Package ‘RODBC’

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Author Brian Ripley [aut, cre],
Maintainer Brian Ripley <ripley@stats.ox.ac.uk>
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Description

Package RODBC implements ODBC database connectivity.

See the package manual for details of installation and use. (This will show up as a vignette, and can be accessed via `RShowDoc("RODBC", package="RODBC")`.)

Details

Two groups of functions are provided. The mainly internal odbc* commands implement low-level access to the ODBC functions of similar name. The sql* functions operate at a higher level to read, save, copy and manipulate data between data frames and SQL tables. Many connections can be open at once to any combination of DSN-hosts.

Author(s)

Michael Lapsley and Brian Ripley

Usage

```r
odbcTables(channel, catalog = NULL, schema = NULL,
            tableName = NULL, tableType = NULL, literal = FALSE)
```

```r
odbcQuery(channel, query, rows_at_time = attr(channel, "rows_at_time"))
```

```r
odbcFetchRows(channel, max = 0, buffsize = 1000,
               nullstring = NA_character_, believeNRows = TRUE)
```

```r
odbcGetErrMsg(channel)
```

```r
odbcClearError(channel)
```
**odbc-low-level**

**Arguments**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>channel</td>
<td>connection handle as returned by <code>odbcConnect</code>, of class &quot;RODBC&quot;.</td>
</tr>
<tr>
<td>catalog, schema, tableName, tableType</td>
<td>NULL or character: whether these do anything depends on the ODBC driver. The first three can be length-one character vectors, and <code>tableType</code> can specify zero or more types.</td>
</tr>
<tr>
<td>literal</td>
<td>logical: should arguments be interpreted literally or including wildcards?</td>
</tr>
<tr>
<td>query</td>
<td>any valid SQL statement.</td>
</tr>
<tr>
<td>rows_at_time</td>
<td>The number of rows to fetch at a time, between 1 and 1024. Not all drivers work correctly with values &gt; 1: see <code>sqlQuery</code>.</td>
</tr>
<tr>
<td>max</td>
<td>limit on the number of rows to fetch, with 0 indicating no limit.</td>
</tr>
<tr>
<td>buffsize</td>
<td>the number of records to be transferred at a time.</td>
</tr>
<tr>
<td>nullstring</td>
<td>character string to be used when reading SQL_NULL_DATA items in a column transferred as character.</td>
</tr>
<tr>
<td>believeNRows</td>
<td>logical. Is the number of rows returned by the ODBC connection believable?</td>
</tr>
</tbody>
</table>

**Details**

These are low-level functions called by `sqlTables, sqlQuery, sqlGetResults` and similar high-level functions. They are likely to be confined to the `RODBC` namespace in the near future.

`odbcTables` enquires about the tables on the connected database. Whether arguments after the first do anything and what they do depends on the ODBC driver: see the help on `sqlTables` for some driver-specific details.

`odbcFetchRows` returns a data frame of the pending rowset, limited to `max` rows if `max` is greater than 0.

`buffsize` may be increased from the default of 1000 rows for increased performance on a large dataset. This only has an effect when `max = 0` and `believeNRows = FALSE` (either for the ODBC connection or for this function call), in which case `buffsize` is used as the initial allocation length of the `R` vectors to hold the results. (Values of less than 100 are increased to 100.) If the initial size is too small the vector length is doubled, repeatedly if necessary.

**Value**

- `odbcGetErrMsg` returns a (possibly zero-length) character vector of pending messages.
- `odbcClearError` returns nothing, invisibly.

The others return 1 on success and -1 on failure, indicating that a message is waiting to be retrieved `odbcGetErrMsg`. `odbcFetchRows` may return -2 indicating "No Data", the message that would be returned by `odbcGetErrMsg`.

**Author(s)**

Michael Lapsley and Brian Ripley

**See Also**

- `sqlQuery, odbcConnect, odbcGetErrMsg`
odbcClose

ODBC Close Connections

Description
Close connections to ODBC databases.

Usage

odbcClose(channel)

## S3 method for class 'RODBC'
close(con, ...)

odbcCloseAll()

Arguments

channel, con RODBC connection object as returned by odbcConnect.
... additional arguments passed from the generic.

Details

odbcClose cleans up and frees resources. It is also the method for the generic function close.

odbcCloseAll closes all open channels (amongst the first 1000 used in the session).

Channels are closed at the end of an R session, and may also be closed by garbage collection if no object refers to them. In both cases a warning is given (but may not be seen at the end of a console session).

Value

Function odbcClose returns a logical indicating if it succeeded, invisibly unless a warning is given. The close method returns 0 (success) or 1, invisibly.

Author(s)
Michael Lapsley and Brian Ripley

See Also

odbcConnect
odbcConnect  ODBC Open Connections

Description

Open connections to ODBC databases.

Usage

odbcConnect(dsn, uid = "", pwd = "", ...)

odbcDriverConnect(connection = "", case, believeNRows = TRUE,
   colQuote, tabQuote = colQuote,
   interpretDot = TRUE, DBMSencoding = "",
   rows_at_time = 100, readOnlyOptimize = FALSE)

odbcReConnect(channel, ...)

