

Kalashnikov DB

0.9.3

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Chapter 1

Todo List

Member [AK_acquire_lock](#) (int, int, pthread_t)

Implement a better deadlock detection. This method uses a very simple approach. It waits for 60sec before it restarts a transaction.

Implement a better deadlock detection. This method uses a very simple approach. It waits for 60sec before it restarts a transaction.

Member [AK_acquire_lock](#) (int, int, pthread_t)

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Implement a better deadlock detection. This method uses a very simple approach. It waits for 60sec before it restarts a transaction.

Member [AK_archive_log](#) (int sig)

this function takes static filename to store the failed commands, create certain logic that would make the function to use dynamic filename (this is partly implemented inside [AK_get_timestamp](#), but there is no logic that uses the last file when recovering - [recovery.c](#))
{link} [recovery.c](#) function test

Member [AK_execute_commands](#) (command *, int)

Check multithreading, check if it's working correctly

Check multithreading, check if it's working correctly

Member [AK_execute_commands](#) (command *, int)

Check multithreading, check if it's working correctly

Check multithreading, check if it's working correctly

Member [AK_get_timestamp](#) ()

Think about this in the future when creating multiple binary recovery files. Implementation gives the timestamp, but is not used anywhere for now.

Member [AK_memory_block_hash](#) (int)

The current implementation is very limited it doesn't cope well with collision. recommendation use some better version of hash calculation. Maybe Knuth's memory address hashing function.

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Member [AK_memory_block_hash](#) (int)

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Member `AK_sort_segment` (`char *srcTable`, `char *destTable`, `struct list_node *attributes`)

Make it to suport multiple sort atributes and ASC|DESC ordering

Make it to suport multiple sort atributes and ASC|DESC ordering

Chapter 2

Class Index

2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

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Structure that contains attributes from table header, tasks for this table and counter value	13	
AK_agg_value		
Structure that contains attribute name, date and aggregation task associated	13	
AK_block		
Structure that defines a block of data inside a DB file. It contains address, type, chained_with, AK_free space, last_tuple_dict_id, header and tuple_dict and data	14	
AK_block_activity		
Structure which holds information about each block, whether it is locked for reading or writing. It is important to note such information, to enable quick and thread-safe reading from or writing to disk. Structure contains of: locked_for_reading - thread which locks particular block for reading will set this value locked_for_writing - thread which locks particular block for writing will set this value block_lock - each reading and writing operation will be done atomically and un-interruptable, using this mutex block lock reading_done - represents signal, which sends thread that just finished reading block. This signal will indicate that writing thread can start writing to block writing_done - represents signal, which sends thread that just finished writing to block. This signal will indicate that other threads can start reading from this block or even writing to it thread_holding_lock - the only thread which can unlock locked "block_lock" is the one that locked it. This variable makes sure that ONLY the thread, which actually holds the lock, releases it	14	
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Structure that represents header structure of blocks (describes an attribute inside an object). It contains type, attribute name, integrity, constraint name and constraint code	18	

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Chapter 4

Class Documentation

4.1 `_dictionary_` Struct Reference

Dictionary object.

```
#include <dictionary.h>
```

Public Attributes

- `int n`
- `int size`
- `char ** val`
- `char ** key`
- `unsigned * hash`

4.1.1 Detailed Description

Dictionary object.

This object contains a list of string/string associations. Each association is identified by a unique string key. Looking up values in the dictionary is speeded up by the use of a (hopefully collision-AK_free) hash function.

4.1.2 Member Data Documentation

4.1.2.1 `hash`

```
unsigned* _dictionary_::hash
```

List of string keys

4.1.2.2 key

```
char** _dictionary_::key
```

List of string values

4.1.2.3 size

```
int _dictionary_::size
```

Number of entries in dictionary

4.1.2.4 val

```
char** _dictionary_::val
```

Storage size

The documentation for this struct was generated from the following file:

- [auxi/dictionary.h](#)

4.2 _file_metadata Struct Reference

Public Attributes

- char * **new_path**
- char * **new_name**
- char * **old_path**
- char * **old_name**
- char * **checksum**

The documentation for this struct was generated from the following file:

- [file/blobs.h](#)

4.3 _notifyDetails Struct Reference

Public Attributes

- char * **message**
- NotifyType **type**

The documentation for this struct was generated from the following file:

- [auxi/observable.c](#)

4.4 AK_agg_input Struct Reference

Structure that contains attributes from table header, tasks for this table and counter value.

```
#include <aggregation.h>
```

Collaboration diagram for AK_agg_input:

Public Attributes

- [AK_header](#) **attributes** [[MAX_ATTRIBUTES](#)]
- int **tasks** [[MAX_ATTRIBUTES](#)]
- int **counter**

4.4.1 Detailed Description

Structure that contains attributes from table header, tasks for this table and counter value.

Author

Unknown

The documentation for this struct was generated from the following file:

- [rel/aggregation.h](#)

4.5 AK_agg_value Struct Reference

Structure that contains attribute name, date and aggregation task associated.

```
#include <aggregation.h>
```

Public Attributes

- char **att_name** [[MAX_ATT_NAME](#)]
- char **data** [[MAX_VARCHAR_LENGTH](#)]
- int **agg_task**

4.5.1 Detailed Description

Structure that contains attribute name, date and aggregation task associated.

Author

Unknown

The documentation for this struct was generated from the following file:

- [rel/aggregation.h](#)

4.6 AK_block Struct Reference

Structure that defines a block of data inside a DB file. It contains address, type, chained_with, AK_free space, last_tuple_dict_id, header and tuple_dict and data.

```
#include <dbman.h>
```

Collaboration diagram for AK_block:

Public Attributes

- int [address](#)
block number (address) in DB file
- int [type](#)
block type (can be BLOCK_TYPE_FREE, BLOCK_TYPE_NORMAL or BLOCK_TYPE_CHAINED)
- int [chained_with](#)
address of chained block; NOT_CHAINED otherwise
- int [AK_free_space](#)
AK_free space in block.
- int [last_tuple_dict_id](#)
- [AK_header](#) header [[MAX_ATTRIBUTES](#)]
attribute definitions
- [AK_tuple_dict](#) tuple_dict [[DATA_BLOCK_SIZE](#)]
dictionary of data entries
- unsigned char [data](#) [[DATA_BLOCK_SIZE](#) *[DATA_ENTRY_SIZE](#)]
actual data entries

4.6.1 Detailed Description

Structure that defines a block of data inside a DB file. It contains address, type, chained_with, AK_free space, last_tuple_dict_id, header and tuple_dict and data.

Author

Markus Schatten

The documentation for this struct was generated from the following file:

- [dm/dbman.h](#)

4.7 AK_block_activity Struct Reference

Structure which holds information about each block, whether it is locked for reading or writing. It is important to note such information, to enable quick and thread-safe reading from or writing to disk. Structure contains of: locked_for_reading - thread which locks particular block for reading will set this value locked_for_writing - thread which locks particular block for writing will set this value block_lock - each reading and writing operation will be done atomically and uninterruptable, using this mutex block_lock_reading_done - represents signal, which sends thread that just finished reading block. This signal will indicate that writing thread can start writing to block writing_done - represents signal, which sends thread that just finished writing to block. This signal will indicate that other threads can start reading from this block or even writing to it thread_holding_lock - the only thread which can unlock locked "block_lock" is the one that locked it. This variable makes sure that ONLY the thread, which actually holds the lock, releases it.

```
#include <dbman.h>
```

Public Attributes

- short **locked_for_reading**
- short **locked_for_writing**
- pthread_mutex_t **block_lock**
- pthread_cond_t **writing_done**
- pthread_cond_t **reading_done**
- int * **thread_holding_lock**

4.7.1 Detailed Description

Structure which holds information about each block, whether it is locked for reading or writing. It is important to note such information, to enable quick and thread-safe reading from or writing to disk. Structure contains of: **locked_for_reading** - thread which locks particular block for reading will set this value **locked_for_writing** - thread which locks particular block for writing will set this value **block_lock** - each reading and writing operation will be done atomically and uninterruptable, using this mutex **block_lock** **reading_done** - represents signal, which sends thread that just finished reading block. This signal will indicate that writing thread can start writing to block **writing_done** - represents signal, which sends thread that just finished writing to block. This signal will indicate that other threads can start reading from this block or even writing to it **thread_holding_lock** - the only thread which can unlock **locked_block_lock** is the one that locked it. This variable makes sure that ONLY the thread, which actually holds the lock, releases it.

Author

Domagoj Šitum

The documentation for this struct was generated from the following file:

- [dm/dbman.h](#)

4.8 AK_blocktable Struct Reference

Public Attributes

- unsigned int **allocationtable** [DB_FILE_BLOCKS_NUM_EX]
- unsigned char **bittable** [BITNSLOTS(DB_FILE_BLOCKS_NUM_EX)]
- int **last_allocated**
- int **last_initialized**
- int **prepared**
- time_t **ltime**

The documentation for this struct was generated from the following file:

- [dm/dbman.h](#)

4.9 AK_command_recovery_struct Struct Reference

recovery structure used to recover commands from binary file

```
#include <memoman.h>
```

Public Attributes

- int **operation**
- char **table_name** [[MAX_VARCHAR_LENGTH](#)]
- char **arguments** [[MAX_ATTRIBUTES](#)][[MAX_VARCHAR_LENGTH](#)]
- char **condition** [[MAX_ATTRIBUTES](#)][[MAX_VARCHAR_LENGTH](#)]
- int **finished**

4.9.1 Detailed Description

recovery structure used to recover commands from binary file

Structure that contains all vital information for the command that is about to execute. It is defined by the operation (INSERT, UPDATE, DELETE that are defined inside the const.c file), table where the data is stored, and certain data that will be stored. Updated can be used to save select operation

Author

Tomislav Turek updated by Danko Bukovac

The documentation for this struct was generated from the following file:

- [mm/memoman.h](#)

4.10 AK_command_struct Struct Reference

Public Attributes

- int **id_command**
- char * **tblName**
- void * **parameters**

The documentation for this struct was generated from the following file:

- [sql/command.h](#)

4.11 AK_create_table_struct Struct Reference

Public Attributes

- char **name** [[MAX_ATT_NAME](#)]
- int **type**

The documentation for this struct was generated from the following files:

- [file/table.h](#)
- [file/tableOld.h](#)

4.12 AK_db_cache Struct Reference

Structure that defines global cache memory.

```
#include <memoman.h>
```

Collaboration diagram for AK_db_cache:

Public Attributes

- [AK_mem_block](#) * [cache](#) [[MAX_CACHE_MEMORY](#)]
last recently read blocks
- int [next_replace](#)
next cached block to be replaced (0 - MAX_CACHE_MEMORY-1); depends on caching algorithm

4.12.1 Detailed Description

Structure that defines global cache memory.

Author

Unknown

The documentation for this struct was generated from the following file:

- mm/[memoman.h](#)

4.13 AK_debmod_state Struct Reference

Global structure that holds all relevant information for the debug mode and related functionality.

```
#include <mempro.h>
```

Public Attributes

- uint8_t [init](#)
- uint32_t [page_size](#)
- uint8_t [ready](#)
- void * [page](#) [[AK_DEBMOD_PAGES_NUM](#)]
- uint8_t [used](#) [[AK_DEBMOD_PAGES_NUM](#)]
- uint32_t [nomi](#) [[AK_DEBMOD_PAGES_NUM](#)]
- uint32_t [real](#) [[AK_DEBMOD_PAGES_NUM](#)]
- uint8_t [dirty](#) [[AK_DEBMOD_PAGES_NUM](#)]
- char [function](#) [[AK_DEBMOD_MAX_FUNCTIONS](#)][[AK_DEBMOD_MAX_FUNC_NAME](#)]
- int32_t [last_function_id](#)
- int32_t [alloc_owner](#) [[AK_DEBMOD_PAGES_NUM](#)]
- int32_t [free_owner](#) [[AK_DEBMOD_PAGES_NUM](#)]
- int8_t [func_used_by](#) [[AK_DEBMOD_MAX_FUNCTIONS](#)][[AK_DEBMOD_MAX_FUNCTIONS](#)]
- uint8_t [print](#)
- int32_t [fstack_size](#)
- int32_t [fstack_items](#) [[AK_DEBMOD_STACKSIZE](#)]

4.13.1 Detailed Description

Global structure that holds all relevant information for the debug mode and related functionality.

Author

Marin Rukavina, Mislav Bozicevic

The documentation for this struct was generated from the following file:

- [auxi/mempro.h](#)

4.14 AK_header Struct Reference

Structure that represents header structure of blocks (describes an attribute inside an object). It contains type, attribute name, integrity, constraint name and constraint code.

```
#include <dbman.h>
```

Public Attributes

- int [type](#)
type of attribute
- char [att_name](#) [[MAX_ATT_NAME](#)]
attribute name
- int [integrity](#) [[MAX_CONSTRAINTS](#)]
standard integrity constraints
- char [constr_name](#) [[MAX_CONSTRAINTS](#)][[MAX_CONSTR_NAME](#)]
extra integrity constraint names
- char [constr_code](#) [[MAX_CONSTRAINTS](#)][[MAX_CONSTR_CODE](#)]
extra integrity constraint codes

4.14.1 Detailed Description

Structure that represents header structure of blocks (describes an attribute inside an object). It contains type, attribute name, integrity, constraint name and constraint code.

Author

Markus Schatten

The documentation for this struct was generated from the following file:

- [dm/dbman.h](#)

4.15 AK_mem_block Struct Reference

Structure that defines a block of data in memory.

```
#include <memoman.h>
```

Collaboration diagram for AK_mem_block:

Public Attributes

- [AK_block * block](#)
pointer to block from DB file
- int [dirty](#)
dirty bit (BLOCK_CLEAN if unchanged; BLOCK_DIRTY if changed but not yet written to file)
- unsigned long [timestamp_read](#)
timestamp when the block has lastly been read
- unsigned long [timestamp_last_change](#)
timestamp when the block has lastly been changed

4.15.1 Detailed Description

Structure that defines a block of data in memory.

Author

Unknown

The documentation for this struct was generated from the following file:

- mm/[memoman.h](#)

4.16 AK_operand Struct Reference

Public Attributes

- char **value** [[MAX_VARCHAR_LENGTH](#)]
- int **type**

The documentation for this struct was generated from the following file:

- rel/[projection.h](#)

4.17 AK_query_mem Struct Reference

Structure that defines global query memory.

```
#include <memoman.h>
```

Collaboration diagram for AK_query_mem:

Public Attributes

- [AK_query_mem_lib](#) * [parsed](#)
parsed queries
- [AK_query_mem_dict](#) * [dictionary](#)
obtained data dictionaries
- [AK_query_mem_result](#) * [result](#)
obtained query results

4.17.1 Detailed Description

Structure that defines global query memory.

Author

Unknown

The documentation for this struct was generated from the following file:

- [mm/memoman.h](#)

4.18 AK_query_mem_dict Struct Reference

Structure that defines global query memory for data dictionaries.

```
#include <memoman.h>
```

Collaboration diagram for AK_query_mem_dict:

Public Attributes

- [AK_tuple_dict](#) * [dictionary](#) [[MAX_QUERY_DICT_MEMORY](#)]
last used data dictionaries
- [int](#) [next_replace](#)
next dictionary to be replaced (0 - MAX_QUERY_DICT_MEMORY-1); field pointer (LIFO)

4.18.1 Detailed Description

Structure that defines global query memory for data dictionaries.

Author

Unkown

The documentation for this struct was generated from the following file:

- [mm/memoman.h](#)

4.19 AK_query_mem_lib Struct Reference

Structure that defines global query memory for libraries.

```
#include <memoman.h>
```

Public Attributes

- char [parsed](#) [[MAX_QUERY_LIB_MEMORY](#)]
last parsed queries; to be changed to more adequate data structure
- int [next_replace](#)
next query to be replaced (0 - MAX_QUERY_LIB_MEMORY-1); field pointer (LIFO)

4.19.1 Detailed Description

Structure that defines global query memory for libraries.

Author

Unkown

The documentation for this struct was generated from the following file:

- [mm/memoman.h](#)

4.20 AK_query_mem_result Struct Reference

Structure that defines global query memory for results.

```
#include <memoman.h>
```

Collaboration diagram for AK_query_mem_result:

Public Attributes

- [AK_results](#) * **results**
- int [next_replace](#)
next result to be replaced (0 - MAX_QUERY_RESULT_MEMORY-1); field pointer (LIFO)

4.20.1 Detailed Description

Structure that defines global query memory for results.

Author

Unknown

The documentation for this struct was generated from the following file:

- mm/[memoman.h](#)

4.21 AK_redo_log Struct Reference

Structure that defines global redo log.

```
#include <memoman.h>
```

Collaboration diagram for AK_redo_log:

Public Attributes

- [AK_command_recovery_struct](#) **command_recovery** [MAX_REDO_LOG_ENTRIES]
- int **number**

4.21.1 Detailed Description

Structure that defines global redo log.

The structure defines an array of commands being executed at the moment. If and when commands fail to execute, the rest of the commands that did not execute will be stored inside a binary file and the system will try recovery and execution for those commands. With the array, we also store a number that defines the number of commands that failed to execute (length of command_recovery array).

Author

Dražen Bandić, updated by Tomislav Turek

The documentation for this struct was generated from the following file:

- mm/[memoman.h](#)

4.22 AK_ref_item Struct Reference

Structure that represents reference item. It contains of table, attributes, parent table and it's attributes, number of attributes, constraint and type of reference.

```
#include <reference.h>
```

Public Attributes

- char **table** [[MAX_ATT_NAME](#)]
- char **attributes** [[MAX_REFERENCE_ATTRIBUTES](#)][[MAX_ATT_NAME](#)]
- char **parent** [[MAX_ATT_NAME](#)]
- char **parent_attributes** [[MAX_REFERENCE_ATTRIBUTES](#)][[MAX_ATT_NAME](#)]
- int **attributes_number**
- char **constraint** [[MAX_VARCHAR_LENGTH](#)]
- int **type**

4.22.1 Detailed Description

Structure that represents reference item. It contains of table, attributes, parent table and it's attributes, number of attributes, constraint and type of reference.

Author

Dejan Franković

The documentation for this struct was generated from the following file:

- [sql/cs/reference.h](#)

4.23 AK_results Struct Reference

Structure used for in-memory result caching.

```
#include <memoman.h>
```

Collaboration diagram for AK_results:

Public Attributes

- unsigned long **result_id**
- int **result_size**
- char **date_created** [80]
- short **free**
- char * **source_table**
- [AK_block](#) * **result_block**
- [AK_header](#) **header** [[MAX_ATTRIBUTES](#)]

4.23.1 Detailed Description

Structure used for in-memory result caching.

Author

Mario Novoselec

The documentation for this struct was generated from the following file:

- [mm/memoman.h](#)

4.24 AK_synchronization_info Struct Reference

Structure for managing the synchronization between multiple threads accessing the same resources (essentially a mutex).

```
#include <auxiliary.h>
```

Public Attributes

- `int` **init**
- `int` **ready**

4.24.1 Detailed Description

Structure for managing the synchronization between multiple threads accessing the same resources (essentially a mutex).

Author

Marko Sinko

The documentation for this struct was generated from the following file:

- [auxi/auxiliary.h](#)

4.25 AK_tuple_dict Struct Reference

Structure that defines a mapping in a header of an object to the actual entries (data). It contains type, address and size.

```
#include <dbman.h>
```

Public Attributes

- int [type](#)
data entry type
- int [address](#)
data entry address (in AK_block->data)
- int [size](#)
*data entry size (using sizeof(***))*

4.25.1 Detailed Description

Structure that defines a mapping in a header of an object to the actual entries (data). It contains type, address and size.

Author

Markus Schatten

The documentation for this struct was generated from the following file:

- [dm/dbman.h](#)

4.26 blocktable Struct Reference

Structure that defines bit status of blocks, last initialized and last allocated index.

```
#include <dbman.h>
```

4.26.1 Detailed Description

Structure that defines bit status of blocks, last initialized and last allocated index.

Author

dv

The documentation for this struct was generated from the following file:

- [dm/dbman.h](#)

4.27 btree_node Struct Reference

Collaboration diagram for btree_node:

Public Attributes

- int **values** [B]
- [struct_add](#) pointers [B+1]

The documentation for this struct was generated from the following file:

- [file/idx/btree.h](#)

4.28 bucket_elem Struct Reference

Structure for defining a single bucket element.

```
#include <hash.h>
```

Collaboration diagram for bucket_elem:

Public Attributes

- unsigned int [value](#)
bucket element hash value
- [struct_add](#) add
bucket element address values

4.28.1 Detailed Description

Structure for defining a single bucket element.

Author

Unknown

The documentation for this struct was generated from the following file:

- [file/idx/hash.h](#)

4.29 cost_eval_t Struct Reference

Structure for cost estimation on relations. It contains value (number of rows in table) and data (used to store table name)

```
#include <rel_eq_assoc.h>
```

Public Attributes

- int **value**
- char **data** [[MAX_VARCHAR_LENGTH](#)]

4.29.1 Detailed Description

Structure for cost estimation on relations. It contains value (number of rows in table) and data (used to store table name)

Author

Dino Laktašić

The documentation for this struct was generated from the following file:

- [opti/rel_eq_assoc.h](#)

4.30 DEBUG_LEVEL Struct Reference

Structure for setting debug level. Divide debug information according to their importance. More levels can be defined in the enum if needed. Each debug level can be easily excluded from output by setting corresponding enum element to 0.

```
#include <debug.h>
```

4.30.1 Detailed Description

Structure for setting debug level. Divide debug information according to their importance. More levels can be defined in the enum if needed. Each debug level can be easily excluded from output by setting corresponding enum element to 0.

Author

Dino Laktašić

The documentation for this struct was generated from the following file:

- [auxi/debug.h](#)

4.31 DEBUG_TYPE Struct Reference

Structure for setting debug type. Divide debug information according to their type (e.g. DB modules). More modules can be additional added to the enum. Each debug type can be easily excluded from output by setting corresponding enum element to 0.

```
#include <debug.h>
```

4.31.1 Detailed Description

Structure for setting debug type. Divide debug information according to their type (e.g. DB modules). More modules can be additional added to the enum. Each debug type can be easily excluded from output by setting corresponding enum element to 0.

