate files:

- DB-TABLES.xls - Table details
- DB-INDEXES.xls - Index details
- DB-SUMMARY.xls -Summary information

The "DB" is replaced with the name of the database you are analysing. If the program finds an existing analysis on disk, it will overwrite the previous version.

The exported file will contain the detailed table or index information:

	A	B	C	D	E	F	G	H	I	J	K
1	DB2 Compression Estimator										
2	Version	2013.10.03									
3	Date	10/3/2013									
4	Time	2:38:08 PM									
5											
6	Schema	Table	Comment	BLU	Original(K)	Current(K)	%Static	Static(K)	%Adaptive	Adaptive(K)	%BLU
7	ATT	TRAVEL	T		0	0	42	0	44	0	77
8	C	CHAR_ILC1C1			1384	1384	0	1384	0	1384	85
9	C	CHAR_ILC1C2			1384	1384	0	1384	0	1384	85
10	C	CHAR_ILC1C3			1384	1384	0	1384	0	1384	85
11	C	CHAR_ILC1C4			1384	1384	0	1384	0	1384	85
12	C	CHAR_ILC1C5			1480	1480	0	1480	0	1480	85
13	C	CHAR_ILC1C6			1584	1584	0	1584	0	1584	86
14	C	CHAR_ILC1C7			1680	1680	0	1680	1	1664	85
15	C	CHAR_ILC1C8			1776	1776	0	1776	0	1776	85
16	C	CHAR_ILC1C9			1880	1880	0	1880	0	1880	85
17	C	CHAR_ILC1CX			1976	1976	0	1976	0	1976	85
18	C	CHAR_ILC1C1			2472	2472	35	1608	42	1440	90
19	C	CHAR_ILC1C2			2644	2644	0	1664	63	1464	90
20	C	CHAR_ILC1C3			5444	5444	70	1640	71	1584	90
21	C	CHAR_ILC1C4			6904	6904	75	1728	76	1664	90
22	C	CHAR_ILC1C5			8432	8432	78	1856	78	1856	90
23	C	CHAR_ILC1C6			9880	9880	80	1976	80	1976	90
24	C	CHAR_ILC1C7			11432	11432	80	2288	85	2288	90
25	C	CHAR_ILC1C8			12912	12912	82	2328	82	2328	90
26	C	CHAR_ILC1C9			14296	14296	82	2576	82	2576	90
27	C	CHAR_ILC1CX			16008	16008	83	2728	84	2568	90
28	C	STATS	T		0	0	47	0	50	0	91
29	CHLOB	PRICES	U		0	0	22	0	28	0	96
30	COBRA	DEPT	U		0	0	36	0	48	0	91
31	COBRA	EMPL	U	U	0	0	24	0	29	0	29
32	COBRA	EMPLOYEE	U		0	0	0	0	5	0	79
33	COBRA	TABLESOK	U		0	0	22	0	27	0	87
34	COBRA	TOTAL SALARY	U		0	0	0	0	0	0	79
35	COMP	DEPARTMENTS	U		0	0	39	0	44	0	90
36	COMP	EMPLOYEE	A	U	7152	3676	41	4224	60	3676	88

At this point you can exit the simulator, or click on any of the tabs on the top of the screen to go back to a previous step, or change the database that you are analysing.

## Interpreting Results

There are a couple of points to remember when analysing these results. The program does not look at any of the raw data but uses the information in the system catalog tables instead. The more up to date these statistics are, the better an estimate the program can make.

The estimates are based on extensive testing against similar data types and columns. However, wide variations can occur depending on the distribution of values in a column, and whether a pattern crosses multiple columns. The program can only predict compression at an individual column level while DB2 can find patterns that cross column boundaries.

Testing has shown that the compression estimator is typically +/-10% across the entire database. Using the compression functions built-in to DB2 will give you the most accurate compression estimate.

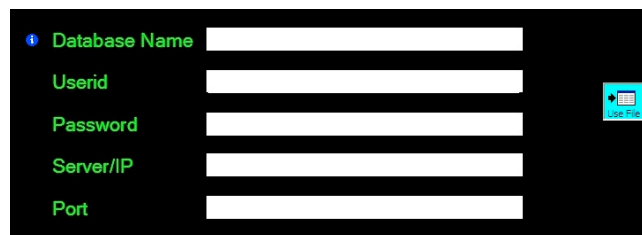
The final database size estimated by the program is based on the information found in the catalog tables. If the statistics are out of date then the answer will be inaccurate. The total size is based on regular table objects, regular indexes, and system catalog tables. Long Objects, XML Objects, procedures, and other non-data objects will not be included in the estimate. The database size is close to what would be produced with a DB2MOVE command that extracts all of the data and DLL for a given database.

You have the option of adjusting some of the settings that are used by the program to determine the level of compression applied to a table.

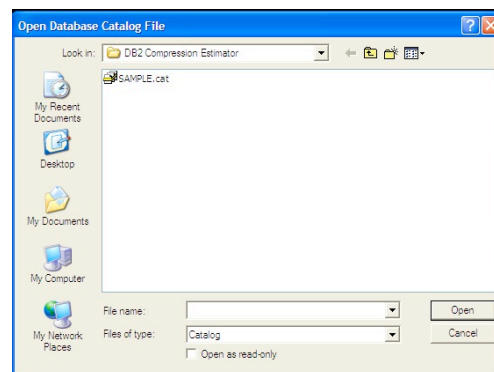
Once you have viewed the summary screen, you can always return to the OPTIONS screen and modify the level of Data Patterns. When you set a value on this screen, the next compression estimate will use the updated data patterns. There is no need to re-connect to the database since you will be using the catalog that is found on disk, rather than a direct connection.

## **Sample Database**

The program installs a sample catalogue (SAMPLE.CAT) in the installation directory. If you are not connected to a DB2 system you can still try out the estimator by selecting “Use File” in the “Select Database” panel:

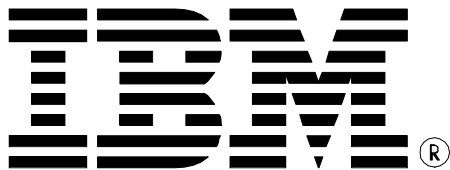


Then select the SAMPLE.cat file from the file selection dialog:



You can then do the analysis using this SAMPLE catalogue table.

Every time you complete an analysis of a connected database, a catalogue file will be written to the installation directory. This allows you to do further analysis against the database without having to directly connect to it. Note that if you restricted the analysis to a certain schema or set of tables, the catalogue will only contain those schemas and tables. If you want to have the most flexibility in using this catalogue feature, you should run the first analysis against the entire database. Then you can go back and be more selective in your analysis, but use the file instead of a direct database connection.



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