Arguments

dsn character string. A registered data source name.
uid, pwd UID and password for authentication (if required).
connection character string. See your ODBC documentation for the format.
... further arguments to be passed to odbcDriverConnect.
case Controls case changes for different DBMS engines. See ‘Details’.
channel RODBC connection object returned by odbcConnect.
believeNRows logical. Is the number of rows returned by the ODBC connection believable?
   Not true for some Oracle and Sybase drivers, apparently, nor for Actual Technologies’ SQLite driver for Mac OS X.
colQuote, tabQuote how to quote column (table) names in SQL statements. Can be of length 0 (no quoting), a length–1 character vector giving the quote character to be used at both ends, or a length–2 character vector giving the beginning and ending quotes. ANSI SQL uses double quotes, but the default mode for a MySQL server is to use backticks.
   The defaults are backtick (‘`’) if the DBMS is identified as "MySQL" by the driver, and double quote otherwise. A user reported that the SAS ODBC driver required colQuote = NULL.
interpretDot logical. Should table names of the form qualifier.table be interpreted as table table in schema qualifier (and for MySQL ‘schema’ means database)?
DBMSencoding character string naming the encoding returned by the DBMS. The default means the encoding of the locale \( \mathcal{R} \) is running under. Values other than the default require iconv to be available: it always is from \( \mathcal{R} \) 2.10.0, otherwise see capabilities.
odbcConnect

rows_at_time  The default number of rows to fetch at a time, between 1 and 1024. Not all
drivers work correctly with values > 1: see sqlQuery.

readOnlyOptimize
    logical: should the connection be optimized for read-only access?

Details

odbcConnect establishes a connection to the specified DSN, and odbcDriverConnect allows a
more flexible specification via a connection string. odbcConnect uses the connection string
"DSN=dsn;UID=uid;PWD=pwd",
omitting the last two components if they are empty.

For DBMSs that translate table and column names case must be set appropriately. Allowable
values are "nochange", "toupper" and "tolower" as well as the names of databases where the
behaviour is known to us (currently "mysql", which maps to lower case on Windows but not on Linux, "postgresql" (lower), and "msaccess" (nochange)). If case is not specified, the default is
"nochange" unless the appropriate value can be figured out from the DBMS name reported by the
ODBC driver. It is likely that "toupper" is desirable on IBM's DB2, but this is not enforced.

Note that readOnlyOptimize may do nothing, and is not guaranteed to enforce read-only access.
With drivers that support it, it is used to optimize locking strategies, transaction management and
so on. It does make access to Mimer read-only, and has no effect on MySQL.

Function odbcReConnect re-connects to a database using the settings of an existing (and presum-
ably now closed) channel object. Arguments given in the original call can be overridden as needed.

Note that if a password is supplied (either as a pwd argument or as part of the DSN) it may be stored
in the connection.string element of the return value, but the value is (from RODBC 1.3-0)
replaced by ******. (This will break odbcReConnect.)

If it is possible to set the DBMS or ODBC driver to communicate in the character set of the R
session then this should be done. For example, MySQL can set the communication character set via
SQL, e.g. 'SET NAMES 'utf8'''

Value

A non-negative integer which is used as handle if no error occurred, -1 otherwise. A successful
return has class "RODBC", and attributes including

connection.string
    the full ODBC connection string.

case
    the value of case.

id
    a numeric ID for the channel.

believeNRows
    the value of believeNRows.

rows_at_time
    the value of rows_at_time.

Note

Several errors which have been reported as bugs in RODBC 1.3-0 which were in fact ODBC driver
ersors that can be circumvented by setting rows_at_time = 1 (and the warning under that argument
has always been there). The drivers involved have been third-party Oracle drivers and old SQL
Server drivers.
Author(s)
Michael Lapsley, Brian Ripley

See Also
odbcClose, sqlQuery, odbcGetInfo

Examples
## Not run:
# MySQL
channel <- odbcConnect("test", uid="ripley", pwd="secret")
# PostgreSQL: 'case' should be detected automatically
channel <- odbcConnect("pg", uid="ripley", pwd="secret", case="postgresql")

# re-connection
odbcCloseAll()
channel <- odbcReConnect(channel) # must re-assign as the data may change

## End(Not run)

### Description
List known ODBC data sources.

### Usage
odbcDataSources(type = c("all", "user", "system"))

### Arguments
type User DSNs, system DSNs or all?

### Value
A named character vector of DSN descriptions, with names the DSNs.

### Author(s)
Brian Ripley
Examples

```r
## Not run:
> odbcDataSources()

  test   sqlite3   testpg
  "MySQL" "sqlite3" "PostgreSQL"

or

  testdb3   sqlite3
  "MySQL ODBC 3.51 Driver" "SQLite3 ODBC Driver"

  bdr.xls   testacc
  "Microsoft Excel Driver (*.xls)" "Microsoft Access Driver (*.mdb)"

  testpg
  "PostgreSQL ANSI" "SQL Native Client"

  Oracle
  "Oracle in Oradb10g_home1" "IBM DB2 ODBC DRIVER - DB2COPY1"

  testpgw   testdb5
  "PostgreSQL Unicode" "MySQL ODBC 5.1 Driver"

  SQLite Datasource   SQLite UTF-8 Datasource
  "SQLite ODBC Driver" "SQLite ODBC (UTF-8) Driver"

  SQLite3 Datasource
  "SQLite3 ODBC Driver"

## End(Not run)
```

---

**odbcGetInfo**  
*Request Information on an ODBC Connection*

**Description**

Request information on an ODBC connection.

**Usage**

```r
odbcGetInfo(channel)
```

**Arguments**

- `channel` connection handle as returned by `odbcConnect` of class "RODBC".