Author

Dino Laktašić

The documentation for this struct was generated from the following file:

- [auxi/debug.h](#)

4.32 drop_arguments Struct Reference

Collaboration diagram for drop_arguments:

Public Attributes

- void * **value**
- struct [drop_arguments](#) * **next**

The documentation for this struct was generated from the following file:

- [sql/drop.h](#)

4.33 hash_bucket Struct Reference

Structure for hash bucket for table hashing.

```
#include <hash.h>
```

Collaboration diagram for hash_bucket:

Public Attributes

- int [bucket_level](#)
hash bucket level
- [bucket_elem](#) element [HASH_BUCKET_SIZE]
hash bucket array of [bucket_elem](#) elements

4.33.1 Detailed Description

Structure for hash bucket for table hashing.

Author

Unknown

The documentation for this struct was generated from the following file:

- file/idx/[hash.h](#)

4.34 hash_info Struct Reference

Structure for defining a hash info element.

```
#include <hash.h>
```

Public Attributes

- int [modulo](#)
modulo value for hash function
- int [main_bucket_num](#)
bucket number
- int [hash_bucket_num](#)
hash bucket number

4.34.1 Detailed Description

Structure for defining a hash info element.

Author

Unknown

The documentation for this struct was generated from the following file:

- file/idx/[hash.h](#)

4.35 intersect_attr Struct Reference

Structure defines intersect attribute.

```
#include <intersect.h>
```

Public Attributes

- int [type](#)
type of attribute
- char [att_name](#) [[MAX_ATT_NAME](#)]
attribute name

4.35.1 Detailed Description

Structure defines intersect attribute.

Author

Dino Laktašić

The documentation for this struct was generated from the following file:

- rel/[intersect.h](#)

4.36 list_node Struct Reference

Structure defines a list node.

```
#include <auxiliary.h>
```

Collaboration diagram for list_node:

Public Attributes

- int [type](#)
TODO - type, attribute name, table staviti na početak polja data data type.
- int **size**
- char [data](#) [[MAX_VARCHAR_LENGTH](#)]
loaded data
- char **table** [[MAX_ATT_NAME](#)]
- char **attribute_name** [[MAX_ATT_NAME](#)]
- int **constraint**
- struct [list_node](#) * [next](#)
pointer to next element

4.36.1 Detailed Description

Structure defines a list node.

Author

Ljiljana Pintarić

The documentation for this struct was generated from the following file:

- aux/[auxiliary.h](#)

4.37 list_structure_ad Struct Reference

Collaboration diagram for list_structure_ad:

Public Attributes

- char * [attName](#)
attribute name
- [struct_add](#) [add](#)
addresses
- struct [list_structure_ad](#) * [next](#)
next node pointer

The documentation for this struct was generated from the following file:

- file/idx/[index.h](#)

4.38 list_structure_add Struct Reference

Structure that defines linked list node for index.

```
#include <index.h>
```

4.38.1 Detailed Description

Structure that defines linked list node for index.

The documentation for this struct was generated from the following file:

- file/idx/[index.h](#)

4.39 main_bucket Struct Reference

Structure for defining main bucket for table hashing.

```
#include <hash.h>
```

Collaboration diagram for main_bucket:

Public Attributes

- [bucket_elem](#) [element](#) [[MAIN_BUCKET_SIZE](#)]
main bucket array of [bucket_elem](#) elements

4.39.1 Detailed Description

Structure for defining main bucket for table hashing.

Author

Unknown

The documentation for this struct was generated from the following file:

- file/idx/[hash.h](#)

4.40 memoryAddresses Struct Reference

Structure that represents a linked list of locked addresses.

```
#include <transaction.h>
```

Collaboration diagram for memoryAddresses:

Public Attributes

- int **adresa**
- struct [memoryAddresses](#) * **nextElement**

4.40.1 Detailed Description

Structure that represents a linked list of locked addresses.

Author

Frane Jakelić

The documentation for this struct was generated from the following file:

- trans/[transaction.h](#)

4.41 Observable Struct Reference

Structure that defines the functions for observable object.

```
#include <observable.h>
```

Collaboration diagram for Observable:

Public Attributes

- [AK_observer](#) * **observers** [[MAX_OBSERVABLE_OBSERVERS](#)]
- int **observer_id_counter**
- void * **AK_observable_type**
- int **AK_ObservableType_Def**
- int(* **AK_destroy_observable**)(struct [Observable](#) *)
- int(* **AK_register_observer**)(struct [Observable](#) *, [AK_observer](#) *)
- int(* **AK_unregister_observer**)(struct [Observable](#) *, [AK_observer](#) *)
- int(* **AK_notify_observer**)(struct [Observable](#) *, [AK_observer](#) *)
- int(* **AK_notify_observers**)(struct [Observable](#) *)
- int(* **AK_run_custom_action**)(void *)
- [AK_observer](#) *(* **AK_get_observer_by_id**)(struct [Observable](#) *, int id)

4.41.1 Detailed Description

Structure that defines the functions for observable object.

Author

Ivan Pusic

The documentation for this struct was generated from the following file:

- [auxi/observable.h](#)

4.42 observable_transaction Struct Reference

Structure which defines transaction observable type.

```
#include <transaction.h>
```

4.42.1 Detailed Description

Structure which defines transaction observable type.

Author

Ivan Pusic

The documentation for this struct was generated from the following file:

- [trans/transaction.h](#)

4.43 observable_transaction_struct Struct Reference

Collaboration diagram for observable_transaction_struct:

Public Attributes

- `int(* AK_transaction_register_observer)(struct observable_transaction_struct *, AK_observer *)`
- `int(* AK_transaction_unregister_observer)(struct observable_transaction_struct *, AK_observer *)`
- `void(* AK_lock_released)()`
- `void(* AK_transaction_finished)()`
- `void(* AK_all_transactions_finished)()`
- `AK_observable * observable`

The documentation for this struct was generated from the following file:

- `trans/transaction.h`

4.44 Observer Struct Reference

Structure that defines the functions for observer object.

```
#include <observable.h>
```

Public Attributes

- `int observer_id`
- `void * AK_observer_type`
- `void(* AK_observer_type_event_handler)(void *, void *, AK_ObservableType_Enum)`
- `int(* AK_notify)(struct Observer *, void *observable_type, AK_ObservableType_Enum)`
- `int(* AK_destroy_observer)(struct Observer *)`

4.44.1 Detailed Description

Structure that defines the functions for observer object.

Author

Ivan Pusic

The documentation for this struct was generated from the following file:

- `aux/observable.h`

4.45 observer_lock Struct Reference

Structure which defines transaction lock observer type.

```
#include <transaction.h>
```

Collaboration diagram for `observer_lock`:

Public Attributes

- [AK_observer](#) * **observer**

4.45.1 Detailed Description

Structure which defines transaction lock observer type.

Author

Ivan Pusic

The documentation for this struct was generated from the following file:

- trans/[transaction.h](#)

4.46 root_info Struct Reference

Public Attributes

- int **root**
- int **level** [ORDER]

The documentation for this struct was generated from the following file:

- file/idx/[btree.h](#)

4.47 search_params Struct Reference

Structure that contains attribute name, lower and upper data value, special(NULL or *) which is input for AK_[↔](#) equisearch_unsorted and AK_rangesearch_unsorted.

```
#include <filesearch.h>
```

Public Attributes

- char * [szAttribute](#)
name of attribute
- void * [pData_lower](#)
pointer to lower value of search range
- void * [pData_upper](#)
pointer to upper value of search range
- int [iSearchType](#)
if searching for NULL values, set to SEARCH_NULL, all values -> SEARCH_ALL, particular value -> SEARCH_[↔](#) PARTICULAR, range of values -> SEARCH_RANGE

4.47.1 Detailed Description

Structure that contains attribute name, lower and upper data value, special(NULL or *) which is input for AK_↔
equisearch_unsorted and AK_rangesearch_unsorted.

Author

Unknown

The documentation for this struct was generated from the following file:

- file/[filesearch.h](#)

4.48 search_result Struct Reference

Structure which represents search result of AK_equisearch_unsorted and AK_rangesearch_unsorted.

```
#include <filesearch.h>
```

Public Attributes

- int * [aiTuple_addresses](#)
array of tuple addresses
- int * [aiBlocks](#)
array of blocks to which the tuple addresses are relative
- int [iNum_tuple_addresses](#)
number of tuple addresses/blocks in corresponding arrays
- int * [aiSearch_attributes](#)
array of indexes of searched-for attributes
- int [iNum_search_attributes](#)
number of searched-for attributes in array
- int [iNum_tuple_attributes](#)
number of attributes in tuple

4.48.1 Detailed Description

Structure which represents search result of AK_equisearch_unsorted and AK_rangesearch_unsorted.

Author

Unknown

The documentation for this struct was generated from the following file:

- file/[filesearch.h](#)

4.49 Stack Struct Reference

Structure defines a [Stack](#) element. Every [Stack](#) has its [Vertex](#) pointer and pointer to next [Stack](#) in the linked list.

```
#include <auxiliary.h>
```

Collaboration diagram for Stack:

Public Attributes

- struct [Vertex](#) * **link**
- struct [Stack](#) * **nextElement**

4.49.1 Detailed Description

Structure defines a [Stack](#) element. Every [Stack](#) has its [Vertex](#) pointer and pointer to next [Stack](#) in the linked list.

Author

Frane Jakelić

The documentation for this struct was generated from the following file:

- auxi/[auxiliary.h](#)

4.50 struct_add Struct Reference

Structure defining node address.

```
#include <index.h>
```

Public Attributes

- int [addBlock](#)
block address
- int [indexTd](#)
index table destination

4.50.1 Detailed Description

Structure defining node address.

Author

Unknown

The documentation for this struct was generated from the following file:

- file/idx/[index.h](#)

4.51 Succesor Struct Reference

Structure defines a [Succesor](#) element. Every [Succesor](#) has its [Vertex](#) pointer and pointer to next [Succesor](#) in the linked list.

```
#include <auxiliary.h>
```

Collaboration diagram for Succesor:

Public Attributes

- struct [Vertex](#) * **link**
- struct [Succesor](#) * **nextSuccesor**

4.51.1 Detailed Description

Structure defines a [Succesor](#) element. Every [Succesor](#) has its [Vertex](#) pointer and pointer to next [Succesor](#) in the linked list.

Author

Frane Jakelić

The documentation for this struct was generated from the following file:

- auxi/[auxiliary.h](#)

4.52 table_addresses Struct Reference

Structure that defines start and end address of extent.

```
#include <dbman.h>
```

Public Attributes

- int [address_from](#) [MAX_EXTENTS_IN_SEGMENT]
sturcture for extents start end stop adresses
- int **address_to** [MAX_EXTENTS_IN_SEGMENT]

4.52.1 Detailed Description

Structure that defines start and end address of extent.

Author

Matija Novak

The documentation for this struct was generated from the following file:

- dm/[dbman.h](#)

4.53 TestResult Struct Reference

Used so tests can report the amount of successful tests.

```
#include <test.h>
```

Public Attributes

- int **testSucceeded**
- int **testFailed**
- char **implemented**

4.53.1 Detailed Description

Used so tests can report the amount of successful tests.

This structure is used so tests can report the amount of successful tests.

Author

Igor Rinkovec

The documentation for this struct was generated from the following file:

- auxi/test.h

4.54 threadContainer Struct Reference

Structure that represents a linked list of threads.

```
#include <transaction.h>
```

Collaboration diagram for threadContainer:

Public Attributes

- pthread_t **thread**
- struct [threadContainer](#) * **nextThread**

4.54.1 Detailed Description

Structure that represents a linked list of threads.

Author

Frane Jakelić

The documentation for this struct was generated from the following file:

- [trans/transaction.h](#)

4.55 transaction_list_elem Struct Reference

Structure that represents LockTable entry about transaction lock holder.Element indexed by Hash table.

```
#include <transaction.h>
```

Collaboration diagram for transaction_list_elem:

Public Attributes

- int **address**
- int **lock_type**
- int **isWaiting**
- struct [transaction_locks_list_elem](#) * **DLLLocksHead**
- struct [transaction_list_elem](#) * **nextBucket**
- struct [transaction_list_elem](#) * **prevBucket**
- [AK_observer_lock](#) * **observer_lock**

4.55.1 Detailed Description

Structure that represents LockTable entry about transaction lock holder.Element indexed by Hash table.

Author

Frane Jakelić

The documentation for this struct was generated from the following file:

- [trans/transaction.h](#)

4.56 transaction_list_head Struct Reference

Structure that represents LockTable entry about doubly linked list of collision in Hash table.

```
#include <transaction.h>
```

Collaboration diagram for transaction_list_head:

Public Attributes

- struct [transaction_list_elem](#) * **DLLHead**

4.56.1 Detailed Description

Structure that represents LockTable entry about doubly linked list of collision in Hash table.

Author

Frane Jakelić

The documentation for this struct was generated from the following file:

- trans/[transaction.h](#)

4.57 transaction_locks_list_elem Struct Reference

Structure that represents LockTable entry about transaction resource lock.

```
#include <transaction.h>
```

Collaboration diagram for transaction_locks_list_elem:

Public Attributes

- pthread_t **TransactionId**
- int **lock_type**
- int **isWaiting**
- struct [transaction_locks_list_elem](#) * **nextLock**
- struct [transaction_locks_list_elem](#) * **prevLock**

4.57.1 Detailed Description

Structure that represents LockTable entry about transaction resource lock.

Author

Frane Jakelić

The documentation for this struct was generated from the following file:

- trans/[transaction.h](#)

4.58 transactionData Struct Reference

Structure used to transport transaction data to the thread.

```
#include <transaction.h>
```

Collaboration diagram for transactionData:

Public Attributes

- int **lengthOfArray**
- [command](#) * **array**

4.58.1 Detailed Description

Structure used to transport transaction data to the thread.

Author

Frane Jakelić

The documentation for this struct was generated from the following file:

- trans/[transaction.h](#)

4.59 TypeObservable Struct Reference

Collaboration diagram for TypeObservable:

Public Attributes

- [NotifyDetails](#) * **notifyDetails**
- char *(* **AK_get_message**)(struct [TypeObservable](#) *)
- int(* **AK_custom_register_observer**)(struct [TypeObservable](#) *, [AK_observer](#) *)
- int(* **AK_custom_unregister_observer**)(struct [TypeObservable](#) *, [AK_observer](#) *)
- void(* **AK_set_notify_info_details**)(struct [TypeObservable](#) *, NotifyType type, char *message)
- [AK_observable](#) * **observable**

The documentation for this struct was generated from the following file:

- auxi/[observable.c](#)

4.60 TypeObserver Struct Reference

Collaboration diagram for TypeObserver:

Public Attributes

- [AK_TypeObservable](#) * **observable**
- [AK_observer](#) * **observer**

The documentation for this struct was generated from the following file:

- [auxi/observable.c](#)

4.61 Vertex Struct Reference

Structure defines a [Vertex](#) node element. Every [Vertex](#) has its VertexId, index, lowLink and pointer to next edge and vertex.

```
#include <auxiliary.h>
```

Collaboration diagram for Vertex:

Public Attributes

- int **vertexId**
- int **index**
- int **lowLink**
- struct [Successor](#) * **nextSuccessor**
- struct [Vertex](#) * **nextVertex**

4.61.1 Detailed Description

Structure defines a [Vertex](#) node element. Every [Vertex](#) has its VertexId, index, lowLink and pointer to next edge and vertex.

Author

Frane Jakelić

The documentation for this struct was generated from the following file:

- [auxi/auxiliary.h](#)

Chapter 5

File Documentation

5.1 auxi/auxiliary.c File Reference

```
#include "auxiliary.h"
```

Include dependency graph for auxiliary.c:

5.2 auxi/auxiliary.h File Reference

```
#include "constants.h"
#include "configuration.h"
#include "test.h"
#include "assert.h"
#include "time.h"
#include "string.h"
#include "ctype.h"
#include "debug.h"
#include "mempro.h"
```

Include dependency graph for auxiliary.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [list_node](#)
Structure defines a list node.
- struct [Vertex](#)
Structure defines a [Vertex](#) node element. Every [Vertex](#) has its VertexId, index, lowLink and pointer to next edge and vertex.
- struct [Successor](#)
Structure defines a [Successor](#) element. Every [Successor](#) has its [Vertex](#) pointer and pointer to next [Successor](#) in the linked list.
- struct [Stack](#)
Structure defines a [Stack](#) element. Every [Stack](#) has its [Vertex](#) pointer and pointer to next [Stack](#) in the linked list.
- struct [AK_synchronization_info](#)
Structure for managing the synchronization between multiple threads accessing the same resources (essentially a mutex).

Macros

- #define **MAX_LOOP_ITERATIONS** 1000
- #define **TBL_BOX_OFFSET** 1

Typedefs

- typedef struct [list_node](#) **AK_list**
- typedef struct [list_node](#) * **AK_list_elem**
- typedef struct [Vertex](#) **AK_graph**
- typedef struct [Succesor](#) * **AK_succesor**
- typedef struct [Vertex](#) * **AK_vertex**
- typedef struct [Stack](#) * **AK_stack**
- typedef struct [Stack](#) **AK_stackHead**

Functions

- char * [AK_convert_type](#) (char *arg_type)
Function that change type of argument from string to integer.
- int [AK_strcmp](#) (const void *a, const void *b)
Function compares two Strings.
- int [AK_chars_num_from_number](#) (int number, int base)
Function that gets the number of digits for any given number.
- size_t [AK_type_size](#) (int iDB_type, char *szVarchar)
Function returns the size in bytes for the provided database type.
- void [AK_Init_L3](#) (struct [list_node](#) **L)
Function that initializes an empty list.
- struct [list_node](#) * [AK_First_L2](#) (struct [list_node](#) *L)
Function that fetches the first element of the list.
- struct [list_node](#) * [AK_End_L2](#) (struct [list_node](#) *L)
Function that fetches the last element of the list.
- struct [list_node](#) * [AK_Next_L2](#) (struct [list_node](#) *current)
Function that fetches the next element of the list.
- struct [list_node](#) * [AK_Previous_L2](#) (struct [list_node](#) *current, struct [list_node](#) *L)
Function that fetches the previous element of the list.
- unsigned int [AK_IsEmpty_L2](#) (struct [list_node](#) *L)
Function that tests if the list is empty.
- void [AK_InsertBefore_L2](#) (int type, char *data, int size, struct [list_node](#) **current, struct [list_node](#) **L)
Function that inserts a new element before the current element of the list.
- void [AK_InsertAfter_L2](#) (int type, char *data, int size, struct [list_node](#) **current, struct [list_node](#) **L)
Function that inserts a new element after the current element of the list.
- void [AK_InsertAtBegin_L3](#) (int type, char *data, int size, struct [list_node](#) *L)
Function that inserts a new element at the beginning of the list. It uses function called: AK_InsertBefore_L.
- void [AK_InsertAtEnd_L3](#) (int type, char *data, int size, struct [list_node](#) *L)
Function that inserts a new element at the end of the list. It uses a function called: AK_InsertAfter_L2.
- void [AK_Delete_L3](#) (struct [list_node](#) **current, struct [list_node](#) **L)
Function that deletes the current element of the list.
- void [AK_DeleteAll_L3](#) (struct [list_node](#) **L)
Function that empties the list.
- int [AK_Size_L2](#) (struct [list_node](#) *L)

- Function that fetches the number of the elements in the list.*

 - char * [AK_Retrieve_L2](#) (struct [list_node](#) *current, struct [list_node](#) *L)
- Function that retrieves the data from the current element of the list.*

 - struct [list_node](#) * [AK_GetNth_L2](#) (int pos, struct [list_node](#) *row)
- Function that fetches the nth element in a row.*

 - char * [AK_get_array_perms](#) (char *arr)
- Get all permutations without repetition (currently not used, but it can be helpful)*

 - [AK_vertex](#) [AK_search_vertex](#) (int id)
- Function that searches for a specific graph node by its ID.*

 - [AK_vertex](#) [AK_search_empty_link](#) ()
- Looks for empty link for a new graph node.*

 - [AK_vertex](#) [AK_add_vertex](#) (int id)
- Function that adds a new graph node.*

 - [AK_succesor](#) [AK_add_succesor](#) (int succesorId, int succesorOf)
- Creates an edge between two nodes.*

 - [AK_stack](#) [AK_search_empty_stack_link](#) ([AK_stack](#) stackRoot)
- Returns a empty link for the stack.*

 - [AK_stack](#) [AK_push_to_stack](#) (int id)
- Adds a entry to the stack.*

 - [AK_stack](#) [AK_pop_from_stack](#) ()
- Pops a entry to the stack.*

 - [AK_stack](#) [AK_search_in_stack](#) (int id)
- Finds an element in the stack.*

 - int **MIN** (int X, int Y)
- void [AK_tarjan](#) (int id)

Tarjan algorithm that looks for a strongly connected component inside all subgraphs; using DFS.
- [TestResult](#) [AK_tarjan_test](#) ()
- [AK_synchronization_info](#) * [AK_init_critical_section](#) ()

Initializes an [AK_synchronization_info](#) structure and returns an owned pointer that must later be passed on to [AK_↔destroy_critical_section](#).
- void [AK_destroy_critical_section](#) ([AK_synchronization_info](#) *info)

Destroys a synchronization object when it is no longer necessary and frees the pointer.
- void [AK_enter_critical_section](#) ([AK_synchronization_info](#) *info)

Enters a critical section.
- void [AK_leave_critical_section](#) ([AK_synchronization_info](#) *info)

Leaves a critical section.

Variables

- int [testMode](#)

You can turn testMode on or off with `TEST_MODE_ON` and `TEST_MODE_OFF`. To do this, simply enable or disable it in YOUR function (not in any other!) Test mode can be used when you need some special cases in your functions (i.e., when you are testing some functionality, which doesn't apply in normal conditions). But don't forget to turn this mode off, after you are done (within test function for example)!

5.2.1 Detailed Description

Header file that provides a data structure for the auxiliary functions

5.2.2 Function Documentation

5.2.2.1 AK_add_succesor()

```
AK_succesor AK_add_succesor (
    int succesorId,
    int succesorOf )
```

Creates an edge between two nodes.

