Package 'RODBC'

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Title ODBC Database Access

Description An ODBC database interface.

SystemRequirements An ODBC3 driver manager and drivers.

Depends R (>= 4.0.0)

Imports stats

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Contents

`RODBC-package` *ODBC Database Connectivity*

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

`odbc-low-level` *Low-level ODBC functions*

Description

R functions which talk directly to the ODBC interface.

Usage

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

odbcQuery(channel, query, rows_at_time = attr(channel, "rows_at_time"))
odbcFetchRows(channel, max = 0, buffsize = 1000,
              nullstring = NA_character_, believeNRows = TRUE)

odbcGetErrMsg(channel)
odbcClearError(channel)
```

Arguments

channel	connection handle as returned by odbcConnect, of class "RODBC".
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.
literal	logical: should arguments be interpreted literally or including wildcards?
query	any valid SQL statement.
rows_at_time	The number of rows to fetch at a time, between 1 and 1024. Not all drivers work correctly with values > 1: see sqlQuery.
max	limit on the number of rows to fetch, with 0 indicating no limit.
buffsize	the number of records to be transferred at a time.
nullstring	character string to be used when reading SQL_NULL_DATA items in a column transferred as character.
believeNRows	logical. Is the number of rows returned by the ODBC connection believable?

Details

These are low-level functions called by sqlTables, sqlQuery, sqlGetResults and similar high-level functions. They are likely to be confind 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 otheres 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 R is running under. Values other than the default require iconv to be available: it always is from R 2.10.0, otherwise see capabilities.

`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 presumably 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 errors 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)
```

---

odbcDataSources *List ODBC Data Sources*

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

```
## 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                          SQLServer
               "PostgreSQL ANSI"               "SQL Native Client"
                           Oracle                                DB2
       "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                              mimdb
            "SQLite3 ODBC Driver"                           "MIMER"

## End(Not run)
```

---

odbcGetInfo *Request Information on an ODBC Connection*

Description

Request information on an ODBC connection.

Usage

```
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:
odbcGetInfo(channel) # under Windows XP
## MySQL returned
             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
       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
             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

```
odbcSetAutoCommit(channel, autoCommit = TRUE)

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?

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 statements 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

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

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`. Optional 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 arguments `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 `NA`s to be represented. (Bit and boolean types often are not.)

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`	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 columnns: 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

```
## 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)
```

`sqlCopy` *ODBC Copy*

Description

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

Usage

```
sqlCopy(channel, query, destination, destchannel = channel,
        verbose = FALSE, errors = TRUE, ...)

sqlCopyTable(channel, srctable, desttable, destchannel = channel,
             verbose = FALSE, errors = TRUE)
```

Arguments

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

Details

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

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

Value

See sqlGetResults.

Author(s)

Michael Lapsley and Brian Ripley

See Also

sqlQuery, sqlSave

Examples

```
## 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)
```

sqlDrop *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`

sqlFetch *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 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

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

## End(Not run)
```

---

sqlQuery *Query an ODBC Database*

Description

Submit an SQL query to an ODBC database, and retrieve the results.

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

```
## 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

```
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)

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".

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).

Warning

`sqlSave(safer = FALSE)` uses the 'great white shark' method of testing tables (bite it and see). The logic will unceremoniously `DROP` the table and create it anew with its own choice of column types in its attempt to find a writable solution. `test = TRUE` will not necessarily predict this behaviour. Attempting to write indexed columns or writing to pseudo-columns are less obvious causes of failed writes followed by a `DROP`. If your table structure is precious it is up to you back it up.

Author(s)

Michael Lapsley and Brian Ripley

See Also

`sqlFetch`, `sqlQuery`, `odbcConnect`, `odbcGetInfo`

Examples

```
## Not run:
channel <- odbcConnect("test")
sqlSave(channel, USArrests, rownames = "state", addPK=TRUE)
sqlFetch(channel, "USArrests", rownames = "state") # get the lot
foo <- cbind(state=row.names(USArrests), USArrests)[1:3, c(1,3)]
foo[1,2] <- 222
sqlUpdate(channel, foo, "USArrests")
sqlFetch(channel, "USArrests", rownames = "state", max = 5)
sqlDrop(channel, "USArrests")
close(channel)

## End(Not run)
```

---

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

```
catalog = "", schema = "", tableName = "", 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

```
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

```
## 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)
```

Index