**Value**

A named character string giving information on the database and ODBC driver in use on the connection channel.

**Author(s)**

Brian Ripley
## Examples

### Not run:
```r
odbcGetInfo(channel) # under Windows XP
```

### MySQL returned
```r
DBMS_Name    DBMS_Ver     Driver_ODBC_Ver
"MySQL"      "5.1.35-community"  "03.51"
Data_Source_Name      Driver_Name     Driver_Ver
"testdb5"           "myodbc5.dll"     "05.01.0005"
ODBC_Ver    Server_Name
"03.52.0000" "localhost via TCP/IP"
```

### MS Access returned
```r
DBMS_Name    DBMS_Ver     Driver_ODBC_Ver    Data_Source_Name
"ACCESS"       "04.00.0000"        "03.51"        "testacc"
Driver_Name    Driver_Ver     ODBC_Ver     Server_Name
"odbcjt32.dll" "04.00.6305"        "03.52.0000"  "ACCESS"
```

### SQL Server 2008 Express returned
```r
DBMS_Name    DBMS_Ver     Driver_ODBC_Ver
"Microsoft SQL Server"  "10.00.1600"        "03.52"
Data_Source_Name      Driver_Name     Driver_Ver
"SQLServer"           "SQLNCLI.DLL"        "09.00.4035"
ODBC_Ver    Server_Name
"03.52.0000" "AUK\SQLEXPRESS"
```

### End(Not run)

---

### odbcSetAutoCommit

**ODBC Set Auto-Commit Mode**

**Description**

Set ODBC database connection's auto-commit mode.

**Usage**

```r
odbcSetAutoCommit(channel, autoCommit = TRUE)
```

```r
odbcEndTran(channel, commit = TRUE)
```

**Arguments**

- **channel**: RODBC connection object returned by `odbcConnect`.
- **autoCommit**: logical. Set auto-commit on?
- **commit**: logical. Commit or rollback pending transaction?
setSqlTypeInfo

Details

Auto-commit is a concept supported only by ODBC connections to transactional DBMSs.
If a connection to a transactional DBMS is in auto-commit mode (the default), then all its SQL
statements will be executed and committed as individual transactions. Otherwise, its SQL state-
ments are grouped into transactions that are terminated by an execution of commit or rollback.
Switching a connection to auto-commit mode commits the pending transaction.
By default, new connections are in auto-commit mode. If auto-commit mode has been disabled, a
call to odbcEndTran or an SQL commit statement must be executed in order to commit changes;
otherwise, pending database changes will not be saved.

Value

odbcSetAutoCommit stops if channel is an invalid connection. The function returns -1 on error, 0
on success and on success with a message that would be returned by odbcGetErrMsg.

Author(s)

Norman Yamada, Yasser El-Zein

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setSqlTypeInfo Specify or Query a Mapping of R Types to DBMS Types

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Description

Specify or retrieve a mapping of R types to DBMS datatypes.

Usage

setSqlTypeInfo(driver, value)
getSqlTypeInfo(driver)

Arguments

driver A character string specifying the DBMS_name as returned by odbcGetInfo. Op-
tional for getSqlTypeInfo.
value A named list with character values. This should have names "double", "integer",
"character" and "logical", and values SQL types appropriate to the DBMS.

Details

This information is used by sqlSave if it creates a table in the DBMS and is not overridden by ar-
guments typeInfo or varTypes. Mappings are included for MySQL, PostgreSQL, SQLite, Oracle,
Mimer, DB2 on Windows, and the Microsoft SQL Server, Access, Excel and Dbase drivers.
The SQL types chosen should be nullable to allow NAs to be represented. (Bit and boolean types
often are not.)
sqlColumns

Value
For setSqlTypeInfo none.
For getSqlTypeInfo with an argument, a named list. Without an argument, a data frame.

Author(s)
Brian Ripley

See Also
sqlTypeInfo, sqlSave.

Examples

## Not run:
getSqlTypeInfo()
getSqlTypeInfo("MySQL")
setSqlTypeInfo("Microsoft SQL Server",
            list(double="float", integer="int",
                   character="varchar(255)", logical="varchar(5)")

## End(Not run)

sqlColumns

Query Column Structure in ODBC Tables

Description
Enquire about the column structure of tables on an ODBC database connection.

Usage

sqlColumns(channel, sqtable, errors = FALSE, as.is = TRUE,
            special = FALSE, catalog = NULL, schema = NULL,
            literal = FALSE)

sqlPrimaryKeys(channel, sqtable, errors = FALSE, as.is = TRUE,
               catalog = NULL, schema = NULL)

Arguments

channel character string: a database table (or view or similar) name accessible from the
connection object as returned by odbcConnect.
sqtable character string: a database table (or view or similar) name accessible from the
connected DSN. If wildcards are allowed (only for sqlColumns(special=FALSE)),
results for all matching tables.
errors logical: if true halt and display error, else return -1.
as.is see sqlGetResults.
special logical. If true, return only the column(s) needed to specify a row uniquely. Depending on the database, there might be none.
catalog, schema NULL or character: additional information on where to locate the table: see sqlTables for driver-specific details. Wildcards may be supported in schema for sqlColumns(special=FALSE).
literal logical: wildcards may be interpreted in schema and sqtable: if so this may suppress such interpretation.