Author

Frane Jakelić

Parameters

<i>succesorId</i>	id of a newly created edge
<i>succesorOf</i>	source of the newly created edge

Returns

pointer to the newly created edge

5.2.2.2 AK_add_vertex()

```
AK_vertex AK_add_vertex (
    int id )
```

Function that adds a new graph node.

Author

Frane Jakelić

Parameters

<i>id</i>	of the vertex that needs to be added
<i>graphRoot</i>	root node of the graph structure

Returns

pointer to the newly created node

5.2.2.3 AK_chars_num_from_number()

```
int AK_chars_num_from_number (
    int number,
    int base )
```

Function that gets the number of digits for any given number.

Author

Dino Laktašić.

Parameters

<i>number</i>	number to evaluate
<i>int</i>	base mathematic base (e.g. 2, 10 etc.)

Returns

the number of digits for the given number

5.2.2.4 AK_convert_type()

```
char* AK_convert_type (
    char * arg_type )
```

Function that change type of argument from string to integer.

Author

Aleksandra Polak

Parameters

<i>*arg_type</i>	type of an argument
------------------	---------------------

Returns

EXIT_SUCCESS of the function (return type of argument in value of integer) or EXIT_ERROR

Function that change type of argument from string to integer.

Author

Aleksandra Polak

Parameters

<i>*arg_type</i>	type of argument
------------------	------------------

Returns

EXIT_SUCCESS of the function (return type of argument as a value of the integer) or EXIT_ERROR

5.2.2.5 AK_Delete_L3()

```
void AK_Delete_L3 (
    struct list_node ** current,
    struct list_node ** L )
```

Function that deletes the current element of the list.

Author

Ljiljana Pintarić.

Parameters

<i>current</i>	current element of the list
<i>L</i>	root of the list @retrun No return value

5.2.2.6 AK_DeleteAll_L3()

```
void AK_DeleteAll_L3 (
    struct list_node ** L )
```

Function that empties the list.

Author

Ljiljana Pintarić.

Parameters

<i>L</i>	root of the list
----------	------------------

Returns

No return value

5.2.2.7 AK_destroy_critical_section()

```
void AK_destroy_critical_section (
    AK_synchronization_info * info )
```

Destroys a synchronization object when it is no longer necessary and frees the pointer.

Author

Marko Sinko

Parameters

<i>info</i>	Synchronization info structure
-------------	--------------------------------

Returns

void

5.2.2.8 AK_End_L2()

```
struct list_node* AK_End_L2 (
    struct list_node * L )
```

Function that fetches the last element of the list.

Author

Ljiljana Pintarić.

Parameters

<i>L</i>	root of the list
----------	------------------

Returns

last element of the list

5.2.2.9 AK_enter_critical_section()

```
void AK_enter_critical_section (
    AK_synchronization_info * info )
```

Enters a critical section.

Author

Marko Sinko

Parameters

<i>info</i>	Synchronization info structure
-------------	--------------------------------

Returns

void

5.2.2.10 AK_First_L2()

```
struct list_node* AK_First_L2 (
    struct list_node * L )
```

Function that fetches the first element of the list.

Author

Ljiljana Pintarić.

Parameters

<i>L</i>	root of the list
----------	------------------

Returns

first element of the list

5.2.2.11 AK_get_array_perms()

```
char* AK_get_array_perms (
    char * arr )
```

Get all permutations without repetition (currently not used, but it can be helpful)

Author

Dino Laktašić.

Parameters

<i>arr</i>	array of chars to perform permutation on
------------	------------------------------------------

Returns

char pointer to an array of pointers pointing to permuted char arrays

Get all permutations without repetition (currently not used, but it can be helpful)

Author

Matija Novak

Parameters

<i>SearchElement</i>	element whose posititon we search for
<i>L</i>	root of the list

Returns

returns the posititon number of some elelemnt

Author

Dino Laktašić.

Get all permutations without repetition (currently not used, but it can be helpful)

Parameters

<i>arr</i>	array of chars to perform permutation on
------------	------------------------------------------

Returns

char pointer to an array of pointers pointing to permuted char arrays

5.2.2.12 AK_GetNth_L2()

```
struct list_node* AK_GetNth_L2 (
    int pos,
    struct list_node * row )
```

Function that fetches the nth element in a row.

Author

Ljiljana Pintarić

Parameters

<i>pos</i>	position of element in a row
<i>row</i>	list of elements of a row in the table

Returns

element of list of elements of a row in the table

Function that fetches the nth element in a row.

Author

Matija Šestak.

Parameters

<i>current</i>	current list element
<i>L</i>	root of the list

Returns

data type of the current list element

Author

Matija Šestak.

Function that fetches the data size of the element

Parameters

<i>current</i>	current list element
<i>L</i>	- root of the list

Returns

data size of the current list element

Author

Ljiljana Pintarić

Function that fetches the nth element in a row

Parameters

<i>pos</i>	position of element in a row
<i>row</i>	list of elements of a row in the table

Returns

element of list of elements of a row in the table

5.2.2.13 AK_init_critical_section()

```
AK_synchronization_info* AK_init_critical_section ( )
```

Initializes an [AK_synchronization_info](#) structure and returns an owned pointer that must later be passed on to [AK_destroy_critical_section](#).

Author

Marko Sinko

Returns

Initialized synchronization object

5.2.2.14 AK_Init_L3()

```
void AK_Init_L3 (
    struct list_node ** L )
```

Function that initializes an empty list.

Author

Ljiljana Pintarić

Parameters

<i>L</i>	root of the list
----------	------------------

Returns

NO return value

5.2.2.15 AK_InsertAfter_L2()

```
void AK_InsertAfter_L2 (
    int type,
```

```
char * data,  
int size,  
struct list_node ** current,  
struct list_node ** L )
```

Function that inserts a new element after the current element of the list.

Author

Ljiljana Pintarić.

Parameters

<i>data</i>	new data
<i>current</i>	current element of the list
<i>L</i>	root of the list

Returns

No return value.

5.2.2.16 AK_InsertAtBegin_L3()

```
void AK_InsertAtBegin_L3 (  
    int type,  
    char * data,  
    int size,  
    struct list_node * L )
```

Function that inserts a new element at the beginning of the list. It uses function called: AK_InsertBefore_L.

Author

Ljiljana Pintarić.

Parameters

<i>data</i>	new data
<i>L</i>	root of the list

Returns

No return value

5.2.2.17 AK_InsertAtEnd_L3()

```
void AK_InsertAtEnd_L3 (
    int type,
    char * data,
    int size,
    struct list_node * L )
```

Function that inserts a new element at the end of the list. It uses a function called: AK_InsertAfter_L2.

Author

Ljiljana Pintarić.

Parameters

<i>data</i>	new data
<i>L</i>	root of the list

Returns

No return value.

5.2.2.18 AK_InsertBefore_L2()

```
void AK_InsertBefore_L2 (
    int type,
    char * data,
    int size,
    struct list_node ** current,
    struct list_node ** L )
```

Function that inserts a new element before the current element of the list.

Author

Ljiljana Pintarić.

Parameters

<i>data</i>	new data
<i>current</i>	current element of the list
<i>L</i>	root of the list

Returns

No return value

5.2.2.19 AK_IsEmpty_L2()

```
unsigned int AK_IsEmpty_L2 (
    struct list_node * L )
```

Function that tests if the list is empty.

Author

Ljiljana Pintarić.

Parameters

<i>L</i>	root of the list
----------	------------------

Returns

1 if the list is empty, otherwise returns 0

5.2.2.20 AK_leave_critical_section()

```
void AK_leave_critical_section (
    AK_synchronization_info * info )
```

Leaves a critical section.

Author

Marko Sinko

Parameters

<i>info</i>	Synchronization info structure
-------------	--------------------------------

Returns

void

5.2.2.21 AK_Next_L2()

```
struct list_node* AK_Next_L2 (
    struct list_node * current )
```

Function that fetches the next element of the list.

Author

Ljiljana Pintarić.

Parameters

<i>current</i>	current element of the list
----------------	-----------------------------

Returns

next element of the list

5.2.2.22 AK_pop_from_stack()

```
AK_stack AK_pop_from_stack ( )
```

Pops a entry to the stack.

Author

Frane Jakelić

Returns

pointer to the popped stack node

5.2.2.23 AK_Previous_L2()

```
struct list_node* AK_Previous_L2 (  
    struct list_node * current,  
    struct list_node * L )
```

Function that fetches the previous element of the list.

Author

Ljiljana Pintarić.

Parameters

<i>current</i>	current element of the list
<i>L</i>	root of the list

Returns

previous element of the list

5.2.2.24 AK_push_to_stack()

```
AK_stack AK_push_to_stack (
    int id )
```

Adds a entry to the stack.

Author

Frane Jakelić

Parameters

<i>id</i>	of the element that is being added to the stack
-----------	-------------------------------------------------

Returns

pointer to the newly added stack node

5.2.2.25 AK_Retrieve_L2()

```
char* AK_Retrieve_L2 (
    struct list_node * current,
    struct list_node * L )
```

Function that retrieves the data from the current element of the list.

Author

Ljiljana Pintarić.

Parameters

<i>current</i>	current element of the list
<i>L</i>	root of the list

Returns

data from the list element

5.2.2.26 AK_search_empty_link()

```
AK_vertex AK_search_empty_link ( )
```

Looks for empty link for a new graph node.

Author

Frane Jakelić

Parameters

<i>graphRoot</i>	oot node of the graph structure
------------------	---------------------------------

Returns

empty link for a new graph node

5.2.2.27 AK_search_empty_stack_link()

```
AK_stack AK_search_empty_stack_link (
    AK_stack stackRoot )
```

Returns a empty link for the stack.

Author

Frane Jakelić

Parameters

<i>stackRoot</i>	root node of the selected stack
------------------	---------------------------------

Returns

pointer to the empty link

5.2.2.28 AK_search_in_stack()

```
AK_stack AK_search_in_stack (
    int id )
```

Finds an element in the stack.

Author

Frane Jakelić

Parameters

<i>id</i>	of the node that needs to be found in the stack
-----------	-------------------------------------------------

Returns

pointer to the found stack node

5.2.2.29 AK_search_vertex()

```
AK_vertex AK_search_vertex (
    int id )
```

Function that searches for a specific graph node by its ID.

Author

Frane Jakelić

Parameters

<i>id</i>	of the vertex that needs to be found
<i>graphRoot</i>	root node of the graph structure

Returns

found graph nod or null

5.2.2.30 AK_Size_L2()

```
int AK_Size_L2 (
    struct list_node * L )
```

Function that fetches the number of the elements in the list.

Author

Ljiljana Pintarić.

Parameters

<i>L</i>	root of the list
----------	------------------

Returns

Size of the list

5.2.2.31 AK_strcmp()

```
int AK_strcmp (
    const void * a,
    const void * b )
```

Function compares two Strings.

Author

Dino Laktašić

Parameters

<i>*a</i>	pointer of a value to compare
<i>*b</i>	pointer of a value to compare

Returns

result of the comparison in line with strcmp function

5.2.2.32 AK_tarjan()

```
void AK_tarjan (
    int id )
```

Tarjan algorithm that looks for a strongly connected component inside all subgraphs; using DFS.

Author

Frane Jakelić

Parameters

<i>id</i>	of the element on which the algorithm looks for an id of a strongly connected component
-----------	-----------------------------------------------------------------------------------------

```
####\nStrongy connected component. Edges:\n");
```

```
####\n");
```

5.2.2.33 AK_type_size()

```
size_t AK_type_size (
    int iDB_type,
    char * szVarchar )
```

Function returns the size in bytes for the provided database type.

Author

Miroslav Policki

Parameters

<i>iDB_type</i>	database data type (defined in constants.h)
<i>szVarchar</i>	if iDB_type == TYPE_VARCHAR, pointer to the string, otherwise unused

Returns

size of provided data type in bytes if the provided data type is valid, else return 0

5.2.3 Variable Documentation**5.2.3.1 testMode**`testMode`

You can turn testMode on or off with TEST_MODE_ON and TEST_MODE_OFF. To do this, simply enable or disable it in YOUR function (not in any other!) Test mode can be used when you need some special cases in your functions (i.e., when you are testing some functionality, which doesn't apply in normal conditions). But don't forget to turn this mode off, after you are done (within test function for example)!

Author

Domagoj Šitum

5.3 auxi/constants.h File Reference

This graph shows which files directly or indirectly include this file:

Macros

- `#define MAX_VARCHAR_LENGTH 200`
Constant declaring the maximum length of varchar data value.
- `#define MAX_ATTRIBUTES 10`
Constant declaring the maximum number of attributes per block.
- `#define MAX_ATT_NAME 255`
Constant declaring the maximum length of attribute name string (used in AK_header->att_name)
- `#define MAX_CONSTRAINTS 5`
Constant declaring the maximum number of constraints per attribute.
- `#define MAX_CONSTR_NAME 255`
Constant declaring the maximum length of constraint name string (used in AK_header->constr_name)
- `#define MAX_CONSTR_CODE 255`
Constant declaring the maximum length of constraint code string.

- `#define MAX_OBSERVABLE_OBSERVERS 4096`
Constant for declaring the maximum number of observers objects for some observable type.
- `#define MAX_ACTIVE_TRANSACTIONS_COUNT 100`
Constant for declaring the maximum number of active trasactions in DBMS.
- `#define DATA_BLOCK_SIZE 500`
Constant declaring length of data block size (used in AK_block->data)
- `#define DATA_ENTRY_SIZE 10`
Constant declaring lenght of data entry in sizeof(int)
- `#define MAX_QUERY_LIB_MEMORY 255`
Constant declaring the maximum size of query lib memory.
- `#define MAX_CACHE_MEMORY 255`
Constant declaring the maximum size of DB cache memory.
- `#define MAX_QUERY_DICT_MEMORY 255`
Constant declaring the maximum size of query dictionary memory.
- `#define MAX_QUERY_RESULT_MEMORY 255`
Constant declaring the maximum size of query result cache memory.
- `#define MAX_TOKENS 255`
Constant declaring the maximum number of attributes to handle in relation equivalence function.
- `#define MAX_MAIN_BUCKETS 512`
Constant declaring the maximum number of main buckets.
- `#define MAIN_BUCKET_SIZE 4`
Constant declaring the size of main buckets.
- `#define HASH_BUCKET_SIZE 4`
Constant declaring the size of hash buckets.
- `#define NUMBER_OF_KEYS 4096`
Constant declaring the number of buckets in hash table.
- `#define EXIT_SUCCESS 0`
Constant declaring a successful exit.
- `#define EXIT_ERROR -1`
Constant declaring unsuccessful exit.
- `#define EXIT_WARNING -2`
- `#define BLOCK_TYPE_FREE -1`
Constant declaring AK_free block type (used in AK_block->type)
- `#define BLOCK_TYPE_NORMAL 0`
Constant declaring normal block type e.g. used by some extent (used in AK_block->type)
- `#define BLOCK_TYPE_CHAINED 1`
Constant declaring chained block type e.g. used if the block is chained with another (used in AK_block->type)
- `#define NOT_CHAINED -1`
Constant used in AK_block->chained_with if the block isn't chained.
- `#define FREE_INT -10`
Constant declaring dummy data for empty integers.
- `#define FREE_CHAR '\0'`
Constant declaring dummy data for empty chars.
- `#define SEGMENT_TYPE_SYSTEM_TABLE 0`
Constant declaring system table segment type (used in system catalog)
- `#define SEGMENT_TYPE_TABLE 1`
Constant declaring table segment type (used in system catalog)
- `#define SEGMENT_TYPE_INDEX 2`
Constant declaring index segment type (used in system catalog)
- `#define SEGMENT_TYPE_TRANSACTION 3`
Constant declaring transaction segment type (used in system catalog)

- #define **SEGMENT_TYPE_TEMP** 4
Constant declaring temporary segment type (used in system catalog)
- #define **TYPE_INTERNAL** 0
Constant declaring internal data type (used in AK_header->type and AK_tuple_dict->type)
- #define **TYPE_INT** 1
integer data type (used in AK_header->type and AK_tuple_dict->type)
- #define **TYPE_FLOAT** 2
Constant declaring float data type (used in AK_header->type and AK_tuple_dict->type)
- #define **TYPE_NUMBER** 3
Constant declaring number data type (used in AK_header->type and AK_tuple_dict->type)
- #define **TYPE_VARCHAR** 4
Constant declaring varchar data type (used in AK_header->type and AK_tuple_dict->type)
- #define **TYPE_DATE** 5
Constant declaring date data type (used in AK_header->type and AK_tuple_dict->type)
- #define **TYPE_DATETIME** 6
Datetime data type (used in AK_header->type and AK_tuple_dict->type)
- #define **TYPE_TIME** 7
Constant declaring time data type (used in AK_header->type and AK_tuple_dict->type)
- #define **TYPE_BLOB** 8
Blob data type (used in AK_header->type and AK_tuple_dict->type)
- #define **TYPE_BOOL** 9
Constant declaring boolean data type (used in AK_header->type and AK_tuple_dict->type)
- #define **TYPE_OPERAND** 10
Constant indicating operand in AK_list.
- #define **TYPE_OPERATOR** 11
indicates operator in AK_list
- #define **TYPE_ATTRIBS** 12
Constant indicating attribute/s in AK_list.
- #define **TYPE_CONDITION** 13
Constant indicating condition in AK_list.
- #define **BLOCK_CLEAN** 0
Constant indicating block cleaning (not changed since read from disk)
- #define **BLOCK_DIRTY** 1
Constant indicating dirty block (changed since read from disk, has to be written)
- #define **ATTR_DELIMITER** ","
Constant declaring attributes delimiter.
- #define **ATTR_ESCAPE** ``
Constant indicating attributes escape section.
- #define **NULLL** "asdfgXYZ"
Constant declaring null value for tables.
- #define **RO_SELECTION** 's'
- #define **RO_PROJECTION** 'p'
- #define **RO_NAT_JOIN** 'n'
- #define **RO_RENAME** 'r'
- #define **RO_UNION** 'u'
- #define **RO_INTERSECT** 'i'
- #define **RO_EXCEPT** 'e'
- #define **RO_THETA_JOIN** 't'
- #define **NEW_VALUE** 0
Constant indicating that the data is a new value.
- #define **SEARCH_CONSTRAINT** 1

- Constant indicating that the data is constraint to search for.*

 - #define **UPDATE** 0
- Constant indicating that the operation to be performed is 'update'.*

 - #define **DELETE** 1
- Constant indicating that the operation to be performed is 'delete'.*

 - #define **INSERT** 2
- Constant indicating that the operation to be performed is 'insert'.*

 - #define **SELECT** 3
- Constant indicating 'select' operation.*

 - #define **FIND** 2
- Constant indicating that the operation to be performed is 'search'.*

 - #define **INFO_BUCKET** 0
- Constant declaring the type of bucket as "info bucket" when inserting bucket to block.*

 - #define **MAIN_BUCKET** 1
- Constant declaring the type of bucket as "main bucket" when inserting bucket to block.*

 - #define **HASH_BUCKET** 2
- Constant declaring the type of bucket as "hash bucket" when inserting bucket to block.*

 - #define **SHARED_LOCK** 0
- Constant declaring the type of lock as SHARED LOCK.*

 - #define **EXCLUSIVE_LOCK** 1
- Constant declaring the type of lock as EXCLUSIVE LOCK.*

 - #define **WAIT_FOR_UNLOCK** 0
- Constant declaring that a lock has to wait until other locks release the resource.*

 - #define **PASS_LOCK_QUEUE** 1
- Constant declaring that a lock can acquire the resource AK_freely.*

 - #define **OK** 1
- Constant declaring that the method is completed successfully.*

 - #define **NOT_OK** 0
- Constant declaring that the method isn't completed successfully.*

 - #define **COMMIT** 1
- Constant declaring that the transaction is completed successfully.*

 - #define **ABORT** 0
- Constant declaring if the transaction is being aborted.*

 - #define **NEW_ID** 0
- Constant declaring if new obj_id should be created.*

 - #define **MAX_BLOCKS_CURRENTLY_ACCESSED** 32
- Indicates the maximum number of threads that can access (read or write) database at the same time.*

 - #define **TEST_MODE_ON** 1
- This constant is used to turn testMode (auxi/auxillary.h) ON.*

 - #define **TEST_MODE_OFF** 0
- This constant is used to turn testMode (auxi/auxillary.h) OFF.*

 - #define **SEPARATOR** "[{(|&&|)}]"
- Used in [unique.c](#) for separation of names of attributes and their values when UNIQUE constraint is being set or tested on combination of values of attributes.*

 - #define **AK_CONSTRAINTS_BEWTEEN** "AK_constraints_between"
- Defines system table name for storing between constraints.*

 - #define **AK_CONSTRAINTS_CHECK_CONSTRAINT** "AK_constraints_check_constraint"
- Defines system table name for storing check constraints.*

 - #define **AK_CONSTRAINTS_NOT_NULL** "AK_constraints_not_null"
- Defines system table name for storing check constraints.*

 - #define **AK_CONSTRAINTS_UNIQUE** "AK_constraints_unique"

- Defines system table name for storing check constraints.*
 - `#define AK_CONSTRAINTS_INDEX "AK_constraints_index"`
- Defines system table name for storing check constraints.*
 - `#define AK_CONSTRAINTS_PRIMARY_KEY "AK_constraints_primary_key"`
- Defines system table name for storing check constraints.*
 - `#define AK_CONSTRAINTS_FOREIGN_KEY "AK_constraints_foreign_key"`
- Defines system table name for storing check constraints.*
 - `#define AK_CONSTRAINTS_DEFAULT "AK_constraints_default"`
- Defines system table name for storing check constraints.*
 - `#define AK_REFERENCE "AK_reference"`
- Defines system table name for storing check constraints.*
 - `#define DROP_TABLE 0`
- Constant which defines the number of drop statement.*
 - `#define DROP_INDEX 1`
- Constant which defines the number of drop statement.*
 - `#define DROP_VIEW 2`
- Constant which defines the number of drop statement.*
 - `#define DROP_SEQUENCE 3`
- Constant which defines the number of drop statement.*
 - `#define DROP_TRIGGER 4`
- Constant which defines the number of drop statement.*
 - `#define DROP_FUNCTION 5`
- Constant which defines the number of drop statement.*
 - `#define DROP_USER 6`
- Constant which defines the number of drop statement.*
 - `#define DROP_GROUP 7`
- Constant which defines the number of drop statement.*
 - `#define DROP_CONSTRAINT 8`
- Constant which defines the number of drop statement.*
 - `#define NUM_SYS_TABLES 20`
- Constant which defines the length of system_catalog.*

5.3.1 Detailed Description

Header file that provides global macros, constants and variables

5.3.2 Macro Definition Documentation

5.3.2.1 AK_CONSTRAINTS_DEFAULT

```
#define AK_CONSTRAINTS_DEFAULT "AK_constraints_default"
```

Defines system table name for storing check constraints.