Details

The argument special = TRUE to sqlColumns returns the column(s) needed to specify a row uniquely. This is intended to form the basis of an SQL WHERE clause for update queries (see sqlUpdate), and what (if anything) it does is DBMS-specific. On many DBMSs it will return the primary keys if present: on others it will return a pseudo-column such as ‘ROWID’ (Oracle) or ‘_ROWID_’ (SQLite), either always (Oracle) or if there is no primary key.

Primary keys are implemented in some DBMSs and drivers. A table can have a single column designated as a primary key or, in some cases, multiple columns. Primary keys should not be nullable (that is, cannot contain missing values). They can be specified as part of a ‘CREATE TABLE’ statement or added by a ‘ALTER TABLE’ statement.

In principle specifying catalog should select an alternative database in MySQL or an attached database in SQLite, but neither works with current drivers.

If sqtable contains ‘.’ and neither catalog nor schema is supplied, an attempt is made to interpret qualifier.table as table table in schema qualifier (and for MySQL ‘schema’ means ‘database’, but the current drivers fail to interpret catalog=, so this does not yet work). (This can be suppressed by opening the connection with interpretDot = FALSE.) This has been tested successfully on PostgreSQL, SQL Server, Oracle, DB2 and Mimer.

Whether wildcards are accepted for sqtable and schema in sqlColumns(special = FALSE) depends on the driver and may be changed by the value of literal. For example, the PostgreSQL driver tested allowed wildcards in schema only if literal = FALSE and never in sqtable, whereas two MySQL drivers both failed to match a database when catalog was supplied and always allowed wildcards in sqtable even if literal = TRUE.

Value

A data frame on success. If no data is returned, either a zero-row data frame or an error. (For example, if there are no primary keys or special column(s) in this table an empty data frame is returned, but if primary keys are not supported by the ODBC driver or DBMS, an error code results.) The column names are not constant across ODBC versions so the data should be accessed by column number.

For sqlPrimaryKeys and sqlColumns(special=FALSE) the first four columns give the catalog, schema, table and column names (where applicable). For sqlPrimaryKeys the next two columns are the column sequence number (starting with 1) and name of the primary key: drivers can define further columns. For sqlColumns(special=FALSE) there are 18 columns: see https://learn.microsoft.com/en-us/sql/odbc/reference/syntax/sqlcolumns-function?view=sql-server-ver15.

Those beyond the first 6 shown in the examples give the ‘ordinal position’ (column 17) and further characteristics of the column type: see sqlTypeInfo.
For the numeric values returned by `sqlColumns(special=TRUE)` see https://learn.microsoft.com/en-us/sql/odbc/reference/syntax/sqlspecialcolumns-function?view=sql-server-ver15: the scope should always be 2 (the session) since that is the scope requested in the call. For the PSEUDO_COLUMN column, the possible values are 0 (unknown), 1 (no) and 2 (yes).

**Author(s)**
Michael Lapsley and Brian Ripley

**See Also**
`odbcConnect`, `sqlQuery`, `sqlFetch`, `sqlSave`, `sqlTables`, `odbcGetInfo`

**Examples**
```r
## Not run: ## example results from MySQL
> channel <- odbcConnect("test")
> sqlDrop(channel, "USArrests", errors = FALSE) # precautionary
> sqlSave(channel, USArrests, addPK = TRUE)
> sqlColumns(channel, "USArrests")
   TABLE_CAT TABLE_SCHEM TABLE_NAME COLUMN_NAME DATA_TYPE TYPE_NAME
1  ripley    <NA>   USArrests  rownames        12  varchar
2  ripley    <NA>   USArrests   Murder          8  double
3  ripley    <NA>   USArrests  Assault          4  integer
4  ripley    <NA>   USArrests UrbanPop          4  integer
5  ripley    <NA>   USArrests    Rape           8  double
... 12 more columns
> sqlColumns(channel, "USArrests", special = TRUE)
   SCOPE COLUMN_NAME DATA_TYPE TYPE_NAME COLUMN_SIZE BUFFER_LENGTH
1  2  rownames        12  varchar  255  255
   DECIMAL_DIGITS PSEUDO_COLUMN
1  NA  1
> sqlPrimaryKeys(channel, "USArrests")
   TABLE_CAT TABLE_SCHEM TABLE_NAME COLUMN_NAME KEY_SEQ PK_NAME
1  <NA>    <NA>   USArrests  rownames           1 PRIMARY
> sqlDrop(channel, "USArrests")
> close(channel)
## End(Not run)
```

---

**ODBC Copy**

**Description**

Functions to copy tables or result sets from one database to another.
Usage

\texttt{sqlCopy(channel, query, destination, destchannel = channel, verbose = FALSE, errors = TRUE, ...)}

\texttt{sqlCopyTable(channel, srctable, desttable, destchannel = channel, verbose = FALSE, errors = TRUE)}

Arguments

- \texttt{channel, destchannel}: connection handle as returned by \texttt{odbcConnect}.
- \texttt{query}: any valid SQL statement
- \texttt{destination, srctable, desttable}: character: a database table name accessible from the connected DSN.
- \texttt{verbose}: Display statements as they are sent to the server?
- \texttt{errors}: if TRUE halt and display error, else return -1.
- ...: additional arguments to be passed to \texttt{sqlSave}.

Details

\texttt{sqlCopy} as is like \texttt{sqlQuery}, but saves the output of \texttt{query} in table \texttt{destination} on channel \texttt{destchannel}.