- —

5.3.2.2 AK_CONSTRAINTS_FOREIGN_KEY

```
#define AK_CONSTRAINTS_FOREIGN_KEY "AK_constraints_foreign_key"
```

Defines system table name for storing check constraints.

- —

5.3.2.3 AK_CONSTRAINTS_INDEX

```
#define AK_CONSTRAINTS_INDEX "AK_constraints_index"
```

Defines system table name for storing check constraints.

- —

5.3.2.4 AK_CONSTRAINTS_PRIMARY_KEY

```
#define AK_CONSTRAINTS_PRIMARY_KEY "AK_constraints_primary_key"
```

Defines system table name for storing check constraints.

- —

5.4 auxi/debug.c File Reference

```
#include "debug.h"
```

Include dependency graph for debug.c:

Functions

- int [AK_dbg_messg](#) ([DEBUG_LEVEL](#) level, [DEBUG_TYPE](#) type, const char *format,...)
Function that prints the debug message. Provides debug level, debug type and message with corresponding variables for the output.

5.4.1 Detailed Description

Provides a function for debugging

5.4.2 Function Documentation

5.4.2.1 AK_dbg_messg()

```
int AK_dbg_messg (
    DEBUG_LEVEL level,
    DEBUG_TYPE type,
    const char * format,
    ... )
```

Function that prints the debug message. Provides debug level, debug type and message with corresponding variables for the output.

Author

Dino Laktašić

Parameters

<i>level</i>	level of debug information for a given DB module
<i>type</i>	the name of DB module for which to print debug information
<i>format</i>	format for the output message
...	variable number of (different) type args used in printf

Returns

if debug message is printed return 1, else return 0

5.5 auxi/debug.h File Reference

```
#include "stdarg.h"
#include "stdio.h"
#include "stdlib.h"
#include "mempro.h"
```

Include dependency graph for debug.h: This graph shows which files directly or indirectly include this file:

Macros

- #define **DEBUG_ALL** 0
Set constant to 1 for a complete project debug, else set constant to 0.

Typedefs

- typedef enum debug_level **DEBUG_LEVEL**
- typedef enum debug_type **DEBUG_TYPE**

Enumerations

- enum **debug_level** { **LOW** = 1, **MIDDLE** = 0, **HIGH** = 0 }
- enum **debug_type** {
 GLOBAL = 0, **DB_MAN** = 0, **FILE_MAN** = 1, **MEMO_MAN** = 0,
 INDICES = 0, **TABLES** = 0, **REL_OP** = 0, **REL_EQ** = 1,
 CONSTRAINTS = 0, **FUNCTIONS** = 0, **SEQUENCES** = 0, **TRIGGERS** = 0,
 REDO = 0 }

Functions

- int **AK_dbg_messg** (**DEBUG_LEVEL** level, **DEBUG_TYPE** type, const char *format,...)
 Function that prints the debug message. Provides debug level, debug type and message with corresponding variables for the output.

5.5.1 Detailed Description

Header file that defines global macros, constants and variables for debugging

5.5.2 Macro Definition Documentation

5.5.2.1 DEBUG_ALL

```
#define DEBUG_ALL 0
```

Set constant to 1 for a complete project debug, else set constant to 0.

Author

Dino Laktašić

5.5.3 Function Documentation

5.5.3.1 AK_dbg_messg()

```
int AK_dbg_messg (  
    DEBUG_LEVEL level,  
    DEBUG_TYPE type,  
    const char * format,  
    ... )
```

Function that prints the debug message. Provides debug level, debug type and message with corresponding variables for the output.

Author

Dino Laktašić

Parameters

<i>level</i>	level of debug information for a given DB module
<i>type</i>	the name of DB module for which to print debug information
<i>format</i>	format for the output message
...	variable number of (different) type args used in printf

Returns

if debug message is printed return 1, else return 0

5.6 auxi/dictionary.c File Reference

Implements a dictionary for string variables.

```
#include "dictionary.h"
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
Include dependency graph for dictionary.c:
```

Macros

- #define [MAXVALSZ](#) 1024
- #define [DICTMINSZ](#) 128
- #define [DICT_INVALID_KEY](#) ((char*)-1)

Functions

- unsigned [dictionary_hash](#) (const char *key)
Compute the hash key for a string.
- [dictionary](#) * [dictionary_new](#) (int size)
Create a new dictionary object.
- void [dictionary_del](#) ([dictionary](#) *d)
Delete a dictionary object.
- char * [dictionary_get](#) ([dictionary](#) *d, const char *key, char *def)
Get a value from a dictionary.
- int [dictionary_set](#) ([dictionary](#) *d, const char *key, const char *val)
Set a value in a dictionary.
- void [dictionary_unset](#) ([dictionary](#) *d, const char *key)
Delete a key in a dictionary.
- void [dictionary_dump](#) ([dictionary](#) *d, FILE *out)
Dump a dictionary to an opened file pointer.

5.6.1 Detailed Description

Implements a dictionary for string variables.

Author

N. Devillard This module implements a simple dictionary object, i.e. a list of string/string associations. This object is useful to store e.g. informations retrieved from a configuration file (ini files).

5.6.2 Macro Definition Documentation

5.6.2.1 DICT_INVALID_KEY

```
#define DICT_INVALID_KEY ((char*)-1)
```

Invalid key token

5.6.2.2 DICTMINSZ

```
#define DICTMINSZ 128
```

Minimal allocated number of entries in a dictionary

5.6.2.3 MAXVALSZ

```
#define MAXVALSZ 1024
```

Maximum value size for integers and doubles.

5.6.3 Function Documentation

5.6.3.1 dictionary_del()

```
void dictionary_del (  
    dictionary * d )
```

Delete a dictionary object.

Parameters

<i>d</i>	dictionary object to deallocate.
----------	----------------------------------

Returns

void

Deallocate a dictionary object and all memory associated to it.

5.6.3.2 dictionary_dump()

```
void dictionary_dump (
    dictionary * d,
    FILE * out )
```

Dump a dictionary to an opened file pointer.

Parameters

<i>d</i>	Dictionary to dump
<i>f</i>	Opened file pointer.

Returns

void

Dumps a dictionary onto an opened file pointer. Key pairs are printed out as [Key]=[Value], one per line. It is Ok to provide stdout or stderr as output file pointers.

5.6.3.3 dictionary_get()

```
char* dictionary_get (
    dictionary * d,
    const char * key,
    char * def )
```

Get a value from a dictionary.

Parameters

<i>d</i>	dictionary object to search.
<i>key</i>	Key to look for in the dictionary.
<i>def</i>	Default value to return if key not found.

Returns

1 pointer to internally allocated character string.

This function locates a key in a dictionary and returns a pointer to its value, or the passed 'def' pointer if no such key can be found in dictionary. The returned character pointer points to data internal to the dictionary object, you should not try to AK_free it or modify it.

5.6.3.4 dictionary_hash()

```
unsigned dictionary_hash (
    const char * key )
```

Compute the hash key for a string.

Parameters

<i>key</i>	Character string to use for key.
------------	----------------------------------

Returns

1 unsigned int on at least 32 bits.

This hash function has been taken from an Article in Dr Dobbs Journal. This is normally a collision-AK_free function, distributing keys evenly. The key is stored anyway in the struct so that collision can be avoided by comparing the key itself in last resort.

5.6.3.5 dictionary_new()

```
dictionary* dictionary_new (
    int size )
```

Create a new dictionary object.

Parameters

<i>size</i>	Optional initial size of the dictionary.
-------------	------------------------------------------

Returns

1 newly allocated dictionary objet.

This function allocates a new dictionary object of given size and returns it. If you do not know in advance (roughly) the number of entries in the dictionary, give size=0.

5.6.3.6 dictionary_set()

```
int dictionary_set (
    dictionary * d,
    const char * key,
    const char * val )
```

Set a value in a dictionary.

Parameters

<i>d</i>	dictionary object to modify.
<i>key</i>	Key to modify or add.
<i>val</i>	Value to add.

Returns

int 0 if Ok, anything else otherwise

If the given key is found in the dictionary, the associated value is replaced by the provided one. If the key cannot be found in the dictionary, it is added to it.

It is Ok to provide a NULL value for val, but NULL values for the dictionary or the key are considered as errors: the function will return immediately in such a case.

Notice that if you dictionary_set a variable to NULL, a call to dictionary_get will return a NULL value: the variable will be found, and its value (NULL) is returned. In other words, setting the variable content to NULL is equivalent to deleting the variable from the dictionary. It is not possible (in this implementation) to have a key in the dictionary without value.

This function returns non-zero in case of failure.

5.6.3.7 dictionary_unset()

```
void dictionary_unset (
    dictionary * d,
    const char * key )
```

Delete a key in a dictionary.

Parameters

<i>d</i>	dictionary object to modify.
<i>key</i>	Key to remove.

Returns

void

This function deletes a key in a dictionary. Nothing is done if the key cannot be found.

5.7 auxi/dictionary.h File Reference

Implements a dictionary for string variables.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include "mempro.h"
```

Include dependency graph for dictionary.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [_dictionary_](#)
Dictionary object.

Typedefs

- typedef struct `_dictionary_ dictionary`
Dictionary object.

Functions

- unsigned `dictionary_hash` (const char *key)
Compute the hash key for a string.
- `dictionary * dictionary_new` (int size)
Create a new dictionary object.
- void `dictionary_del` (`dictionary *vd`)
Delete a dictionary object.
- char * `dictionary_get` (`dictionary *d`, const char *key, char *def)
Get a value from a dictionary.
- int `dictionary_set` (`dictionary *vd`, const char *key, const char *val)
Set a value in a dictionary.
- void `dictionary_unset` (`dictionary *d`, const char *key)
Delete a key in a dictionary.
- void `dictionary_dump` (`dictionary *d`, FILE *out)
Dump a dictionary to an opened file pointer.

5.7.1 Detailed Description

Implements a dictionary for string variables.

Author

N. Devillard This module implements a simple dictionary object, i.e. a list of string/string associations. This object is useful to store e.g. informations retrieved from a configuration file (ini files).

5.7.2 Typedef Documentation

5.7.2.1 dictionary

```
typedef struct _dictionary_ dictionary
```

Dictionary object.

This object contains a list of string/string associations. Each association is identified by a unique string key. Looking up values in the dictionary is speeded up by the use of a (hopefully collision-AK_free) hash function.

5.7.3 Function Documentation

5.7.3.1 dictionary_del()

```
void dictionary_del (  
    dictionary * d )
```

Delete a dictionary object.

Parameters

<i>d</i>	dictionary object to deallocate.
----------	----------------------------------

Returns

void

Deallocate a dictionary object and all memory associated to it.

5.7.3.2 dictionary_dump()

```
void dictionary_dump (
    dictionary * d,
    FILE * out )
```

Dump a dictionary to an opened file pointer.

Parameters

<i>d</i>	Dictionary to dump
<i>f</i>	Opened file pointer.

Returns

void

Dumps a dictionary onto an opened file pointer. Key pairs are printed out as [Key]=[Value], one per line. It is Ok to provide stdout or stderr as output file pointers.

5.7.3.3 dictionary_get()

```
char* dictionary_get (
    dictionary * d,
    const char * key,
    char * def )
```

Get a value from a dictionary.

Parameters

<i>d</i>	dictionary object to search.
<i>key</i>	Key to look for in the dictionary.
<i>def</i>	Default value to return if key not found.

Returns

1 pointer to internally allocated character string.

This function locates a key in a dictionary and returns a pointer to its value, or the passed 'def' pointer if no such key can be found in dictionary. The returned character pointer points to data internal to the dictionary object, you should not try to AK_free it or modify it.

5.7.3.4 dictionary_hash()

```
unsigned dictionary_hash (
    const char * key )
```

Compute the hash key for a string.

Parameters

<i>key</i>	Character string to use for key.
------------	----------------------------------

Returns

1 unsigned int on at least 32 bits.

This hash function has been taken from an Article in Dr Dobbs Journal. This is normally a collision-AK_free function, distributing keys evenly. The key is stored anyway in the struct so that collision can be avoided by comparing the key itself in last resort.

5.7.3.5 dictionary_new()

```
dictionary* dictionary_new (
    int size )
```

Create a new dictionary object.

Parameters

<i>size</i>	Optional initial size of the dictionary.
-------------	------------------------------------------

Returns

1 newly allocated dictionary objet.

This function allocates a new dictionary object of given size and returns it. If you do not know in advance (roughly) the number of entries in the dictionary, give size=0.

5.7.3.6 dictionary_set()

```
int dictionary_set (
    dictionary * d,
    const char * key,
    const char * val )
```

Set a value in a dictionary.

Parameters

<i>d</i>	dictionary object to modify.
<i>key</i>	Key to modify or add.
<i>val</i>	Value to add.

Returns

int 0 if Ok, anything else otherwise

If the given key is found in the dictionary, the associated value is replaced by the provided one. If the key cannot be found in the dictionary, it is added to it.

It is Ok to provide a NULL value for val, but NULL values for the dictionary or the key are considered as errors: the function will return immediately in such a case.

Notice that if you dictionary_set a variable to NULL, a call to dictionary_get will return a NULL value: the variable will be found, and its value (NULL) is returned. In other words, setting the variable content to NULL is equivalent to deleting the variable from the dictionary. It is not possible (in this implementation) to have a key in the dictionary without value.

This function returns non-zero in case of failure.

5.7.3.7 dictionary_unset()

```
void dictionary_unset (
    dictionary * d,
    const char * key )
```

Delete a key in a dictionary.

Parameters

<i>d</i>	dictionary object to modify.
<i>key</i>	Key to remove.

Returns

void

This function deletes a key in a dictionary. Nothing is done if the key cannot be found.

5.8 auxi/iniparser.c File Reference

Parser for ini files.

```
#include <ctype.h>
#include "iniparser.h"
Include dependency graph for iniparser.c:
```

Macros

- `#define ASCIIINESZ (1024)`
- `#define INI_INVALID_KEY ((char*)-1)`

Typedefs

- `typedef enum _line_status _line_status`

Enumerations

- `enum _line_status {
 LINE_UNPROCESSED, LINE_ERROR, LINE_EMPTY, LINE_COMMENT,
 LINE_SECTION, LINE_VALUE }`

Functions

- `int iniparser_getnsec (dictionary *d)`
Get number of sections in a dictionary.
- `char * iniparser_getsecname (dictionary *d, int n)`
Get name for section n in a dictionary.
- `void iniparser_dump (dictionary *d, FILE *f)`
Dump a dictionary to an opened file pointer.
- `void iniparser_dump_ini (dictionary *d, FILE *f)`
Save a dictionary to a loadable ini file.
- `void iniparser_dumpsection_ini (dictionary *d, char *s, FILE *f)`
Save a dictionary section to a loadable ini file.
- `int iniparser_getsecnkeys (dictionary *d, char *s)`
Get the number of keys in a section of a dictionary.
- `char ** iniparser_getseckeys (dictionary *d, char *s)`
Get the number of keys in a section of a dictionary.
- `char * iniparser_getstring (dictionary *d, const char *key, char *def)`
Get the string associated to a key.
- `int iniparser_getint (dictionary *d, const char *key, int notfound)`
Get the string associated to a key, convert to an int.
- `double iniparser_getdouble (dictionary *d, const char *key, double notfound)`
Get the string associated to a key, convert to a double.
- `int iniparser_getboolean (dictionary *d, const char *key, int notfound)`
Get the string associated to a key, convert to a boolean.
- `int iniparser_find_entry (dictionary *ini, const char *entry)`
Finds out if a given entry exists in a dictionary.
- `int iniparser_set (dictionary *ini, const char *entry, const char *val)`
Set an entry in a dictionary.
- `void iniparser_unset (dictionary *ini, const char *entry)`
Delete an entry in a dictionary.
- `dictionary * iniparser_load (const char *ininame)`
Parse an ini file and return an allocated dictionary object.
- `void iniparser_AK_freedict (dictionary *d)`
Free all memory associated to an ini dictionary.
- `void AK_inflate_config ()`

Variables

- `pthread_mutex_t iniParserMutex` = `PTHREAD_MUTEX_INITIALIZER`
- `dictionary * AK_config`

5.8.1 Detailed Description

Parser for ini files.

Author

N. Devillard

5.8.2 Typedef Documentation

5.8.2.1 `line_status`

```
typedef enum _line_status_ line_status
```

This enum stores the status for each parsed line (internal use only).

5.8.3 Enumeration Type Documentation

5.8.3.1 `_line_status_`

```
enum _line_status_
```

This enum stores the status for each parsed line (internal use only).

5.8.4 Function Documentation

5.8.4.1 `iniparser_AK_freedict()`

```
void iniparser_AK_freedict (
    dictionary * d )
```

Free all memory associated to an ini dictionary.

Parameters

<i>d</i>	Dictionary to AK_free
----------	-----------------------

Returns

void

Free all memory associated to an ini dictionary. It is mandatory to call this function before the dictionary object gets out of the current context.

5.8.4.2 iniparser_dump()

```
void iniparser_dump (
    dictionary * d,
    FILE * f )
```

Dump a dictionary to an opened file pointer.

Parameters

<i>d</i>	Dictionary to dump.
<i>f</i>	Opened file pointer to dump to.

Returns

void

This function prints out the contents of a dictionary, one element by line, onto the provided file pointer. It is OK to specify `stderr` or `stdout` as output files. This function is meant for debugging purposes mostly.

5.8.4.3 iniparser_dump_ini()

```
void iniparser_dump_ini (
    dictionary * d,
    FILE * f )
```

Save a dictionary to a loadable ini file.

Parameters

<i>d</i>	Dictionary to dump
<i>f</i>	Opened file pointer to dump to

Returns

void

This function dumps a given dictionary into a loadable ini file. It is Ok to specify `stderr` or `stdout` as output files.

5.8.4.4 `iniparser_dumpsection_ini()`

```
void iniparser_dumpsection_ini (
    dictionary * d,
    char * s,
    FILE * f )
```

Save a dictionary section to a loadable ini file.

Parameters

<i>d</i>	Dictionary to dump
<i>s</i>	Section name of dictionary to dump
<i>f</i>	Opened file pointer to dump to

Returns

void

This function dumps a given section of a given dictionary into a loadable ini file. It is Ok to specify `stderr` or `stdout` as output files.

5.8.4.5 `iniparser_find_entry()`

```
int iniparser_find_entry (
    dictionary * ini,
    const char * entry )
```

Finds out if a given entry exists in a dictionary.

Parameters

<i>ini</i>	Dictionary to search
<i>entry</i>	Name of the entry to look for

Returns

integer 1 if entry exists, 0 otherwise

Finds out if a given entry exists in the dictionary. Since sections are stored as keys with NULL associated values, this is the only way of querying for the presence of sections in a dictionary.

5.8.4.6 `iniparser_getboolean()`

```
int iniparser_getboolean (
    dictionary * d,
```



```
const char * key,  
int notfound )
```

Get the string associated to a key, convert to a boolean.

Parameters

<i>d</i>	Dictionary to search
<i>key</i>	Key string to look for
<i>notfound</i>	Value to return in case of error

Returns

integer

This function queries a dictionary for a key. A key as read from an ini file is given as "section:key". If the key cannot be found, the notfound value is returned.

A true boolean is found if one of the following is matched:

- A string starting with 'y'
- A string starting with 'Y'
- A string starting with 't'
- A string starting with 'T'
- A string starting with '1'

A false boolean is found if one of the following is matched:

- A string starting with 'n'
- A string starting with 'N'
- A string starting with 'f'
- A string starting with 'F'
- A string starting with '0'

The notfound value returned if no boolean is identified, does not necessarily have to be 0 or 1.

5.8.4.7 iniparser_getdouble()

```
double iniparser_getdouble (  
    dictionary * d,  
    const char * key,  
    double notfound )
```

Get the string associated to a key, convert to a double.

Parameters

<i>d</i>	Dictionary to search
<i>key</i>	Key string to look for
<i>notfound</i>	Value to return in case of error

Returns

double

This function queries a dictionary for a key. A key as read from an ini file is given as "section:key". If the key cannot be found, the notfound value is returned.

5.8.4.8 iniparser_getint()

```
int iniparser_getint (
    dictionary * d,
    const char * key,
    int notfound )
```

Get the string associated to a key, convert to an int.

Parameters

<i>d</i>	Dictionary to search
<i>key</i>	Key string to look for
<i>notfound</i>	Value to return in case of error

Returns

integer

This function queries a dictionary for a key. A key as read from an ini file is given as "section:key". If the key cannot be found, the notfound value is returned.

Supported values for integers include the usual C notation so decimal, octal (starting with 0) and hexadecimal (starting with 0x) are supported. Examples:

"42" -> 42 "042" -> 34 (octal -> decimal) "0x42" -> 66 (hexa -> decimal)

Warning: the conversion may overflow in various ways. Conversion is totally outsourced to strtol(), see the associated man page for overflow handling.

Credits: Thanks to A. Becker for suggesting strtol()

5.8.4.9 iniparser_getnsec()

```
int iniparser_getnsec (
    dictionary * d )
```

Get number of sections in a dictionary.

Parameters

<i>d</i>	Dictionary to examine
----------	-----------------------

Returns

int Number of sections found in dictionary

This function returns the number of sections found in a dictionary. The test to recognize sections is done on the string stored in the dictionary: a section name is given as "section" whereas a key is stored as "section:key", thus the test looks for entries that do not contain a colon.

This clearly fails in the case a section name contains a colon, but this should simply be avoided.

This function returns -1 in case of error.

5.8.4.10 iniparser_getseckey()

```
char** iniparser_getseckey (
    dictionary * d,
    char * s )
```

Get the number of keys in a section of a dictionary.

Parameters

<i>d</i>	Dictionary to examine
<i>s</i>	Section name of dictionary to examine

Returns

pointer to statically allocated character strings

This function queries a dictionary and finds all keys in a given section. Each pointer in the returned char pointer-to-pointer is pointing to a string allocated in the dictionary; do not `AK_free` or modify them.

This function returns NULL in case of error.

5.8.4.11 iniparser_getsecname()