\texttt{sqlCopyTable} copies the structure of \texttt{srctable} to \texttt{desttable} on DSN \texttt{destchannel}. This is within the limitations of the ODBC lowest common denominator. More precise control is possible via \texttt{sqlQuery}.

Value

See \texttt{sqlGetResults}.

Author(s)

Michael Lapsley and Brian Ripley

See Also

\texttt{sqlQuery, sqlSave}

Examples

```r
## Not run: ## example for a l/casing DBMS
sqlSave(channel, USArrests, rownames = "state")
query <- paste("select state, murder from usarrests",
    "where rape > 30", "order by murder")
sqlCopy(channel, query, "HighRape", rownames = FALSE)
sqlFetch(channel, "HighRape", rownames = "state", max = 5)
sqlDrop(channel, "HighRape")

## End(Not run)
```
Deletion Operations on Tables in ODBC databases

Description

sqlClear deletes all the rows of the table sqtable.
sqlDrop removes the table sqtable (if permitted).

Usage

sqlClear(channel, sqtable, errors = TRUE)
sqlDrop(channel, sqtable, errors = TRUE)

Arguments

channel: connection object as returned by odbcConnect.
sqtable: character string: a database table name accessible from the connected DSN. This can be a ‘dotted’ name of the form schema.table.
errors: logical: if TRUE halt and display error, else return -1.

Details

These submit ‘TRUNCATE TABLE’ and ‘DROP TABLE’ SQL queries respectively.
‘Dotted’ table names are allowed on systems that support them but the existence of the table is not checked and so attempting these operations on a non-existent table will give a low-level error. (This can be suppressed by opening the connection with interpretDot = FALSE.)
The default ‘drop’ behaviour in Oracle is to move the table to the ‘recycle bin’: use

sqlQuery(channel, "PURGE recyclebin")

to empty the recycle bin.
The current user might not have privileges to allow these operations, and Actual Technologies’ Mac OS X SQLite driver has a bug causing them silently to fail.

Value

If errors = FALSE, a numeric value, invisibly. Otherwise a character string or invisible().

Author(s)

Michael Lapsley and Brian Ripley

See Also

odbcConnect, sqlQuery, sqlFetch, sqlSave, sqlTables, odbcGetInfo
Reading Tables from ODBC Databases

Description

Read some or all of a table from an ODBC database into a data frame.

Usage

sqlFetch(channel, sqtable, ..., colnames = FALSE, rownames = TRUE)

sqlFetchMore(channel, ..., colnames = FALSE, rownames = TRUE)

Arguments

channel connection handle returned by odbcConnect.
sqtable a database table name accessible from the connected DSN. This should be either a literal character string or a character vector of length 1.
... additional arguments to be passed to sqlQuery or sqlGetResults. See ‘Details’.
colnames logical: retrieve column names from first row of table? (For use when sqlSave(colnames = TRUE) was used.)
rownames either logical or character. If logical, retrieve row names from the first column (rownames) in the table? If character, the column name to retrieve them from.

Details

Note the ‘table’ includes whatever table-like objects are provided by the DBMS, in particular views and system tables.

sqlFetch by default retrieves the entire contents of the table sqtable. Rownames and column names are restored as indicated (assuming that they have been placed in the table by the corresponding arguments to sqlSave).

Alternatively, sqlFetch can fetch the first max rows, in which case sqlFetchMore will retrieve further result rows, provided there has been no other ODBC query on that channel in the meantime.

These functions try to cope with the peculiar way the Excel ODBC driver handles table names, and to quote Access table names which contain spaces. Dotted table names, e.g. myschema.mytable, are allowed on systems that support them, unless the connection was opened with interpretDot = FALSE.

Useful additional parameters to pass to sqlQuery or sqlGetResults include

max: limit on the number of rows to fetch, with 0 (the default) indicating no limit.
nullstring: character string to be used when reading SQL_NULL_DATA character items from the database: default NA_character_.
na.strings: character string(s) to be mapped to NA when reading character data: default "NA".
as.is: as in sqlGetResults.
dec: The character for the decimal place to be assumed when converting character columns to numeric.
rows_at_time: Allow for multiple rows to be retrieved at once. See sqlQuery.

Value

A data frame on success, or a character or numeric error code (see sqlQuery).

Note

If the table name desired is not a valid SQL name (alphanumeric plus _) and these functions are not able to interpret the name, you can use sqlQuery with whatever quoting mechanism your DBMS vendor provides (e.g. [ ] on some Microsoft products and backticks on MySQL).

Author(s)

Michael Lapsley and Brian Ripley

See Also

sqlSave, sqlQuery, odbcConnect, odbcGetInfo

Examples

```r
## Not run:
channel <- odbcConnect("test")
sqlSave(channel, USArrests)
sqfetch(channel, "USArrests") # get the lot
sqlFetch(channel, "USArrests", max = 20, rows_at_time = 10)
sqfetchmore(channel, max = 20)
sqlfetchmore(channel) # get the rest
sqlDrop(channel, "USArrests")
close(channel)

## End(Not run)
```
sqlQuery

Usage

sqlQuery(channel, query, errors = TRUE, ..., rows_at_time)

sqlGetResults(channel, as.is = FALSE, errors = FALSE,
               max = 0, buffsize = 1000,
               nullstring = NA_character_, na.strings = "NA",
               believeNRows = TRUE, dec = getOption("dec"),
               stringsAsFactors = FALSE)

Arguments

channel connection handle as returned by `odbcConnect`.
query any valid SQL statement.
errors logical: if true halt and display error, else return -1.
... additional arguments to be passed to `sqlGetResults`.
rows_at_time The number of rows to fetch at a time, between 1 and 1024. See ‘Details’.
as.is which (if any) columns returned as character should be converted to another
type? Allowed values are as for `read.table`. See ‘Details’.
max limit on the number of rows to fetch, with 0 indicating no limit.
buffsize an initial guess at the number of rows, used if max = 0 and believeNRows ==
false.
nullstring character string to be used when reading SQL_NULL_DATA character items from
the database.
na.strings character vector of strings to be mapped to NA when reading character data.
believeNRows logical. Is the number of rows returned by the ODBC connection believable?
This might have been set to false when the channel was opened, and if so that
setting cannot be overridden.
dec The character for the decimal place to be assumed when converting character
columns to numeric.
stringsAsFactors logical: should columns returned as character and not excluded by as.is and
not converted to anything else be converted to factors?

Details

`sqlQuery` is the workhorse function of `RODBC`. It sends the SQL statement `query` to the server,
using connection `channel` returned by `odbcConnect`, and retrieves (some or all of) the results via
`sqlGetResults`.

The term ‘query’ includes any valid SQL statement including table creation, alteration, updates etc
as well as ‘SELECT’s. The `sqlQuery` command is a convenience wrapper that first calls `odbcQuery`
and then `sqlGetResults`. If finer-grained control is needed, for example over the number of rows
fetched, additional arguments can be passed to `sqlQuery` or the underlying functions called directly.

`sqlGetResults` is a mid-level function. It is called after a call to `sqlQuery` or `odbcQuery` to
retrieve waiting results into a data frame. Its main use is with `max` set to non-zero when it will
retrieve the result set in batches with repeated calls. This is useful for very large result sets which can be subjected to intermediate processing.

Where possible sqlGetResults transfers data in binary form: this happens for columns of (ODBC) SQL types double, real, integer and smallint, and for binary SQL types (which are transferred as lists of raw vectors, given class "ODBC_binary"). All other SQL data types are converted to character strings by the ODBC interface.

This paragraph applies only to SQL data types which are returned by ODBC as character vectors. If when creating the connection (see odbcConnect) DBMSencoding was set to a non-empty value, the character strings are re-encoded. Then if as.is is true for a column, it is returned as a character vector. Otherwise (where detected) date, datetime and timestamp values are converted to the "Date" or "POSIXct" class. (Some drivers seem to confuse times with dates, so times may get converted too. Also, some DBMSs (e.g. Oracle's) idea of date is a date-time.) Remaining cases are converted by R using type.convert. When character data are to be converted to numeric data, the setting of options("dec") is used to map the character used by the ODBC driver in setting decimal points—this is set to a locale-specific value when RODBC is initialized if it is not already set.

Using buffsize will yield a marginal increase in speed if set to no less than the maximum number of rows when believeNRows = FALSE. (If set too small it can result in unnecessarily high memory use as the buffers will need to be expanded.)

Modern drivers should work (and work faster, especially if communicating with a remote machine) with rows_at_time = 100, the usual default, or more. (However, some drivers may mis-fetch multiple rows, in which case set rows_at_time = 1 when creating the connection.) However, if max is specified then this may fetch too many rows and hence it could be reduced (but then this setting applies to all subsequent fetches from that result set). Another circumstance in which you might want to reduce rows_at_time is if there are large character columns in the result set: with the default value up to 6Mb of buffer for each such column could be allocated to store intermediate results.

Value

On success, a data frame (possibly with 0 rows) or character string. On error, if errors = TRUE a character vector of error message(s), otherwise an invisible integer error code -1 (general, call odbcGetErrMsg for details) or -2 (no data, which may not be an error as some SQL statements do return no data).

Author(s)

Michael Lapsley and Brian Ripley

See Also

odbcConnect, sqlFetch, sqlSave, sqlTables, odbcQuery

Examples

```r
## Not run:
channel <- odbcConnect("test")
sqlSave(channel, USArrests, rownames = "State", verbose = TRUE)
# options(dec=".") # optional, if DBMS is not locale-aware or set to ASCII
```
## note case of State, Murder, Rape are DBMS-dependent,
## and some drivers need column and table names double-quoted.
sqlQuery(channel, paste("select State, Murder from USArrests",
                       "where Rape > 30 order by Murder"))
close(channel)

## End(Not run)

sqlSave

### Write a Data Frame to a Table in an ODBC Database

**Description**

Write or update a table in an ODBC database.

**Usage**

```r
sqlSave(channel, dat, tablename = NULL, append = FALSE, rownames = TRUE, colnames = FALSE, verbose = FALSE, safer = TRUE, addPK = FALSE, typeInfo, varTypes, fast = TRUE, test = FALSE, nastring = NULL)
```

```r
sqlUpdate(channel, dat, tablename = NULL, index = NULL, verbose = FALSE, test = FALSE, nastring = NULL, fast = TRUE)
```