```
char* iniparser_getsecname (
    dictionary * d,
    int n )
```

Get name for section n in a dictionary.

Parameters

<i>d</i>	Dictionary to examine
<i>n</i>	Section number (from 0 to nsec-1).

Returns

Pointer to char string

This function locates the n-th section in a dictionary and returns its name as a pointer to a string statically allocated inside the dictionary. Do not `AK_free` or modify the returned string!

This function returns `NULL` in case of error.

5.8.4.12 iniparser_getsecnkeys()

```
int iniparser_getsecnkeys (
    dictionary * d,
    char * s )
```

Get the number of keys in a section of a dictionary.

Parameters

<i>d</i>	Dictionary to examine
<i>s</i>	Section name of dictionary to examine

Returns

Number of keys in section

5.8.4.13 iniparser_getstring()

```
char* iniparser_getstring (
    dictionary * d,
    const char * key,
    char * def )
```

Get the string associated to a key.

Parameters

<i>d</i>	Dictionary to search
<i>key</i>	Key string to look for
<i>def</i>	Default value to return if key not found.

Returns

pointer to statically allocated character string

This function queries a dictionary for a key. A key as read from an ini file is given as "section:key". If the key cannot be found, the pointer passed as 'def' is returned. The returned char pointer is pointing to a string allocated in the dictionary, do not `AK_free` or modify it.

5.8.4.14 iniparser_load()

```
dictionary* iniparser_load (
    const char * ininame )
```

Parse an ini file and return an allocated dictionary object.

Parameters

<i>ininame</i>	Name of the ini file to read.
----------------	-------------------------------

Returns

Pointer to newly allocated dictionary

This is the parser for ini files. This function is called, providing the name of the file to be read. It returns a dictionary object that should not be accessed directly, but through accessor functions instead.

The returned dictionary must be AK_freed using [iniparser_AK_freedict\(\)](#).

5.8.4.15 iniparser_set()

```
int iniparser_set (
    dictionary * ini,
    const char * entry,
    const char * val )
```

Set an entry in a dictionary.

Parameters

<i>ini</i>	Dictionary to modify.
<i>entry</i>	Entry to modify (entry name)
<i>val</i>	New value to associate to the entry.

Returns

int 0 if Ok, -1 otherwise.

If the given entry can be found in the dictionary, it is modified to contain the provided value. If it cannot be found, -1 is returned. It is Ok to set val to NULL.

5.8.4.16 iniparser_unset()

```
void iniparser_unset (
    dictionary * ini,
    const char * entry )
```

Delete an entry in a dictionary.

Parameters

<i>ini</i>	Dictionary to modify
<i>entry</i>	Entry to delete (entry name)

Returns

void

If the given entry can be found, it is deleted from the dictionary.

5.9 auxi/iniparser.h File Reference

Parser for ini files.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <pthread.h>
#include "dictionary.h"
#include "mempro.h"
```

Include dependency graph for iniparser.h: This graph shows which files directly or indirectly include this file:

Functions

- int [iniparser_getnsec](#) (dictionary *d)
Get number of sections in a dictionary.
- char * [iniparser_getsecname](#) (dictionary *d, int n)
Get name for section n in a dictionary.
- void [iniparser_dump_ini](#) (dictionary *d, FILE *f)
Save a dictionary to a loadable ini file.
- void [iniparser_dumpsection_ini](#) (dictionary *d, char *s, FILE *f)
Save a dictionary section to a loadable ini file.
- void [iniparser_dump](#) (dictionary *d, FILE *f)
Dump a dictionary to an opened file pointer.
- int [iniparser_getsecnkeys](#) (dictionary *d, char *s)
Get the number of keys in a section of a dictionary.
- char ** [iniparser_getseckeys](#) (dictionary *d, char *s)
Get the number of keys in a section of a dictionary.
- char * [iniparser_getstring](#) (dictionary *d, const char *key, char *def)
Get the string associated to a key.
- int [iniparser_getint](#) (dictionary *d, const char *key, int notfound)
Get the string associated to a key, convert to an int.
- double [iniparser_getdouble](#) (dictionary *d, const char *key, double notfound)
Get the string associated to a key, convert to a double.
- int [iniparser_getboolean](#) (dictionary *d, const char *key, int notfound)
Get the string associated to a key, convert to a boolean.
- int [iniparser_set](#) (dictionary *ini, const char *entry, const char *val)
Set an entry in a dictionary.

- void `iniparser_unset` (`dictionary` *ini, const char *entry)
Delete an entry in a dictionary.
- int `iniparser_find_entry` (`dictionary` *ini, const char *entry)
Finds out if a given entry exists in a dictionary.
- `dictionary` * `iniparser_load` (const char *ininame)
Parse an ini file and return an allocated dictionary object.
- void `iniparser_AK_freedict` (`dictionary` *d)
Free all memory associated to an ini dictionary.
- void `AK_inflate_config` ()

Variables

- `dictionary` * `AK_config`

5.9.1 Detailed Description

Parser for ini files.

Author

N. Devillard

5.9.2 Function Documentation

5.9.2.1 `iniparser_AK_freedict()`

```
void iniparser_AK_freedict (  
    dictionary * d )
```

Free all memory associated to an ini dictionary.

Parameters

<i>d</i>	Dictionary to AK_free
----------	-----------------------

Returns

void

Free all memory associated to an ini dictionary. It is mandatory to call this function before the dictionary object gets out of the current context.

5.9.2.2 `iniparser_dump()`

```
void iniparser_dump (  
    dictionary * d,  
    FILE * f )
```

Dump a dictionary to an opened file pointer.

Parameters

<i>d</i>	Dictionary to dump.
<i>f</i>	Opened file pointer to dump to.

Returns

void

This function prints out the contents of a dictionary, one element by line, onto the provided file pointer. It is OK to specify `stderr` or `stdout` as output files. This function is meant for debugging purposes mostly.

5.9.2.3 `iniparser_dump_ini()`

```
void iniparser_dump_ini (
    dictionary * d,
    FILE * f )
```

Save a dictionary to a loadable ini file.

Parameters

<i>d</i>	Dictionary to dump
<i>f</i>	Opened file pointer to dump to

Returns

void

This function dumps a given dictionary into a loadable ini file. It is Ok to specify `stderr` or `stdout` as output files.

5.9.2.4 `iniparser_dumpsection_ini()`

```
void iniparser_dumpsection_ini (
    dictionary * d,
    char * s,
    FILE * f )
```

Save a dictionary section to a loadable ini file.

Parameters

<i>d</i>	Dictionary to dump
<i>s</i>	Section name of dictionary to dump
<i>f</i>	Opened file pointer to dump to

Returns

void

This function dumps a given section of a given dictionary into a loadable ini file. It is Ok to specify `stderr` or `stdout` as output files.

5.9.2.5 iniparser_find_entry()

```
int iniparser_find_entry (
    dictionary * ini,
    const char * entry )
```

Finds out if a given entry exists in a dictionary.

Parameters

<i>ini</i>	Dictionary to search
<i>entry</i>	Name of the entry to look for

Returns

integer 1 if entry exists, 0 otherwise

Finds out if a given entry exists in the dictionary. Since sections are stored as keys with NULL associated values, this is the only way of querying for the presence of sections in a dictionary.

5.9.2.6 iniparser_getboolean()

```
int iniparser_getboolean (
    dictionary * d,
    const char * key,
    int notfound )
```

Get the string associated to a key, convert to a boolean.

Parameters

<i>d</i>	Dictionary to search
<i>key</i>	Key string to look for
<i>notfound</i>	Value to return in case of error

Returns

integer

This function queries a dictionary for a key. A key as read from an ini file is given as "section:key". If the key cannot be found, the notfound value is returned.

A true boolean is found if one of the following is matched:

- A string starting with 'y'
- A string starting with 'Y'
- A string starting with 't'
- A string starting with 'T'
- A string starting with '1'

A false boolean is found if one of the following is matched:

- A string starting with 'n'
- A string starting with 'N'
- A string starting with 'f'
- A string starting with 'F'
- A string starting with '0'

The notfound value returned if no boolean is identified, does not necessarily have to be 0 or 1.

5.9.2.7 iniparser_getdouble()

```
double iniparser_getdouble (
    dictionary * d,
    const char * key,
    double notfound )
```

Get the string associated to a key, convert to a double.

Parameters

<i>d</i>	Dictionary to search
<i>key</i>	Key string to look for
<i>notfound</i>	Value to return in case of error

Returns

double

This function queries a dictionary for a key. A key as read from an ini file is given as "section:key". If the key cannot be found, the notfound value is returned.

5.9.2.8 iniparser_getint()

```
int iniparser_getint (
    dictionary * d,
    const char * key,
    int notfound )
```

Get the string associated to a key, convert to an int.

Parameters

<i>d</i>	Dictionary to search
<i>key</i>	Key string to look for
<i>notfound</i>	Value to return in case of error

Returns

integer

This function queries a dictionary for a key. A key as read from an ini file is given as "section:key". If the key cannot be found, the notfound value is returned.

Supported values for integers include the usual C notation so decimal, octal (starting with 0) and hexadecimal (starting with 0x) are supported. Examples:

- "42" -> 42
- "042" -> 34 (octal -> decimal)
- "0x42" -> 66 (hexa -> decimal)

Warning: the conversion may overflow in various ways. Conversion is totally outsourced to strtol(), see the associated man page for overflow handling.

Credits: Thanks to A. Becker for suggesting strtol()

Parameters

<i>d</i>	Dictionary to search
<i>key</i>	Key string to look for
<i>notfound</i>	Value to return in case of error

Returns

integer

This function queries a dictionary for a key. A key as read from an ini file is given as "section:key". If the key cannot be found, the notfound value is returned.

Supported values for integers include the usual C notation so decimal, octal (starting with 0) and hexadecimal (starting with 0x) are supported. Examples:

"42" -> 42 "042" -> 34 (octal -> decimal) "0x42" -> 66 (hexa -> decimal)

Warning: the conversion may overflow in various ways. Conversion is totally outsourced to strtol(), see the associated man page for overflow handling.

Credits: Thanks to A. Becker for suggesting strtol()

5.9.2.9 iniparser_getnsec()

```
int iniparser_getnsec (
    dictionary * d )
```

Get number of sections in a dictionary.

Parameters

<i>d</i>	Dictionary to examine
----------	-----------------------

Returns

int Number of sections found in dictionary

This function returns the number of sections found in a dictionary. The test to recognize sections is done on the string stored in the dictionary: a section name is given as "section" whereas a key is stored as "section:key", thus the test looks for entries that do not contain a colon.

This clearly fails in the case a section name contains a colon, but this should simply be avoided.

This function returns -1 in case of error.

5.9.2.10 iniparser_getseckey()

```
char** iniparser_getseckey (
    dictionary * d,
    char * s )
```

Get the number of keys in a section of a dictionary.

Parameters

<i>d</i>	Dictionary to examine
<i>s</i>	Section name of dictionary to examine

Returns

pointer to statically allocated character strings

This function queries a dictionary and finds all keys in a given section. Each pointer in the returned char pointer-to-pointer is pointing to a string allocated in the dictionary; do not AK_free or modify them.

This function returns NULL in case of error.

5.9.2.11 iniparser_getsecname()

```
char* iniparser_getsecname (
    dictionary * d,
    int n )
```

Get name for section n in a dictionary.

Parameters

<i>d</i>	Dictionary to examine
<i>n</i>	Section number (from 0 to nsec-1).

Returns

Pointer to char string

This function locates the n-th section in a dictionary and returns its name as a pointer to a string statically allocated inside the dictionary. Do not `AK_free` or modify the returned string!

This function returns `NULL` in case of error.

5.9.2.12 iniparser_getsecnkeys()

```
int iniparser_getsecnkeys (
    dictionary * d,
    char * s )
```

Get the number of keys in a section of a dictionary.

Parameters

<i>d</i>	Dictionary to examine
<i>s</i>	Section name of dictionary to examine

Returns

Number of keys in section

5.9.2.13 iniparser_getstring()

```
char* iniparser_getstring (
    dictionary * d,
    const char * key,
    char * def )
```

Get the string associated to a key.

Parameters

<i>d</i>	Dictionary to search
<i>key</i>	Key string to look for
<i>def</i>	Default value to return if key not found.

Returns

pointer to statically allocated character string

This function queries a dictionary for a key. A key as read from an ini file is given as "section:key". If the key cannot be found, the pointer passed as 'def' is returned. The returned char pointer is pointing to a string allocated in the dictionary, do not `AK_free` or modify it.

5.9.2.14 `iniparser_load()`

```
dictionary* iniparser_load (
    const char * ininame )
```

Parse an ini file and return an allocated dictionary object.

Parameters

<i>ininame</i>	Name of the ini file to read.
----------------	-------------------------------

Returns

Pointer to newly allocated dictionary

This is the parser for ini files. This function is called, providing the name of the file to be read. It returns a dictionary object that should not be accessed directly, but through accessor functions instead.

The returned dictionary must be AK_freed using [iniparser_AK_freedict\(\)](#).

5.9.2.15 `iniparser_set()`

```
int iniparser_set (
    dictionary * ini,
    const char * entry,
    const char * val )
```

Set an entry in a dictionary.

Parameters

<i>ini</i>	Dictionary to modify.
<i>entry</i>	Entry to modify (entry name)
<i>val</i>	New value to associate to the entry.

Returns

int 0 if Ok, -1 otherwise.

If the given entry can be found in the dictionary, it is modified to contain the provided value. If it cannot be found, -1 is returned. It is Ok to set val to NULL.

5.9.2.16 `iniparser_unset()`

```
void iniparser_unset (
    dictionary * ini,
    const char * entry )
```

Delete an entry in a dictionary.

Parameters

<i>ini</i>	Dictionary to modify
<i>entry</i>	Entry to delete (entry name)

Returns

void

If the given entry can be found, it is deleted from the dictionary.

5.10 auxi/mempro.c File Reference

```
#include "mempro.h"
Include dependency graph for mempro.c:
```

Functions

- void [AK_debmod_d](#) ([AK_debmod_state](#) *ds, const char *message)
Function prints debug message [private function].
- void [AK_debmod_dv](#) ([AK_debmod_state](#) *ds, const char *format,...)
Function prints debug message [private function].
- void [AK_debmod_enter_critical_sec](#) ([AK_debmod_state](#) *ds)
Reserves ds for use [private function].
- void [AK_debmod_leave_critical_sec](#) ([AK_debmod_state](#) *ds)
Makes ds available [private function].
- [AK_debmod_state](#) * [AK_debmod_init](#) (void)
Initializes debug mode structure [public function].
- void [AK_debmod_die](#) ([AK_debmod_state](#) *ds)
Destroy debug mode state (call before main() exit) [public function].
- void * [AK_debmod_calloc](#) ([AK_debmod_state](#) *ds, uint32_t size)
Allocates memory [private function].
- void [AK_debmod_free](#) ([AK_debmod_state](#) *ds, void *memory)
Frees memory allocated with debmod_alloc [private function].
- void * [AK_calloc](#) (size_t num, size_t size)
Allocates memory (see calloc) [public function].
- void * [AK_malloc](#) (size_t size)
Allocate memory (see malloc) [public function].
- void [AK_free](#) (void *ptr)
Free memory at ptr (see free) [public function].
- void * [AK_realloc](#) (void *ptr, size_t size)
Reallocates memory (see realloc) [public function].
- void [AK_write_protect](#) (void *memory)
Function write-protects memory [public function].
- void [AK_write_unprotect](#) (void *memory)
Function write-unprotects memory [public function].
- void [AK_check_for_writes](#) (void)
Marks pages dirty if there were writes between calls to this function.

- `int32_t AK_debmod_func_id (AK_debmod_state *ds, const char *func_name)`
Returns function id for given func_name.
- `const char * AK_debmod_func_get_name (AK_debmod_state *ds, int32_t function_id)`
Lookup function name [private function].
- `int32_t AK_debmod_func_add (AK_debmod_state *ds, const char *func_name)`
Adds function name to list [private function].
- `void AK_debmod_fstack_push (AK_debmod_state *ds, int32_t func_id)`
Push function id on stack [private function].
- `int32_t AK_debmod_fstack_pop (AK_debmod_state *ds)`
Pops function id from stack [private function].
- `void AK_debmod_function_current (AK_debmod_state *ds, int32_t new_function_id)`
Sets current function [private function].
- `void AK_debmod_function_prologue (const char *func_name, const char *source_file, int source_line)`
Not for direct use (only with macro AK_PRO). Marks function prologue.
- `void AK_debmod_log_memory_alloc (int32_t func_id)`
print debmod information on function [private function]
- `void AK_debmod_function_epilogue (const char *func_name, const char *source_file, int source_line)`
Not for direct use (only with macro AK_EPI). Marks function epilogue.
- `void AK_debmod_print_function_use (const char *func_name, uint8_t in_recur)`
Print function dependency [private function].
- `void AK_print_function_use (const char *func_name)`
Print function dependency [public function].
- `void AK_print_function_uses ()`
Print function dependency for all functions [public function].
- `void AK_print_active_functions ()`
Print all detected functions.
- `size_t AK_fwrite (const void *buf, size_t size, size_t count, FILE *fp)`
Write to a file from a buffer (see fwrite) [public function].
- `size_t AK_fread (void *buf, size_t size, size_t count, FILE *fp)`
Read from a file (see fread) [public function].
- `void AK_mempro_test ()`
Test function.

5.10.1 Detailed Description

Implementation of the memory wrappers and debug mode of Kalashnikov DB.

5.10.2 Function Documentation

5.10.2.1 AK_calloc()

```
void* AK_calloc (
    size_t num,
    size_t size )
```

Allocates memory (see calloc) [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>num</i>	number of elements
<i>size</i>	of element in bytes

Returns

allocated memory or NULL

5.10.2.2 AK_check_for_writes()

```
void AK_check_for_writes (
    void )
```

Marks pages dirty if there were writes between calls to this function.

Author

Marin Rukavina, Mislav Bozicevic

Returns

void

5.10.2.3 AK_debmod_calloc()

```
void* AK_debmod_calloc (
    AK_debmod_state * ds,
    uint32_t size )
```

Allocates memory [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>size</i>	in bytes to allocate

Returns

pointer to allocated memory or NULL

5.10.2.4 AK_debmod_d()

```
void AK_debmod_d (
    AK_debmod_state * ds,
    const char * message )
```

Function prints debug message [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>message</i>	string to print

Returns

void

5.10.2.5 AK_debmod_die()

```
void AK_debmod_die (
    AK_debmod_state * ds )
```

Destroy debug mode state (call before main() exit) [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
-----------	------------------

Returns

void

5.10.2.6 AK_debmod_dv()

```
void AK_debmod_dv (
    AK_debmod_state * ds,
    const char * format,
    ... )
```

Function prints debug message [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>format</i>	format string like printf

Returns

void

5.10.2.7 AK_debmod_enter_critical_sec()

```
void AK_debmod_enter_critical_sec (
    AK_debmod_state * ds )
```

Reserves ds for use [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
-----------	------------------

Returns

void

5.10.2.8 AK_debmod_free()

```
void AK_debmod_free (
    AK_debmod_state * ds,
    void * memory )
```

Frees memory allocated with `debmod_alloc` [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>memory</i>	

Returns

void

5.10.2.9 AK_debmod_fstack_pop()

```
int32_t AK_debmod_fstack_pop (
    AK_debmod_state * ds )
```

Pops function id from stack [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
-----------	------------------

Returns

function id popped

5.10.2.10 AK_debmod_fstack_push()

```
void AK_debmod_fstack_push (
    AK_debmod_state * ds,
    int32_t func_id )
```

Push function id on stack [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>func</i> \leftrightarrow <i>_id</i>	function id

Returns

void

5.10.2.11 AK_debmod_func_add()

```
int32_t AK_debmod_func_add (
    AK_debmod_state * ds,
    const char * func_name )
```

Adds function name to list [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>func_name</i>	

Returns

id for added function name

5.10.2.12 AK_debmod_func_get_name()

```
const char* AK_debmod_func_get_name (
    AK_debmod_state * ds,
    int32_t function_id )
```

Lookup function name [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>function_id</i>	

Returns

function name for given function_id

5.10.2.13 AK_debmod_func_id()

```
int32_t AK_debmod_func_id (
    AK_debmod_state * ds,
    const char * func_name )
```

Returns function id for given func_name.

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>func_name</i>	function name [private function]

Returns

function id

5.10.2.14 AK_debmod_function_current()

```
void AK_debmod_function_current (
    AK_debmod_state * ds,
    int32_t new_function_id )
```

Sets current function [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>new_function</i> ↔ <i>_id</i>	

Returns

void

5.10.2.15 AK_debmod_function_epilogue()

```
void AK_debmod_function_epilogue (
    const char * func_name,
    const char * source_file,
    int source_line )
```

Not for direct use (only with macro AK_EPI). Marks function epilogue.

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>func_name</i>	function name as in source
<i>source_file</i>	file name where function is defined
<i>source_line</i>	line from which this function is called

Returns

void

5.10.2.16 AK_debmod_function_prologue()

```
void AK_debmod_function_prologue (
    const char * func_name,
    const char * source_file,
    int source_line )
```

Not for direct use (only with macro AK_PRO). Marks function prologue.

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>func_name</i>	function name as in source
<i>source_file</i>	file name where function is defined
<i>source_line</i>	line from which this function is called

Returns

void

5.10.2.17 AK_debmod_init()

```
AK_debmod_state* AK_debmod_init (
    void )
```

Initializes debug mode structure [public function].

Author

Marin Rukavina, Mislav Bozicevic

Returns

initialized debug mode state

5.10.2.18 AK_debmod_leave_critical_sec()

```
void AK_debmod_leave_critical_sec (
    AK_debmod_state * ds )
```

Makes ds available [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
-----------	------------------

Returns

void

5.10.2.19 AK_debmod_log_memory_alloc()

```
void AK_debmod_log_memory_alloc (
    int32_t func_id )
```

print debmod information on function [private function]

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>func_id</i>	calling function id
----------------	---------------------

Returns

void

5.10.2.20 AK_debmod_print_function_use()

```
void AK_debmod_print_function_use (
    const char * func_name,
    uint8_t in_recur )
```

Print function dependency [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>func_name</i>	function name
<i>in_recur</i>	called in recursion

Returns

void

5.10.2.21 AK_fread()

```
size_t AK_fread (
    void * buf,
```

```
size_t size,  
size_t count,  
FILE * fp )
```

Read from a file (see fread) [public function].