**Arguments**

- **channel**: connection handle returned by `odbcConnect`.
- **dat**: a data frame.
- **tablename**: character: a database table name accessible from the connected DSN. If missing, the name of `dat`.
- **index**: character. Name(s) of index column(s) to be used.
- **append**: logical. Should data be appended to an existing table?
- **rownames**: either logical or character. If logical, save the row names as the first column `rownames` in the table? If character, the column name under which to save the `rownames`.
- **colnames**: logical: save column names as the first row of table?
- **verbose**: display statements as they are sent to the server?
- **safer**: logical. If true, create a non-existing table but only allow appends to an existing table. If false, allow `sqlSave` to attempt to delete all the rows of an existing table, or to drop it.
- **addPK**: logical. Should `rownames` (if included) be specified as a primary key?
- **typeInfo**: optional list of DBMS datatypes. Should have elements named "character", "double" and "integer".
sqlSave

varTypes
an optional named character vector giving the DBMSs datatypes to be used for some (or all) of the columns if a table is to be created.

fast
logical. If false, write data a row at a time. If true, use a parametrized INSERT INTO or UPDATE query to write all the data in one operation.

test
logical: if TRUE show what would be done, only.

nastring
optional character string to be used for writing NAs to the database. See ‘Details’.

Details

sqlSave saves the data frame dat in the table tablename. If the table exists and has the appropriate structure it is used, or else it is created anew. If a new table is created, column names are remapped by removing any characters which are not alphanumeric or _, and the types are selected by consulting arguments varTypes and typeInfo, then looking the driver up in the database used by getSqlTypeInfo or failing that by interrogating sqlTypeInfo.

If rownames = TRUE the first column of the table will be the row labels with colname rowname: rownames can also be a string giving the desired column name (see ‘Examples’). If colnames is true, the column names are copied into row 1. This is intended for cases where case conversion alters the original column names and it is desired that they are retained. Note that there are drawbacks to this approach: it presupposes that the rows will be returned in the correct order; not always valid. It will also cause numeric columns to be returned as factors.

Argument addPK = TRUE causes the row names to be marked as a primary key. This is usually a good idea, and may allow database updates to be done. However, the ODBC drivers for some DBMSs (e.g. Access) do not support primary keys, and earlier versions of the PostgreSQL ODBC driver generated internal memory corruption if this option is used.

sqlUpdate updates the table where the rows already exist. Data frame dat should contain columns with names that map to (some of) the columns in the table. It also needs to contain the column(s) specified by index which together identify the rows to be updated. If index = NULL, the function tries to identify such columns. First it looks for a primary key for the table, then for the column(s) that the database regards as the optimal for defining a row uniquely (these are returned by sqlColumns(special = TRUE): if this returns a pseudo-column it cannot be used as we do not have values for the rows to be changed). Finally, the row names are used if they are stored as column "rownames" in the table.

When fast = TRUE, NAs are always written as SQL nulls in the database, and this is also the case if fast = FALSE and nastring = NULL (its default value). Otherwise nastring gives the character string to be sent to the driver when NAs are encountered: for all but the simplest applications it will be better to prepare a data frame with non-null missing values already substituted.

If fast = FALSE all data are sent as character strings. If fast = TRUE, integer and double vectors are sent as types SQL_C_SLONG and SQL_C_DOUBLE respectively. Some drivers seem to require fast = FALSE to send other types, e.g. datetime. SQLite’s approach is to use the data to determine how it is stored, and this does not work well with fast = TRUE.

If tablename contains ‘.’ and neither catalog nor schema is supplied, an attempt is made to interpret qualifier.table names as table table in schema qualifier (and for MySQL ‘schema’ means ‘database’). (This can be suppressed by opening the connection with interpretDot = FALSE.)

Value

1 invisibly for success (and failures cause errors).
sqlTables

List Tables on an ODBC Connection

Description

List the table-like objects accessible from an ODBC connection. What objects are ‘table-like’ depends on the DBMS, ODBC driver and perhaps even the configuration settings: in particular some connections report system tables and some do not.

Usage

sqlTables(channel, errors = FALSE, as.is = TRUE,
          catalog = NULL, schema = NULL, tableName = NULL,
          tableType = NULL, literal = FALSE)
Arguments

channel  connection handle as returned by `odbcConnect`.
errors  if TRUE halt and display error, else return -1.
as.is  as in `sqlGetResults`.
catalog, schema, tableName, tableType  NULL or character: whether these do anything depends on the ODBC driver. The first three can be length-one character vectors, and tableType can specify zero or more types in separate elements of a character vector.
literal  logical: (where supported) should arguments be interpreted literally or including wildcards?

Value

A data frame on success, or character/numeric on error depending on the `errors` argument. (Use `sqlGetResults` for further details of errors.)

The column names depend on the database, containing a third column `TABLE_NAME` (not always in upper case): however, they are supposed to be always in the same order.

The first column is the ‘catalog’ or (in ODBC2 parlance) ‘qualifier’, the second the ‘schema’ or (ODBC2) ‘owner’, the third the name, the fourth the table type (one of "TABLE", "VIEW", "SYSTEM TABLE", "ALIAS", "SYNONYM", or a driver-specific type name) and the fifth column any remarks.

Oddly, the Microsoft Excel driver considers worksheets to be system tables, and named ranges to be tables.

Driver-specific details

Whether the additional arguments are implemented and what they do is driver-specific. The standard SQL wildcards are underscore to match a single character and percent to match zero or more characters (and often backslash will escape these): these are not used for table types. All of these drivers interpret wildcards in `tableName`, and in `catalog` or `schema` where supported.

Setting one of `catalog` or `schema` to "%" and the other and `tableName` to "" should give a list of available catalogs or schemas, whereas

\[
\text{catalog} = "", \text{schema} = "", \text{tableName} = "", \text{tableType} = "%"
\]

should list the supported table types.