Author

Marin Rukavina, Mislav Bozicevic

Returns

number of items read

5.10.2.22 AK_free()

```
void AK_free (  
    void * ptr )
```

Free memory at ptr (see free) [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ptr</i>	pointer to memory
------------	-------------------

Returns

void

5.10.2.23 AK_fwrite()

```
size_t AK_fwrite (  
    const void * buf,  
    size_t size,  
    size_t count,  
    FILE * fp )
```

Write to a file from a buffer (see fwrite) [public function].

Author

Marin Rukavina, Mislav Bozicevic

Returns

number of items written

5.10.2.24 AK_malloc()

```
void* AK_malloc (
    size_t size )
```

Allocate memory (see malloc) [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>size</i>	of memory to allocate in bytes
-------------	--------------------------------

Returns

allocated memory or NULL

5.10.2.25 AK_mempro_test()

```
void AK_mempro_test ( )
```

Test function.

Author

Ivan Kristo

5.10.2.26 AK_print_active_functions()

```
void AK_print_active_functions ( )
```

Print all detected functions.

Author

Marin Rukavina, Mislav Bozicevic

Returns

void

5.10.2.27 AK_print_function_use()

```
void AK_print_function_use (
    const char * func_name )
```

Print function dependency [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>func_name</i>	function name
------------------	---------------

Returns

void

5.10.2.28 AK_print_function_uses()

```
void AK_print_function_uses ( )
```

Print function dependency for all functions [public function].

Author

Marin Rukavina, Mislav Bozicevic

Returns

void

5.10.2.29 AK_realloc()

```
void* AK_realloc (
    void * ptr,
    size_t size )
```

Reallocates memory (see realloc) [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ptr</i>	old memory
<i>size</i>	new size

Returns

reallocated memory or NULL

5.10.2.30 AK_write_protect()

```
void AK_write_protect (
    void * memory )
```

Function write-protects memory [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>memory</i>	
---------------	--

Returns

void

5.10.2.31 AK_write_unprotect()

```
void AK_write_unprotect (
    void * memory )
```

Function write-unprotects memory [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>memory</i>	
---------------	--

Returns

void

5.11 auxi/mempro.h File Reference

```
#include <stdio.h>
#include <stdint.h>
#include <stdlib.h>
#include <string.h>
#include <assert.h>
#include <time.h>
#include <stdarg.h>
Include dependency graph for mempro.h:
```

Classes

- struct [AK_debmod_state](#)

Global structure that holds all relevant information for the debug mode and related functionality.

Macros

- #define **NEW**(type, type_size) (calloc(type_size, sizeof(type)))
- #define **AK_INLINE** __inline__
- #define **AK_DEBMOD_ON** 0
Zero to switch memory protection and debug mode off.
- #define **AK_DEBMOD_PRINT** 0
Defines if the debug mode messages are going to be printed.
- #define **AK_DEBMOD_PAGES_NUM** 8192
Defines the total available memory pages for allocation.
- #define **AK_DEBMOD_MAX_WRITE_DETECTIONS** (AK_DEBMOD_PAGES_NUM * 10)
Defines the maximum number of memory write detections.
- #define **AK_DEBMOD_STACKSIZE** AK_DEBMOD_PAGES_NUM
Defines the monitored functions stack.
- #define **AK_DEBMOD_MAX_FUNCTIONS** 500
Defines the maximum number of function names in the application.
- #define **AK_DEBMOD_MAX_FUNC_NAME** 80
Defines the maximum function name length possible.
- #define **AK_PRO** AK_debmod_function_prologue(__func__, __FILE__, __LINE__);
Mandatory function prologue for all functions (AK_debmod and related functions are excluded). Put this macro after variable declarations, before any function instruction.
- #define **AK_EPI** AK_debmod_function_epilogue(__func__, __FILE__, __LINE__);
Mandatory function epilogue for all functions (AK_debmod and related functions are excluded). Put this macro after last function instruction, before every return statement.

Functions

- void [AK_debmod_d](#) ([AK_debmod_state](#) *, const char *)
Function prints debug message [private function].
- void [AK_debmod_dv](#) ([AK_debmod_state](#) *, const char *,...)
Function prints debug message [private function].
- void [AK_debmod_enter_critical_sec](#) ([AK_debmod_state](#) *)
Reserves ds for use [private function].
- void [AK_debmod_leave_critical_sec](#) ([AK_debmod_state](#) *)
Makes ds available [private function].
- [AK_debmod_state](#) * [AK_debmod_init](#) (void)
Initializes debug mode structure [public function].
- void [AK_debmod_die](#) ([AK_debmod_state](#) *)
Destroy debug mode state (call before main() exit) [public function].
- void * [AK_debmod_calloc](#) ([AK_debmod_state](#) *, uint32_t)
Allocates memory [private function].
- void [AK_debmod_free](#) ([AK_debmod_state](#) *, void *)
Frees memory allocated with debmod_alloc [private function].
- void * [AK_calloc](#) (size_t, size_t)
Allocates memory (see calloc) [public function].
- void * [AK_malloc](#) (size_t)
Allocate memory (see malloc) [public function].
- void [AK_free](#) (void *)
Free memory at ptr (see free) [public function].
- void * [AK_realloc](#) (void *, size_t)
Reallocates memory (see realloc) [public function].
- void [AK_write_protect](#) (void *)
Function write-protects memory [public function].
- void [AK_write_unprotect](#) (void *)
Function write-unprotects memory [public function].
- void [AK_check_for_writes](#) (void)
Marks pages dirty if there were writes between calls to this function.
- int32_t [AK_debmod_func_id](#) ([AK_debmod_state](#) *, const char *)
Returns function id for given func_name.
- const char * [AK_debmod_func_get_name](#) ([AK_debmod_state](#) *, int32_t)
Lookup function name [private function].
- int32_t [AK_debmod_func_add](#) ([AK_debmod_state](#) *, const char *)
Adds function name to list [private function].
- void [AK_debmod_fstack_push](#) ([AK_debmod_state](#) *, int32_t)
Push function id on stack [private function].
- int32_t [AK_debmod_fstack_pop](#) ([AK_debmod_state](#) *)
Pops function id from stack [private function].
- void [AK_debmod_function_current](#) ([AK_debmod_state](#) *, int32_t)
Sets current function [private function].
- void [AK_debmod_function_prologue](#) (const char *, const char *, int)
Not for direct use (only with macro AK_PRO). Marks function prologue.
- void [AK_debmod_function_epilogue](#) (const char *, const char *, int)
Not for direct use (only with macro AK_EPI). Marks function epilogue.
- void [AK_debmod_log_memory_alloc](#) (int32_t)
print debmod information on function [private function]
- void [AK_debmod_print_function_use](#) (const char *, uint8_t)

- Print function dependency [private function].*
- void [AK_print_function_use](#) (const char *)
- Print function dependency [public function].*
- void [AK_print_function_uses](#) ()
- Print function dependency for all functions [public function].*
- void [AK_print_active_functions](#) ()
- Print all detected functions.*
- void [AK_mempro_test](#) ()
- Test function.*

Variables

- [AK_debmod_state](#) * [AK_DEBMOD_STATE](#)

5.11.1 Detailed Description

Data structures, includes, macros and declarations for the memory wrappers and debug mode of Kalashnikov DB.

5.11.2 Function Documentation

5.11.2.1 [AK_calloc\(\)](#)

```
void* AK_calloc (
    size_t num,
    size_t size )
```

Allocates memory (see calloc) [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>num</i>	number of elements
<i>size</i>	of element in bytes

Returns

allocated memory or NULL

5.11.2.2 AK_check_for_writes()

```
void AK_check_for_writes (
    void )
```

Marks pages dirty if there were writes between calls to this function.

Author

Marin Rukavina, Mislav Bozicevic

Returns

void

5.11.2.3 AK_debmod_calloc()

```
void* AK_debmod_calloc (
    AK_debmod_state * ds,
    uint32_t size )
```

Allocates memory [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>size</i>	in bytes to allocate

Returns

pointer to allocated memory or NULL

5.11.2.4 AK_debmod_d()

```
void AK_debmod_d (
    AK_debmod_state * ds,
    const char * message )
```

Function prints debug message [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>message</i>	string to print

Returns

void

5.11.2.5 AK_debmod_die()

```
void AK_debmod_die (  
    AK_debmod_state * ds )
```

Destroy debug mode state (call before main() exit) [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
-----------	------------------

Returns

void

5.11.2.6 AK_debmod_dv()

```
void AK_debmod_dv (  
    AK_debmod_state * ds,  
    const char * format,  
    ... )
```

Function prints debug message [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>format</i>	format string like printf

Returns

void

5.11.2.7 AK_debmod_enter_critical_sec()

```
void AK_debmod_enter_critical_sec (
    AK_debmod_state * ds )
```

Reserves ds for use [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
-----------	------------------

Returns

void

5.11.2.8 AK_debmod_free()

```
void AK_debmod_free (
    AK_debmod_state * ds,
    void * memory )
```

Frees memory allocated with debmod_alloc [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>memory</i>	

Returns

void

5.11.2.9 AK_debmod_fstack_pop()

```
int32_t AK_debmod_fstack_pop (
    AK_debmod_state * ds )
```

Pops function id from stack [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
-----------	------------------

Returns

function id popped

5.11.2.10 AK_debmod_fstack_push()

```
void AK_debmod_fstack_push (
    AK_debmod_state * ds,
    int32_t func_id )
```

Push function id on stack [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>func_id</i>	function id

Returns

void

5.11.2.11 AK_debmod_func_add()

```
int32_t AK_debmod_func_add (
    AK_debmod_state * ds,
    const char * func_name )
```

Adds function name to list [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>func_name</i>	

Returns

id for added function name

5.11.2.12 AK_debmod_func_get_name()

```
const char* AK_debmod_func_get_name (
    AK_debmod_state * ds,
    int32_t function_id )
```

Lookup function name [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>function↔ _id</i>	

Returns

function name for given function_id

5.11.2.13 AK_debmod_func_id()

```
int32_t AK_debmod_func_id (
    AK_debmod_state * ds,
    const char * func_name )
```

Returns function id for given func_name.

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>func_name</i>	function name [private function]

Returns

function id

5.11.2.14 AK_debmod_function_current()

```
void AK_debmod_function_current (
    AK_debmod_state * ds,
    int32_t new_function_id )
```

Sets current function [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
<i>new_function_id</i>	

Returns

void

5.11.2.15 AK_debmod_function_epilogue()

```
void AK_debmod_function_epilogue (
    const char * func_name,
    const char * source_file,
    int source_line )
```

Not for direct use (only with macro AK_EPI). Marks function epilogue.

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>func_name</i>	function name as in source
<i>source_file</i>	file name where function is defined
<i>source_line</i>	line from which this function is called

Returns

void

5.11.2.16 AK_debmod_function_prologue()

```
void AK_debmod_function_prologue (
    const char * func_name,
    const char * source_file,
    int source_line )
```

Not for direct use (only with macro AK_PRO). Marks function prologue.

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>func_name</i>	function name as in source
<i>source_file</i>	file name where function is defined
<i>source_line</i>	line from which this function is called

Returns

void

5.11.2.17 AK_debmod_init()

```
AK_debmod_state* AK_debmod_init (
    void )
```

Initializes debug mode structure [public function].

Author

Marin Rukavina, Mislav Bozicevic

Returns

initialized debug mode state

5.11.2.18 AK_debmod_leave_critical_sec()

```
void AK_debmod_leave_critical_sec (
    AK_debmod_state * ds )
```

Makes ds available [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ds</i>	debug mode state
-----------	------------------

Returns

void

5.11.2.19 AK_debmod_log_memory_alloc()

```
void AK_debmod_log_memory_alloc (
    int32_t func_id )
```

print debmod information on function [private function]

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>func</i> _↔ <i>_id</i>	calling function id
----------------------------------------	---------------------

Returns

void

5.11.2.20 AK_debmod_print_function_use()

```
void AK_debmod_print_function_use (
    const char * func_name,
    uint8_t in_recur )
```

Print function dependency [private function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>func_name</i>	function name
<i>in_recur</i>	called in recursion

Returns

void

5.11.2.21 AK_free()

```
void AK_free (
    void * ptr )
```

Free memory at ptr (see free) [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ptr</i>	pointer to memory
------------	-------------------

Returns

void

5.11.2.22 AK_malloc()

```
void* AK_malloc (
    size_t size )
```

Allocate memory (see malloc) [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>size</i>	of memory to allocate in bytes
-------------	--------------------------------

Returns

allocated memory or NULL

5.11.2.23 AK_mempro_test()

```
void AK_mempro_test ( )
```

Test function.

Author

Ivan Kristo

5.11.2.24 AK_print_active_functions()

```
void AK_print_active_functions ( )
```

Print all detected functions.

Author

Marin Rukavina, Mislav Bozicevic

Returns

void

5.11.2.25 AK_print_function_use()

```
void AK_print_function_use (
    const char * func_name )
```

Print function dependency [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>func_name</i>	function name
------------------	---------------

Returns

void

5.11.2.26 AK_print_function_uses()

```
void AK_print_function_uses ( )
```

Print function dependency for all functions [public function].

Author

Marin Rukavina, Mislav Bozicevic

Returns

void

5.11.2.27 AK_realloc()

```
void* AK_realloc (
    void * ptr,
    size_t size )
```

Reallocates memory (see realloc) [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>ptr</i>	old memory
<i>size</i>	new size

Returns

reallocated memory or NULL

5.11.2.28 AK_write_protect()

```
void AK_write_protect (
    void * memory )
```

Function write-protects memory [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>memory</i>	
---------------	--

Returns

void

5.11.2.29 AK_write_unprotect()

```
void AK_write_unprotect (
    void * memory )
```

Function write-unprotects memory [public function].

Author

Marin Rukavina, Mislav Bozicevic

Parameters

<i>memory</i>	
---------------	--

Returns

void

5.12 auxi/observable.c File Reference

```
#include " ./observable.h"
```

Include dependency graph for observable.c:

Classes

- struct [_notifyDetails](#)
- struct [TypeObservable](#)
- struct [TypeObserver](#)

Typedefs

- typedef struct [_notifyDetails](#) **NotifyDetails**
- typedef struct [TypeObservable](#) **AK_TypeObservable**
- typedef struct [TypeObserver](#) **AK_TypeObserver**
- typedef struct [TypeObserver](#) **AK_TypeObserver_Second**

Enumerations

- enum **NotifyType** { **ERROR**, **INFO**, **WARMING** }

Functions

- [AK_observable](#) * [AK_init_observable](#) (void *AK_observable_type, AK_ObservableType_Enum AK_↵
ObservableType_Def, void *AK_custom_action)
Function that initializes a observable object.
- [AK_observer](#) * [AK_init_observer](#) (void *observer_type, void(*observer_type_event_handler)(void *, void *,
AK_ObservableType_Enum))
Function that initializes the observer object.
- char * [AK_get_message](#) ([AK_TypeObservable](#) *self)
- int [AK_custom_register_observer](#) ([AK_TypeObservable](#) *self, [AK_observer](#) *observer)
- int [AK_custom_unregister_observer](#) ([AK_TypeObservable](#) *self, [AK_observer](#) *observer)
- void [AK_set_notify_info_details](#) ([AK_TypeObservable](#) *self, NotifyType type, char *message)
- int [AK_custom_action](#) (void *data)
- [AK_TypeObservable](#) * [init_observable_type](#) ()
- void [handle_AK_custom_type](#) ([AK_TypeObserver](#) *observer, [AK_TypeObservable](#) *observable)
- void [custom_observer_event_handler](#) (void *observer, void *observable, AK_ObservableType_Enum A↵
K_ObservableType_Def)
- [AK_TypeObserver](#) * [init_observer_type](#) (void *observable)
- [AK_TypeObserver](#) * [init_observer_type_second](#) ()
- [TestResult](#) [AK_observable_test](#) ()
Function that runs tests for observable pattern.
- [TestResult](#) [AK_observable_pattern](#) ()

5.12.1 Detailed Description

File that provides the implementations of functions for observable pattern

5.12.2 Function Documentation

5.12.2.1 AK_init_observable()

```
AK_observable* AK_init_observable (
    void * AK_observable_type,
    AK_ObservableType_Enum AK_ObservableType_Def,
    void * AK_custom_action )
```

Function that initializes a observable object.

Author

Ivan Pusic

Returns

Pointer to new observable object

5.12.2.2 AK_init_observer()

```
AK_observer* AK_init_observer (
    void * observer_type,
    void(*) (void *, void *, AK_ObservableType_Enum) observer_type_event_handler )
```

Function that initializes the observer object.

Author

Ivan Pusic

Returns

Pointer to new observer object

5.12.2.3 AK_observable_test()

```
TestResult AK_observable_test ( )
```

Function that runs tests for observable pattern.

Author

Ivan Pusic

5.13 auxi/observable.h File Reference

```
#include "test.h"
#include "constants.h"
#include "debug.h"
#include "mempro.h"
#include <string.h>
```

Include dependency graph for observable.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [Observer](#)
Structure that defines the functions for observer object.
- struct [Observable](#)
Structure that defines the functions for observable object.

Typedefs

- typedef struct [Observer](#) **AK_observer**
- typedef struct [Observable](#) **AK_observable**

Enumerations

- enum **AK_ObservableType_Enum** { **AK_TRANSACTION**, **AK_TRIGGER**, **AK_CUSTOM_FIRST**, **AK_CUSTOM_SECOND** }

Functions

- [AK_observer](#) * [AK_init_observer](#) (void *observable_type, void(*observable_type_event_handler)(void *, void *, AK_ObservableType_Enum))
Function that initializes the observer object.
- [AK_observable](#) * [AK_init_observable](#) (void *AK_observable_type, AK_ObservableType_Enum AK_observable_type_Def, void *AK_custom_action)
Function that initializes a observable object.
- [TestResult](#) [AK_observable_test](#) ()
Function that runs tests for observable pattern.
- [TestResult](#) [AK_observable_pattern](#) ()

5.13.1 Detailed Description

Header file that provides data structures and declarations of functions for observable pattern

5.13.2 Function Documentation

5.13.2.1 AK_init_observable()

```
AK_observable* AK_init_observable (
    void * AK_observable_type,
    AK_ObservableType_Enum AK_ObservableType_Def,
    void * AK_custom_action )
```

Function that initializes a observable object.

Author

Ivan Pusic

Returns

Pointer to new observable object

5.13.2.2 AK_init_observer()

```
AK_observer* AK_init_observer (
    void * observer_type,
    void(*) (void *, void *, AK_ObservableType_Enum) observer_type_event_handler )
```

Function that initializes the observer object.

Author

Ivan Pusic

Returns

Pointer to new observer object

5.13.2.3 AK_observable_test()

```
TestResult AK_observable_test ( )
```

Function that runs tests for observable pattern.

Author

Ivan Pusic

5.14 auxi/test.c File Reference

```
#include "test.h"
```

Include dependency graph for test.c:

Functions

- `TestResult TEST_result` (int successfulAmount, int failedAmount)
Returns the amount of successful and failed tests.
- void `TEST_output_results` (`TestResult` result)
Prints a beautiful string informing the user of test results in the terminal.

5.14.1 Detailed Description

Provides functions for reporting test results for modules.

5.14.2 Function Documentation

5.14.2.1 TEST_output_results()

```
void TEST_output_results (  
    TestResult result )
```

Prints a beautiful string informing the user of test results in the terminal.

Author

Igor Rinkovec

Returns

void

5.14.2.2 TEST_result()

```
TestResult TEST_result (  
    int successfulAmount,  
    int failedAmount )
```

Returns the amount of successful and failed tests.

Author

Igor Rinkovec

Parameters

<i>successfulAmount</i>	amount of successful tests
<i>failedAmount</i>	amount of failed tests

Returns

[TestResult](#)

5.15 file/test.c File Reference

```
#include <pthread.h>
#include <stdio.h>
#include "test.h"
#include "../trans/transaction.h"
#include "../file/table.h"
#include "../auxiliary/auxiliary.h"
#include "../opti/rel_eq_comut.h"
Include dependency graph for test.c:
```

Functions

- char * [AK_get_table_attribute_types](#) (char *tblName)
returns a string containing attribute types for the supplied table name, seperated by ATTR_DELIMITER
- int [create_header_test](#) (char *tbl_name, char **attr_name, int _num, int *_type)
Function for creating test table header.
- int [insert_data_test](#) (char *tbl_name, char **attr_name, char **attr_value, int _num, int *_type)
Function for inserting test data into the table (needed for python testing)
- int [selection_test](#) (char *src_table, char *dest_table, char **sel_query, int _num, int *_type)
Function for selection operator on one table.
- int [get_column_test](#) (int num, char *tbl)
Function that prints the requested column.
- int [get_row_test](#) (int num, char *tbl)
Function that prints the requested row.
- void [AK_create_test_tables](#) ()
Function for creating test tables.

5.15.1 Detailed Description

Provides functions for testing purposes

5.15.2 Function Documentation

5.15.2.1 AK_create_test_tables()

```
void AK_create_test_tables ( )
```

Function for creating test tables.

Author

Dino Laktašić

Returns

No return value

5.15.2.2 AK_get_table_attribute_types()

```
char* AK_get_table_attribute_types (
    char * tblName )
```

returns a string containing attribute types for the supplied table name, seperated by ATTR_DELIMITER

Author

Goran Štok

Parameters

<i>tblName</i>	name of the table for which the attribute types will be returned
----------------	------------------------------------------------------------------

5.15.2.3 create_header_test()

```
int create_header_test (
    char * tbl_name,
    char ** attr_name,
    int _num,
    int * _type )
```

Function for creating test table header.

Author

Luka Rajcevic

Parameters

<i>tbl_name</i>	- name of the table for which the header will be created
<i>attr_name</i>	- array of attribute names
<i>_num</i>	- number of attributes
<i>_type</i>	- array of attribute types (eg. TYPE_INT, TYPE_VARCHAR, etc.)

Returns

1 if ok, 0 otherwise

5.15.2.4 get_column_test()

```
int get_column_test (
    int num,
    char * tbl )
```

Function that prints the requested column.

Author

Luka Rajcevic

Returns

1 if column is found, 0 otherwise

Parameters

<i>num</i>	- 0 based index of column
<i>tbl</i>	- name of the table

5.15.2.5 get_row_test()

```
int get_row_test (
    int num,
    char * tbl )
```

Function that prints the requested row.

Author

Luka Rajcevic

Returns

1 if row is found, 0 otherwise

Parameters

<i>num</i>	- 0 based index of row
<i>tbl</i>	- name of the table

5.15.2.6 insert_data_test()

```
int insert_data_test (
    char * tbl_name,
    char ** attr_name,
    char ** attr_value,
    int _num,
    int * _type )
```

Function for inserting test data into the table (needed for python testing)

Author

Luka Rajcevic

Parameters

<i>tbl_name</i>	- name of the table for which the header will be created
<i>attr_name</i>	- array of attribute names
<i>attr_value</i>	- values of attributes to be inserted
<i>_num</i>	- number of attributes
<i>_type</i>	- array of attribute types (eg. TYPE_INT, TYPE_VARCHAR, etc.)

Returns

EXIT_SUCCESS if ok, EXIT_ERROR otherwise

5.15.2.7 selection_test()

```
int selection_test (
    char * src_table,
    char * dest_table,
    char ** sel_query,
    int _num,
    int * _type )
```

Function for selection operator on one table.

Author

Luka Rajcevic

•

Parameters

<i>src_table</i>	- name of the source table •
<i>dest_table</i>	- table in which selection will be stored
<i>sel_query</i>	- array of operators, operands and attributes (postfix query)
<i>_num</i>	- number of attributes
<i>_type</i>	- array of attribute types (eg. TYPE_INT, TYPE_VARCHAR, etc.)

Returns

EXIT_SUCCESS if ok, EXIT_ERROR otherwise

5.16 file/test.h File Reference

```
#include "files.h"
#include "../auxi/mempro.h"
```

Include dependency graph for test.h: This graph shows which files directly or indirectly include this file:

Functions

- char * [AK_get_table_attribute_types](#) (char *tblName)
returns a string containing attribute types for the supplied table name, seperated by ATTR_DELIMITER
- int [create_header_test](#) (char *tbl_name, char **attr_name, int _num, int *_type)
Function for creating test table header.
- int [insert_data_test](#) (char *tbl_name, char **attr_name, char **attr_value, int _num, int *_type)
Function for inserting test data into the table (needed for python testing)
- int [selection_test](#) (char *src_table, char *dest_table, char **sel_query, int _num, int *_type)
Function for selection operator on one table.
- int [get_column_test](#) (int num, char *tbl)
Function that prints the requested column.
- int [get_row_test](#) (int num, char *tbl)
Function that prints the requested row.
- void [AK_create_test_tables](#) ()
Function for creating test tables.

5.16.1 Detailed Description

Header file that provides functions and defines for testing purposes

5.16.2 Function Documentation

5.16.2.1 AK_create_test_tables()

```
void AK_create_test_tables ( )
```

Function for creating test tables.

Author

Dino Laktašić

Returns

No return value

5.16.2.2 AK_get_table_attribute_types()

```
char* AK_get_table_attribute_types (
    char * tblName )
```

returns a string containing attribute types for the supplied table name, seperated by ATTR_DELIMITER

Author

Goran Štok

Parameters

<i>tblName</i>	name of the table for which the attribute types will be returned
----------------	------------------------------------------------------------------

5.16.2.3 create_header_test()

```
int create_header_test (
    char * tbl_name,
    char ** attr_name,
    int _num,
    int * _type )
```

Function for creating test table header.

Author

Luka Rajcevic

Parameters

<i>tbl_name</i>	- name of the table for which the header will be created
<i>attr_name</i>	- array of attribute names
<i>_num</i>	- number of attributes
<i>_type</i>	- array of attribute types (eg. TYPE_INT, TYPE_VARCHAR, etc.)

Returns

1 if ok, 0 otherwise

5.16.2.4 get_column_test()

```
int get_column_test (
    int num,
    char * tbl )
```

Function that prints the requested column.

Author

Luka Rajcevic

Returns

1 if column is found, 0 otherwise

Parameters

<i>num</i>	- 0 based index of column
<i>tbl</i>	- name of the table

5.16.2.5 get_row_test()

```
int get_row_test (
    int num,
    char * tbl )
```

Function that prints the requested row.

Author

Luka Rajcevic

Returns

1 if row is found, 0 otherwise

Parameters

<i>num</i>	- 0 based index of row
<i>tbl</i>	- name of the table

5.16.2.6 insert_data_test()

```
int insert_data_test (
    char * tbl_name,
    char ** attr_name,
    char ** attr_value,
    int _num,
    int * _type )
```

Function for inserting test data into the table (needed for python testing)

Author

Luka Rajcevic

Parameters

<i>tbl_name</i>	- name of the table for which the header will be created
<i>attr_name</i>	- array of attribute names
<i>attr_value</i>	- values of attributes to be inserted
<i>_num</i>	- number of attributes
<i>_type</i>	- array of attribute types (eg. TYPE_INT, TYPE_VARCHAR, etc.)

Returns

EXIT_SUCCESS if ok, EXIT_ERROR otherwise

5.16.2.7 selection_test()

```
int selection_test (
    char * src_table,
    char * dest_table,
    char ** sel_query,
    int _num,
    int * _type )
```

Function for selection operator on one table.

Author

Luka Rajcevic

•

Parameters

<i>src_table</i>	- name of the source table •
<i>dest_table</i>	- table in which selection will be stored
<i>sel_query</i>	- array of operators, operands and attributes (postfix query)
<i>_num</i>	- number of attributes
<i>_type</i>	- array of attribute types (eg. TYPE_INT, TYPE_VARCHAR, etc.)

Returns

EXIT_SUCCESS if ok, EXIT_ERROR otherwise

5.17 dm/dbman.c File Reference

```
#include "dbman.h"
```

Include dependency graph for dbman.c:

Functions

- int [AK_init_db_file](#) (int size)

Function that initializes a new database file named DB_FILE. It opens database file. New block is allocated. In this block type of header is set to FREE_INT, attribute names are set to FREE_CHAR, integrities are set to FREE_INT, constraint names are set to FREE_CHAR, constraint names and codes are set to FREE_CHAR. Type, address and size of tuples are set to FREE_INT. Data in block is set to FREE_CHAR. Type of block is BLOCK_TYPE_FREE, it is not chained and id of last tuple is 0.
- int [AK_get_allocation_set](#) (int *allocationSet, int fromWhere, int gaplength, int numRequestedBlocks, [AK_allocation_set_mode](#) mode, int target)

Function prepare demanded sets from allocation table.
- int [AK_allocationtable_dump](#) (int verbosity)

Dumps the allocation table from the global allocation bit-vector onto standard output.
- void [AK_blocktable_dump](#) (int verbosity)

Dumps the bit-table from the global allocation bit-vector onto standard output.
- int [AK_blocktable_flush](#) ()

Function flushes bitmask table to the disk.
- void [AK_allocate_block_activity_modes](#) ()

Allocation of an array which will contain information about which blocks are being accessed. Creates an array. Each element of this array will correspond to one initialized block. For more info, see explanation in [dbman.h](#).
- int [AK_blocktable_get](#) ()

Function gets allocation table from the disk.
- int [fsize](#) (FILE *fp)

Helper function to determine file size.
- int [AK_init_allocation_table](#) ()

Function that initializes the allocation table, writes it to the disk and caches it in memory.
- [AK_block](#) * [AK_init_block](#) ()

Function that initializes new block.
- int [AK_print_block](#) ([AK_block](#) *block, int num, char *gg, FILE *fpp)

Function that dumps a block.
- int [AK_allocate_blocks](#) (FILE *db, [AK_block](#) *block, int FromWhere, int HowMany)

Function that allocates new blocks by placing them to appropriate place and then updates the last initialized index.
- [AK_block](#) * [AK_read_block](#) (int address)

Function that reads a block at a given address (block number less than db_file_size). New block is allocated. Database file is opened. Position is set to provided address block. At the end function reads file from that position. Completely thread-safe.
- int [AK_write_block](#) ([AK_block](#) *block)

Function that writes a block to the DB file. Database file is opened. Position is set to provided address block. Block is written to provided address. Completely thread-safe.
- int [AK_copy_header](#) ([AK_header](#) *header, int *blockSet, int blockSetSize)

Function copy header to blocks. Completely thread-safe.

- int * [AK_get_extent](#) (int start_address, int desired_size, [AK_allocation_set_mode](#) *mode, int border, int target, [AK_header](#) *header, int gl)

Function that allocates new extent of blocks. Number of blocks is not ordered as well as a way of search for them.
- int * [AK_increase_extent](#) (int start_address, int add_size, [AK_allocation_set_mode](#) *mode, int border, int target, [AK_header](#) *header, int gl)

Function that allocates a new blocks for increasing extent size.
- int [AK_new_extent](#) (int start_address, int old_size, int extent_type, [AK_header](#) *header)

Function that allocates new extent of blocks. If argument "old_size" is 0 than size of extent is INITIAL_EXTENT_SIZE. Otherwise, resize factor is set according to type of extent. If writing of block is successful, number of blocks is incremented.
- int [AK_new_segment](#) (char *name, int type, [AK_header](#) *header)

Function that allocates new segment of extents. In this phase of implementation, only extents containing INITIAL_EXTENT_SIZE blocks can be allocated. If extent is successfully allocated, number of allocated extents is incremented and function goes to next block after allocated extent. Otherwise, function moves to INITIAL_EXTENT_SIZE blocks. In that way function gets either first block of new extent or some block in that extent which will not be AK_free.
- [AK_header](#) * [AK_create_header](#) (char *attribute_name, int type, int integrity, char *constr_name, char *constr_code)

Function that creates header and initialize integrity, constraint name and constraint code with parameter values of function.
- void [AK_insert_entry](#) ([AK_block](#) *block_address, int type, void *entry_data, int i)

Function that inserts an entry in tuple_dict and data of a block. Address, type and size of catalog_tuple_dict are set. Free space of block is also set.
- int [AK_init_system_tables_catalog](#) (int relation, int attribute, int index, int view, int sequence, int function, int function_arguments, int trigger, int trigger_conditions, int [db](#), int db_obj, int user, int group, int user_group, int user_right, int group_right, int constraint, int constraintNull, int constraintCheck, int constraintUnique, int reference)

Function that initialises the sytem table catalog and writes the result in first (0) block in db_file. Catalog block, catalog header name, catalog header address are allocated. Address, type, chained_with and AK_free_space attributes are initialized. Names of various database elements are written in block.
- void [AK_memset_int](#) (void *block, int value, size_t num)

Function that sets the first num ints of a block of memory to the specified value.
- int [AK_register_system_tables](#) (int relation, int attribute, int index, int view, int sequence, int function, int function_arguments, int trigger, int trigger_conditions, int [db](#), int db_obj, int user, int group, int user_group, int user_right, int group_right, int constraint, int constraintNull, int constraintCheck, int constraintUnique, int reference)

Function that registers system tables. Block at the given address is read. Various data from function arguments are written in block about different database elements.
- int [AK_init_system_catalog](#) ()

Function that initializes the system catalog. Headers for system tables are defined. Segments for those system tables are allocated. Above function [AK_register_system_tables\(\)](#) to register system tables.
- int [AK_delete_block](#) (int address)

Function that deletes a block by a given block address (resets the header and data). Types, integrities, constraint names, constraint codes are set to "AK_free" values. In tuple dictionary type, address and size are set to FREE_INT values. Data of block is set to FREE_CHAR.
- int [AK_delete_extent](#) (int begin, int end)

Function that deletes an extent between the first and the last block.
- int [AK_delete_segment](#) (char *name, int type)
- int [AK_init_disk_manager](#) ()
- [TestResult](#) [AK_allocationbit_test](#) ()
- [TestResult](#) [AK_allocationtable_test](#) ()
- [TestResult](#) [AK_thread_safe_block_access_test](#) ()

This function tests thread safe reading and writing to blocks. There is N writing and N reading threads, which are going through iterations. Each reading thread should read the data (character) that was set by last writing thread.
- void * [AK_read_block_for_testing](#) (void *address)

This function is only for testing. It has to be there, because pthread_create only accepts void function_name (void *) function format. So AK_read_block is no-go for pthread_create.*

- void * [AK_write_block_for_testing](#) (void *block)

This function is only for testing. It has to be there, because pthread_create only accepts void function_name (void *) function format. So AK_write_block is no-go for pthread_create.*

Variables

- pthread_mutex_t **fileLockMutex** = PTHREAD_MUTEX_INITIALIZER
- char [test_lastCharacterWritten](#) = '\0'

This variable is used only when TEST_MODE is ON! It is used only for testing functionality of [AK_thread_safe_block_access_test\(\)](#) function. It will contain first character of last written block. When reading thread reads the block (written by some other thread), it will compare the first character from this block to character contained in this variables. If they don't match, then the error occurred! It is assumed that the same block is being written to and read from (just like [AK_thread_safe_block_access_test](#) function works!)

- int [test_threadSafeBlockAccessSucceeded](#) = 1

Used in combination with [test_lastCharacterWritten](#). Will give the answer to question: "Has [AK_thread_safe_block_access_test](#) succeeded?" 0 means NO, 1 means YES.

5.17.1 Detailed Description

Defines functions for the disk manager

5.17.2 Function Documentation

5.17.2.1 AK_allocate_block_activity_modes()

```
void AK_allocate_block_activity_modes ( )
```

Allocation of an array which will contain information about which blocks are being accessed. Creates an array. Each element of this array will correspond to one initialized block. For more info, see explanation in [dbman.h](#).

Author

Domagoj Šitum

5.17.2.2 AK_allocate_blocks()

```
int AK_allocate_blocks (
    FILE * db,
    AK_block * block,
    int FromWhere,
    int HowMany )
```

Function that allocates new blocks by placing them to appropriate place and then updates the last initialized index.

Author

Markus Schatten , rearranged by dv

Returns

EXIT_SUCCESS if the file has been written to disk, EXIT_ERROR otherwise

5.17.2.3 AK_allocationtable_dump()

```
int AK_allocationtable_dump (
    int verbosity )
```

Dumps the allocation table from the global allocation bit-vector onto standard output.

Author

dv

Parameters

<i>verbosity</i>	level of verbosity (1 - minimal, 0 - no output)
------------------	-------------------------------------------------

5.17.2.4 AK_blocktable_dump()

```
void AK_blocktable_dump (
    int verbosity )
```

Dumps the bit-table from the global allocation bit-vector onto standard output.

Author

dv

Parameters

<i>verbosity</i>	level of verbosity (1 - verbose, 0 - minimal)
------------------	-----------------------------------------------

5.17.2.5 AK_blocktable_flush()

```
int AK_blocktable_flush ( )
```

Function flushes bitmask table to the disk.

Author

dv

Returns

EXIT_SUCCESS if the file has been written to the disk, EXIT_ERROR otherwise

5.17.2.6 AK_blocktable_get()

```
int AK_blocktable_get ( )
```

Function gets allocation table from the disk.

Author

dv

Returns

EXIT_SUCCESS if the file has been taken from disk, EXIT_ERROR otherwise

5.17.2.7 AK_copy_header()

```
int AK_copy_header (
    AK_header * header,
    int * blockSet,
    int blockSetSize )
```

Function copy header to blocks. Completely thread-safe.

Author

Nikola Bakoš, updated by Dino Laktašić (fixed header BUG), refurbished by dv

Parameters

<i>header</i>	Pointer to header which will be copied into each block in blockSet
<i>blockSet</i>	Pointer to array of block addresses into which to copy header
<i>blockSetSize</i>	Number of blocks in blockSet

Returns

number of performed header copy

5.17.2.8 AK_create_header()

```
AK_header* AK_create_header (
    char * attribute_name,
    int type,
    int integrity,
    char * constr_name,
    char * contr_code )
```

Function that creates header and initialize integrity, constraint name and constraint code with parameter values of function.

Author

Matija Novak

Parameters

<i>name</i>	name of the attribute
<i>type</i>	type of the attribute
<i>integrity</i>	standard integrity constraint
<i>constr_name</i>	extra integrity constraint name
<i>contr_code</i>	extra integrity constraint code

Returns[AK_header](#)**5.17.2.9 AK_delete_block()**

```
int AK_delete_block (
    int address )
```

Function that deletes a block by a given block address (resets the header and data). Types, integrities, constraint names, constraint codes are set to "AK_free" values. In tuple dictionary type, address and size are set to FREE_INT values. Data of block is set to FREE_CHAR.

Author

Markus Schatten

Parameters

<i>address</i>	address of the block to be deleted
----------------	------------------------------------

Returns

returns EXIT_SUCCESS if deletion successful, else EXIT_ERROR

5.17.2.10 AK_delete_extent()

```
int AK_delete_extent (
    int begin,
    int end )
```

Function that deletes an extent between the first and the last block.

Author

Dejan Sambolić

Parameters

<i>begin</i>	address of extent's first block
<i>end</i>	address of extent's last block

Returns

EXIT_SUCCESS if extent has been successfully deleted, EXIT_ERROR otherwise

5.17.2.11 AK_delete_segment()

```
int AK_delete_segment (
    char * name,
    int type )
```

Author

Mislav Ćakarĭæ

Parameters

<i>name</i>	name of the segment
<i>type</i>	type of the segment

Returns

EXIT_SUCCESS if extent has been successfully deleted, EXIT_ERROR otherwise

5.17.2.12 AK_get_allocation_set()

```
int AK_get_allocation_set (
    int * allocationSet,
    int fromWhere,
    int gaplength,
    int numRequestedBlocks,
    AK_allocation_set_mode mode,
    int target )
```

Function prepare demanded sets from allocation table.

Author

dv

Parameters

<i>allocationSet</i>	Pointer to array which will be filled and represent the allocation set
<i>fromWhere</i>	Has meaning only if mode is SEQUENCE. It describes from which address searching starts.
<i>gaplength</i>	Tells how many used blocks can be tolerated in allocation set
<i>numRequestedBlocks</i>	Tells how many AK_free blocks have been requested
<i>mode</i>	Defines how to obtain set of indexes to AK_free addresses
<i>target</i>	Has meaning just if mode is AROUND: set will be as close as possible to the requested target address from both sides

Returns

the first element of the allocation set

5.17.2.13 AK_get_extent()

```
int* AK_get_extent (
    int start_address,
    int desired_size,
    AK_allocation_set_mode * mode,
    int border,
    int target,
    AK_header * header,
    int gl )
```

Function that allocates new extent of blocks. Number of blocks is not ordered as well as a way of search for them.

Author

dv

Parameters

<i>start_address</i>	address (block number) to start searching for sufficient space
<i>desired_size</i>	number of desired blocks
<i>AK_allocation_set_mode</i>	a way of trying to find AK_free space. Can be one of: allocationSEQUENCE, allocationUPPER, allocationLOWER, allocationAROUND
<i>border</i>	number of allocated blocks gap
<i>target</i>	block address around which other blocks have to be searched
<i>header</i>	pointer to header that should be written to the new extent (all blocks)
<i>int</i>	gl gap size

Returns

pointer to set of allocated block addresses

vars for loop [for]

if some blocks are not successfully allocated, which means that the extend allocation has FAILED

5.17.2.14 AK_increase_extent()

```
int* AK_increase_extent (
    int start_address,
    int add_size,
    AK_allocation_set_mode * mode,
    int border,
    int target,
    AK_header * header,
    int gl )
```

Function that allocates a new blocks for increasing extent size.

Author

dv

Parameters

<i>start_address</i>	first address of extent that is subject of increasing
<i>add_size</i>	number how many new blocks is to be added to existing extent
<i>AK_allocation_set_mode</i>	a way of trying to find AK_free space. Can be one of: allocationSEQUENCE, allocationUPPER, allocationLOWER, allocationAROUND
<i>border</i>	number of allocated blocks gap
<i>target</i>	block address around which other blocks have to be searched
<i>header</i>	pointer to header that should be written to the new extent (all blocks)
<i>int</i>	gl gap size

Returns

pointer to set of allocated block addresses

5.17.2.15 AK_init_allocation_table()

```
int AK_init_allocation_table ( )
```

Function that initializes the allocation table, writes it to the disk and caches it in memory.

Author

dv

Returns

EXIT_SUCCESS if the file has been written to disk, EXIT_ERROR otherwise

5.17.2.16 AK_init_block()

```
AK_block* AK_init_block ( )
```

Function that initializes new block.

Author

Markus Schatten , rearranged by dv

Returns

pointer to block allocated in memory

5.17.2.17 AK_init_db_file()

```
int AK_init_db_file (
    int size )
```

Function that initializes a new database file named DB_FILE. It opens database file. New block is allocated. In this block type of header is set to FREE_INT, attribute names are set to FREE_CHAR, integrities are set to FREE_INT, constraint names are set to FREE_CHAR, constraint names and codes are set to FREE_CHAR. Type, address and size of tuples are set to FREE_INT. Data in block is set to FREE_CHAR. Type of block is BLOCK_TYPE_FREE, it is not chained and id of last tuple is 0.

Author

Markus Schatten

Parameters

<i>size</i>	size of new file in in blocks
-------------	-------------------------------

Returns

EXIT_SUCCESS if the file has been written to disk, EXIT_ERROR otherwise

5.17.2.18 AK_init_disk_manager()

```
int AK_init_disk_manager ( )
```

Author

Markus Schatten

Returns

Function that calls functions [AK_init_db_file\(\)](#) and [AK_init_system_catalog\(\)](#) to initialize disk manager. It also calls [AK_allocate_array_currently_accessed_blocks\(\)](#) to allocate memory needed for thread-safe reading and writing to disk.

5.17.2.19 AK_init_system_catalog()

```
int AK_init_system_catalog ( )
```

Function that initializes the system catalog. Headers for system tables are defined. Segments for those system tables are allocated. Above function [AK_register_system_tables\(\)](#) to register system tables.