For MySQL, `catalog` refers to a database whereas `schema` is mostly ignored, and `literal` is ignored. To list all databases use just `catalog = "%"`. In the 5.1.x driver, use `catalog="db_name"`, `tableName="%"` to list the tables in another database, and to list the table types use the form displayed above.

For PostgreSQL's ODBC driver `catalog` is ignored (except that `catalog = ""` is required when listing schema or table types) and `literal` works for both `schema` and for `tableName`.

SQLite ODBC ignores `catalog` and `schema`, except that the displayed form is used to list table types. So although it is possible to attach databases and to refer to them by the `dotted name` notation, it is apparently impossible to list tables on attached databases.
Microsoft SQL Server 2008 interprets both catalog and schema. With literal = TRUE it only finds tables if schema is set (even to an empty string). Schemas are only listed if they contain objects.

Oracle’s Windows ODBC driver finds no matches if anything non-empty is supplied for the catalog argument. Unless a schema is specified it lists tables in all schemas. It lists available table types as just "TABLE" and "VIEW", but other types appear in listings. With literal = TRUE it only finds tables if schema is set (even to an empty string).

DB2 implements schemas but not catalogs. literal = TRUE has no effect. In some uses case matters and upper-case names must be used for schemas.

The Microsoft Access and Excel drivers interpret catalog as the name of the Access .mdb or Excel .xls file (with the path but without the extension): wildcards are interpreted in catalog (for files in the same folder as the attached database) and tableName. Using schema is an error except when listing catalogs or table types. The Excel driver matched tableType = "TABLE" (a named range) but not tableType = "SYSTEM TABLE" (the type returned for worksheets).

The Actual Technologies Access/Excel driver ignores all the additional arguments.

Author(s)

Michael Lapsley and Brian Ripley

See Also

sqlGetResults

Examples

## Not run:
> sqlTables(channel, "USArrests")

## MySQL example

   TABLE_CAT   TABLE_SCHEM   TABLE_NAME   TABLE_TYPE   REMARKS
1   ripley      USArrests    TABLE

## PostgreSQL example

   TABLE_QUALIFIER   TABLE_OWNER   TABLE_NAME   TABLE_TYPE   REMARKS
1   ripley      public      usarrests    TABLE

## Microsoft Access example

> sqlTables(channel)

   TABLE_CAT   TABLE_SCHEM   TABLE_NAME   TABLE_TYPE   REMARKS
1   C:\bdr\test         <NA>      MSysAccessObjects   SYSTEM     TABLE   <NA>
2   C:\bdr\test         <NA>      MSysACEs        SYSTEM   TABLE   <NA>
3   C:\bdr\test         <NA>      MSysObjects      SYSTEM   TABLE   <NA>
4   C:\bdr\test         <NA>      MSysQueries      SYSTEM   TABLE   <NA>
5   C:\bdr\test         <NA>      MSysRelationships SYSTEM   TABLE   <NA>
6   C:\bdr\test         <NA>      hills         TABLE   <NA>
7   C:\bdr\test         <NA>      USArrests      TABLE   <NA>

## End(Not run)
sqlTypeInfo  Request Information about Data Types in an ODBC Database

Description

Request information about data types in an ODBC database

Usage

```r
sqlTypeInfo(channel, type = "all", errors = TRUE, as.is = TRUE)
```

Arguments

- `channel` connection handle as returned by `odbcConnect`.
- `type` The types of columns about which information is requested. Possible values are "all", "char", "varchar", "wchar", "wvarchar" (Unicode), "real", "float", "double", "integer", "smallint", "date", "time", "timestamp", "binary", "varbinary", "longvarbinary" and (its alias) "blob".
- `errors` logical: if true halt and display error, else return -1.
- `as.is` as in `sqlGetResults`.

Details

`sqlTypeInfo` attempts to find the types of columns the database supports: ODBC drivers are not required to support this (but all known examples do). Where it is supported, it is used by `sqlSave` to decide what column types to create when creating a new table in the database.

Value

A data frame on success, or character/numeric on error depending on the `errors` argument. Use `sqlGetResults` for further details of errors.

The columns returned may depend on the ODBC driver manager. For a fully ODBC 3 manager, see https://learn.microsoft.com/en-us/sql/odbc/reference/syntax/sqlgettypeinfo-function?view=sql-server-ver15

the symbolic constants mentioned there will be returned as numbers (and the values of the numeric constants can be found in the ODBC headers such as `sql.h` and `sqlext.h`).

Author(s)

Brian Ripley

See Also

`sqlGetResults`, `odbcGetInfo`
Examples

```r
## Not run:
> names(sqlTypeInfo(channel))
[1] "TYPE_NAME"    "DATA_TYPE"    "COLUMN_SIZE"
[4] "LITERAL_PREFIX" "LITERAL_SUFFIX" "CREATE_PARAMS"
[7] "NULLABLE"      "CASE_SENSITIVE" "SEARCHABLE"
[10] "UNSIGNED_ATTRIBUTE" "FIXED_PREC_SCALE" "AUTO_UNIQUE_VALUE"
[13] "LOCAL_TYPE_NAME" "MINIMUM_SCALE" "MAXIMUM_SCALE"
[16] "SQL_DATATYPE"    "SQL_DATETIME_SUB" "NUM_PREC_RADIX"
[19] "INTERVAL_PRECISION"

## End(Not run)
```
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