Author

Miroslav Policki

Returns

EXIT_SUCCESS if the system catalog has been successfully initialized, EXIT_ERROR otherwise

5.17.2.20 AK_init_system_tables_catalog()

```
int AK_init_system_tables_catalog (
    int relation,
    int attribute,
    int index,
    int view,
    int sequence,
    int function,
    int function_arguments,
    int trigger,
    int trigger_conditions,
    int db,
    int db_obj,
    int user,
    int group,
    int user_group,
    int user_right,
    int group_right,
    int constraint,
    int constraintNull,
    int constraintCheck,
    int constraintUnique,
    int reference )
```

Function that initialises the sytem table catalog and writes the result in first (0) block in db_file. Catalog block, catalog header name, catalog header address are allocated. Address, type, chained_with and AK_free_space attributes are initialized. Names of various database elements are written in block.

Author

Matija Novak

Parameters

<i>relation</i>	address of system table of relation in db_file
<i>attribute</i>	address of system table of attribute in db_file
<i>index</i>	address of system table of index in db_file
<i>view</i>	address of system table of view in db_file
<i>sequence</i>	address of system table of sequence in db_file
<i>function</i>	address of system table of function in db_file
<i>function_arguments</i>	address of system table of function_arguments in db_file
<i>trigger</i>	address of system table of trigger in db_file
<i>trigger_conditions</i>	address of system table of trigger_conditions in db_file
<i>db</i>	address of system table of db in db_file
<i>db_obj</i>	address of system table of db_obj in db_file
<i>user</i>	address of system table of user in db_file
<i>group</i>	address of system table of group in db_file
<i>user_group</i>	address of system table of users associated with groups in db_file
<i>user_right</i>	address of system table of user right in db_file
<i>group_right</i>	address of system table of group right in db_file
<i>constraint</i>	address of system table of constraint in db_file
<i>constraintNull</i>	address of system table of constraintNull in db_file
<i>constraintCheck</i>	system table address for check constraint
<i>reference</i>	address of system table of reference in db_file

Returns

EXIT_SUCCESS if initialization was succesful if not returns EXIT_ERROR

first header attribute of catalog_block

second attribute of catalog_block

initialize other elements of block (adress, type, chained_with, AK_free_space)

using as an address for the first AK_free space in block->data

merge catalog_heder with heders created before

5.17.2.21 AK_insert_entry()

```
void AK_insert_entry (
    AK_block * block_address,
    int type,
    void * entry_data,
    int i )
```

Function that inserts an entry in tuple_dict and data of a block. Address, type and size of catalog_tuple_dict are set. Free space of block is also set.

Author

Matija Novak

Parameters

<i>block_address</i>	adress of a block in which we want insert data
<i>type</i>	type of entry_data
<i>entry_data</i>	(char) data which is inserted, can be int but must first be converted to char
<i>i</i>	(int) adress in tuple_dict array (example block_address->tuple_dict[i])

Returns

No return value because it gets the address of an block like a function parameter and works directly with the original block

copy data into bloc->data on start position bloc->AK_free_space

address of entry data in block->data

calculate next AK_free space for the next entry data

sizeof(entry_data)+1);/(sizeof(int)); no need for "+strlen(entry_data)" while "+1" is like "new line"

type of entry data

size of entry data

copy tuple_dict to block->tuple_dict[i] must use & becouse tuple_dict[i] is value and catalog_tuple_dict adress

5.17.2.22 AK_memset_int()

```
void AK_memset_int (
    void * block,
    int value,
    size_t num )
```

Function that sets the first num ints of a block of memory to the specified value.

Author

Miroslav Policki

Parameters

<i>block</i>	pointer to the block of memory to fill
<i>value</i>	int value to be set
<i>num</i>	number of ints in the block of memory to be set

Returns

No return value

5.17.2.23 AK_new_extent()

```
int AK_new_extent (
    int start_address,
    int old_size,
    int extent_type,
    AK_header * header )
```

Function that allocates new extent of blocks. If argument "old_size" is 0 than size of extent is INITIAL_EXTENT_SIZE. Otherwise, resize factor is set according to type of extent. If writing of block is successful, number of blocks is incremented.

Author

Nikola Bakoš, updated by Dino Laktašić (fixed header BUG), refurbished by dv

Parameters

<i>start_address</i>	address (block number) to start searching for sufficient space
<i>old_size</i>	size of previous extent in same segment (in blocks)
<i>extent_type</i>	type of extent (can be one of: SEGMENT_TYPE_SYSTEM_TABLE, SEGMENT_TYPE_TABLE, SEGMENT_TYPE_INDEX, SEGMENT_TYPE_TRANSACTION, SEGMENT_TYPE_TEMP)
<i>header</i>	pointer to header that should be written to the new extent (all blocks)

Returns

address (block number) of new extent if successful, EXIT_ERROR otherwise

5.17.2.24 AK_new_segment()

```
int AK_new_segment (
    char * name,
    int type,
    AK_header * header )
```

Function that allocates new segment of extents. In this phase of implementation, only extents containing INITIAL_EXTENT_SIZE blocks can be allocated. If extent is successfully allocated, number of allocated extents is incremented and function goes to next block after allocated extent. Otherwise, function moves to INITIAL_EXTENT_SIZE blocks. In that way function gets either first block of new extent or some block in that extent which will not be AK_free.

Author

Tomislav Fotak, refurbished by dv

Parameters

<i>name</i>	(character pointer) name of segment
<i>type</i>	segment type (possible values: SEGMENT_TYPE_SYSTEM_TABLE, SEGMENT_TYPE_TABLE, SEGMENT_TYPE_INDEX, SEGMENT_TYPE_TRANSACTION, SEGMENT_TYPE_TEMP)
<i>header</i>	(header pointer) pointer to header that should be written to the new extent (all blocks)

Returns

EXIT_SUCCESS for success or EXIT_ERROR if some error occurs

start address for segment because we can not allocate segment in block 0

5.17.2.25 AK_print_block()

```
int AK_print_block (
    AK_block * block,
    int num,
    char * gg,
    FILE * fpp )
```

Function that dumps a block.

Author

dv

Returns

nothing

5.17.2.26 AK_read_block()

```
AK_block* AK_read_block (
    int address )
```

Function that reads a block at a given address (block number less than db_file_size). New block is allocated. Database file is opened. Position is set to provided address block. At the end function reads file from that position. Completely thread-safe.

Author

Markus Schatten, updated by dv and Domagoj Šitum (thread-safe enabled)

Parameters

<i>address</i>	block number (address)
----------------	------------------------

Returns

pointer to block allocated in memory

5.17.2.27 AK_read_block_for_testing()

```
void* AK_read_block_for_testing (
    void * address )
```

This function is only for testing. It has to be there, because pthread_create only accepts void* function_name (void *) function format. So AK_read_block is no-go for pthread_create.

Author

Domagoj Šitum

5.17.2.28 AK_register_system_tables()

```
int AK_register_system_tables (
    int relation,
    int attribute,
    int index,
    int view,
    int sequence,
    int function,
    int function_arguments,
    int trigger,
    int trigger_conditions,
    int db,
    int db_obj,
    int user,
    int group,
    int user_group,
    int user_right,
    int group_right,
    int constraint,
    int constraintNull,
    int constraintCheck,
    int constraintUnique,
    int reference )
```

Function that registers system tables. Block at the given address is read. Various data from function arguments are written in block about different database elements.

Author

Unknown

Parameters

<i>relation</i>	relation in database
<i>attribute</i>	attribute in databse
<i>index</i>	index in database
<i>view</i>	view in database
<i>sequence</i>	sequence in database
<i>function</i>	function in database

Parameters

<i>function_arguments</i>	functional_arguments in database
<i>trigger</i>	trigger in database
<i>trigger_conditions</i>	trigger conditions in database
<i>db</i>	database
<i>db_obj</i>	database object
<i>user</i>	user in database
<i>group</i>	group in database
<i>user_group</i>	user associated with group in database
<i>user_right</i>	user right in database
<i>group_right</i>	group right in database
<i>constraint</i>	constraint in database
<i>constraintNull</i>	Null constraint in database
<i>constraintCheck</i>	Check constraint in database
<i>reference</i>	reference database

Returns

EXIT_SUCCESS

5.17.2.29 AK_thread_safe_block_access_test()

```
TestResult AK_thread_safe_block_access_test ( )
```

This function tests thread safe reading and writing to blocks. There is N writing and N reading threads, which are going through iterations. Each reading thread should read the data (character) that was set by last writing thread.

Author

Domagoj Šitum

5.17.2.30 AK_write_block()

```
int AK_write_block (
    AK_block * block )
```

Function that writes a block to the DB file. Database file is opened. Position is set to provided address block. Block is written to provided address. Completely thread-safe.

Function that writes the new value in block when index is updated.

Author

Markus Schatten, updated by Domagoj Šitum (thread-safe enabled)

Parameters

<i>block</i>	pointer to block allocated in memory to write
--------------	-----------------------------------------------

Returns

EXIT_SUCCESS if successful, EXIT_ERROR otherwise

5.17.2.31 AK_write_block_for_testing()

```
void* AK_write_block_for_testing (
    void * block )
```

This function is only for testing. It has to be there, because pthread_create only accepts void* function_name (void *) function format. So AK_write_block is no-go for pthread_create.

Author

Domagoj Šitum

5.17.2.32 fsize()

```
int fsize (
    FILE * fp )
```

Helper function to determine file size.

Returns

file size

5.18 dm/dbman.h File Reference

```
#include "../auxi/test.h"
#include "../auxi/auxiliary.h"
#include <errno.h>
#include <pthread.h>
#include "sys/time.h"
#include <sys/types.h>
#include <sys/stat.h>
#include <fcntl.h>
#include "../auxi/mempro.h"
#include <limits.h>
```

Include dependency graph for dbman.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [AK_header](#)
Structure that represents header structure of blocks (describes an attribute inside an object). It contains type, attribute name, integrity, constraint name and constraint code.
- struct [AK_tuple_dict](#)
Structure that defines a mapping in a header of an object to the actual entries (data). It contains type, address and size.
- struct [AK_block](#)
Structure that defines a block of data inside a DB file. It contains address, type, chained_with, AK_free space, last_tuple_dict_id, header and tuple_dict and data.
- struct [table_addresses](#)
Structure that defines start and end address of extent.
- struct [AK_blocktable](#)
- struct [AK_block_activity](#)
Structure which holds information about each block, whether it is locked for reading or writing. It is important to note such information, to enable quick and thread-safe reading from or writing to disk. Structure contains of: locked_for_reading - thread which locks particular block for reading will set this value locked_for_writing - thread which locks particular block for writing will set this value block_lock - each reading and writing operation will be done atomically and uninterruptable, using this mutex block_lock_reading_done - represents signal, which sends thread that just finished reading block. This signal will indicate that writing thread can start writing to block writing_done - represents signal, which sends thread that just finished writing to block. This signal will indicate that other threads can start reading from this block or even writing to it thread_holding_lock - the only thread which can unlock locked "block_lock" is the one that locked it. This variable makes sure that ONLY the thread, which actually holds the lock, releases it.

Macros

- #define **BITMASK(b)** (1 << ((b) % CHAR_BIT))
- #define **BITSLLOT(b)** ((int)((b) / CHAR_BIT))
- #define **BITSET(a, b)** ((a)[BITSLLOT(b)] |= BITMASK(b))
- #define **BITCLEAR(a, b)** ((a)[BITSLLOT(b)] &= ~BITMASK(b))
- #define **BITTEST(a, b)** ((a)[BITSLLOT(b)] & BITMASK(b))
- #define **BITNSLOTS(nb)** ((int)(nb + CHAR_BIT - 1) / CHAR_BIT)
- #define **SEGMENTLENGTH()** (BITNSLOTS(DB_FILE_BLOCKS_NUM) + 2*sizeof(int))
- #define **DB_FILE_SIZE_EX** 200
- #define **DB_FILE_BLOCKS_NUM_EX** (int)(1024 * 1024 * DB_FILE_SIZE_EX / sizeof([AK_block](#)))
- #define [AK_ALLOCATION_TABLE_SIZE](#) sizeof([AK_blocktable](#))
Holds size of allocation table.
- #define [CHAR_IN_LINE](#) 80
How many characters could line contain.
- #define [MAX_BLOCK_INIT_NUM](#) [MAX_CACHE_MEMORY](#)
How many blocks would be initially allocated.

Enumerations

- enum [AK_allocation_set_mode](#) {
 allocationSEQUENCE = 10001, **allocationUPPER**, **allocationLOWER**, **allocationAROUND**,
 allocationNOMODE }
Different modes to obtain allocation indexes: SEQUENCE - first found set of sequence indexes UPPER - set tries to place itself to upper part of allocation table LOWER - set tries to place itself to lower part of allocation table AROUND - set tries to place itself around targeted index.

Functions

- `int AK_print_block (AK_block *block, int num, char *gg, FILE *fpp)`
Function that dumps a block.
- `TestResult AK_allocationbit_test ()`
- `TestResult AK_allocationtable_test ()`
- `int * AK_increase_extent (int start_address, int add_size, AK_allocation_set_mode *mode, int border, int target, AK_header *header, int gl)`
Function that allocates a new blocks for increasing extent size.
- `int * AK_get_extent (int start_address, int desired_size, AK_allocation_set_mode *mode, int border, int target, AK_header *header, int gl)`
Function that allocates new extent of blocks. Number of blocks is not ordered as well as a way of search for them.
- `int AK_get_allocation_set (int *bitsetbs, int fromWhere, int gaplength, int num, AK_allocation_set_mode mode, int target)`
Function prepare demanded sets from allocation table.
- `int AK_copy_header (AK_header *header, int *blocknum, int num)`
Function copy header to blocks. Completely thread-safe.
- `int AK_allocate_blocks (FILE *db, AK_block *block, int FromWhere, int HowMany)`
Function that allocates new blocks by placing them to appropriate place and then updates the last initialized index.
- `AK_block * AK_init_block ()`
Function that initializes new block.
- `int AK_allocationtable_dump (int zz)`
Dumps the allocation table from the global allocation bit-vector onto standard output.
- `void AK_blocktable_dump (int zz)`
Dumps the bit-table from the global allocation bit-vector onto standard output.
- `int AK_blocktable_flush ()`
Function flushes bitmask table to the disk.
- `TestResult AK_thread_safe_block_access_test ()`
This function tests thread safe reading and writing to blocks. There is N writing and N reading threads, which are going through iterations. Each reading thread should read the data (character) that was set by last writing thread.
- `void * AK_read_block_for_testing (void *address)`
This function is only for testing. It has to be there, because pthread_create only accepts void function_name (void *) function format. So AK_read_block is no-go for pthread_create.*
- `void * AK_write_block_for_testing (void *block)`
This function is only for testing. It has to be there, because pthread_create only accepts void function_name (void *) function format. So AK_write_block is no-go for pthread_create.*
- `int AK_blocktable_get ()`
Function gets allocation table from the disk.
- `int fsize (FILE *fp)`
Helper function to determine file size.
- `int AK_init_allocation_table ()`
Function that initializes the allocation table, writes it to the disk and caches it in memory.
- `int AK_init_db_file (int size)`
Function that initializes a new database file named DB_FILE. It opens database file. New block is allocated. In this block type of header is set to FREE_INT, attribute names are set to FREE_CHAR, integrities are set to FREE_INT, constraint names are set to FREE_CHAR, constraint names and codes are set to FREE_CHAR. Type, address and size of tuples are set to FREE_INT. Data in block is set to FREE_CHAR. Type of block is BLOCK_TYPE_FREE, it is not chained and id of last tuple is 0.
- `AK_block * AK_read_block (int address)`
Function that reads a block at a given address (block number less than db_file_size). New block is allocated. Database file is opened. Position is set to provided address block. At the end function reads file from that position. Completely thread-safe.
- `int AK_write_block (AK_block *block)`

Function that writes a block to the DB file. Database file is opened. Position is set to provided address block. Block is written to provided address. Completely thread-safe.

- int [AK_new_extent](#) (int start_address, int old_size, int extent_type, [AK_header](#) *header)

Function that allocates new extent of blocks. If argument "old_size" is 0 than size of extent is INITIAL_EXTENT_SIZE. Otherwise, resize factor is set according to type of extent. If writing of block is successful, number of blocks is incremented.

- int [AK_new_segment](#) (char *name, int type, [AK_header](#) *header)

Function that allocates new segment of extents. In this phase of implementation, only extents containing INITIAL_EXTENT_SIZE blocks can be allocated. If extent is successfully allocated, number of allocated extents is incremented and function goes to next block after allocated extent. Otherwise, function moves to INITIAL_EXTENT_SIZE blocks. In that way function gets either first block of new extent or some block in that extent which will not be AK_free.

- [AK_header](#) * [AK_create_header](#) (char *name, int type, int integrity, char *constr_name, char *constr_code)

Function that creates header and initialize integrity, constraint name and constraint code with parameter values of function.

- void [AK_insert_entry](#) ([AK_block](#) *block_address, int type, void *entry_data, int i)

Function that inserts an entry in tuple_dict and data of a block. Address, type and size of catalog_tuple_dict are set. Free space of block is also set.

- int [AK_init_system_tables_catalog](#) (int relation, int attribute, int index, int view, int sequence, int function, int function_arguments, int trigger, int trigger_conditions, int [db](#), int db_obj, int user, int group, int user_group, int user_right, int group_right, int constraint, int constraintNull, int constraintCheck, int constraintUnique, int reference)

Function that initialises the sytem table catalog and writes the result in first (0) block in db_file. Catalog block, catalog header name, catalog header address are allocated. Address, type, chained_with and AK_free_space attributes are initialized. Names of various database elements are written in block.

- void [AK_memset_int](#) (void *block, int value, size_t num)

Function that sets the first num ints of a block of memory to the specified value.

- int [AK_register_system_tables](#) (int relation, int attribute, int index, int view, int sequence, int function, int function_arguments, int trigger, int trigger_conditions, int [db](#), int db_obj, int user, int group, int user_group, int user_right, int group_right, int constraint, int constraintNull, int constraintCheck, int constraintUnique, int reference)

Function that registers system tables. Block at the given address is read. Various data from function arguments are written in block about different database elements.

- int [AK_init_system_catalog](#) ()

Function that initializes the system catalog. Headers for system tables are defined. Segments for those system tables are allocated. Above function [AK_register_system_tables\(\)](#) to register system tables.

- int [AK_delete_block](#) (int address)

Function that deletes a block by a given block address (resets the header and data). Types, integrities, constraint names, constraint codes are set to "AK_free" values. In tuple dictionary type, address and size are set to FREE_INT values. Data of block is set to FREE_CHAR.

- int [AK_delete_extent](#) (int begin, int end)

Function that deletes an extent between the first and the last block.

- int [AK_delete_segment](#) (char *name, int type)

- int [AK_init_disk_manager](#) ()

Variables

- FILE * [db](#)

Variable that defines the DB file file handle.

- unsigned int [db_file_size](#)

Variable that defines the size of the DB file (in blocks)

- [AK_blocktable](#) * [AK_allocationbit](#)

Global variable that holds allocation bit-vector.

- [AK_block_activity](#) * [AK_block_activity_info](#)

- [AK_synchronization_info](#) * [dbmanFileLock](#)

5.18.1 Detailed Description

Header file that contains all defines, includes and data structures for the disk manager of Kalashnikov DB

5.18.2 Macro Definition Documentation

5.18.2.1 AK_ALLOCATION_TABLE_SIZE

```
#define AK_ALLOCATION_TABLE_SIZE sizeof(AK_blocktable)
```

Holds size of allocation table.

Author

dv

5.18.2.2 CHAR_IN_LINE

```
#define CHAR_IN_LINE 80
```

How many characters could line contain.

Author

dv

5.18.2.3 MAX_BLOCK_INIT_NUM

```
#define MAX_BLOCK_INIT_NUM MAX_CACHE_MEMORY
```

How many blocks would be initially allocated.

Author

dv

5.18.3 Enumeration Type Documentation

5.18.3.1 AK_allocation_set_mode

enum `AK_allocation_set_mode`

Different modes to obtain allocation indexes: SEQUENCE - first found set of sequence indexes UPPER - set tries to place itself to upper part of allocation table LOWER - set tries to place itself to lower part of allocation table AROUND - set tries to place itself around targeted index.

Author

dv

5.18.4 Function Documentation

5.18.4.1 AK_allocate_blocks()

```
int AK_allocate_blocks (
    FILE * db,
    AK_block * block,
    int FromWhere,
    int HowMany )
```

Function that allocates new blocks by placing them to appropriate place and then updates the last initialized index.

Author

Markus Schatten , rearranged by dv

Returns

EXIT_SUCCESS if the file has been written to disk, EXIT_ERROR otherwise

5.18.4.2 AK_allocationtable_dump()

```
int AK_allocationtable_dump (
    int verbosity )
```

Dumps the allocation table from the global allocation bit-vector onto standard output.

Author

dv

Parameters

<i>verbosity</i>	level of verbosity (1 - minimal, 0 - no output)
------------------	-------------------------------------------------

5.18.4.3 AK_blocktable_dump()

```
void AK_blocktable_dump (
    int verbosity )
```

Dumps the bit-table from the global allocation bit-vector onto standard output.

Author

dv

Parameters

<i>verbosity</i>	level of verbosity (1 - verbose, 0 - minimal)
------------------	-----------------------------------------------

5.18.4.4 AK_blocktable_flush()

```
int AK_blocktable_flush ( )
```

Function flushes bitmask table to the disk.

Author

dv

Returns

EXIT_SUCCESS if the file has been written to the disk, EXIT_ERROR otherwise

5.18.4.5 AK_blocktable_get()

```
int AK_blocktable_get ( )
```

Function gets allocation table from the disk.

Author

dv

Returns

EXIT_SUCCESS if the file has been taken from disk, EXIT_ERROR otherwise

5.18.4.6 AK_copy_header()

```
int AK_copy_header (
    AK_header * header,
    int * blockSet,
    int blockSetSize )
```

Function copy header to blocks. Completely thread-safe.

Author

Nikola Bakoš, updated by Dino Laktašić (fixed header BUG), refurbished by dv

Parameters

<i>header</i>	Pointer to header which will be copied into each block in blockSet
<i>blockSet</i>	Pointer to array of block addresses into which to copy header
<i>blockSetSize</i>	Number of blocks in blockSet

Returns

number of performed header copy

5.18.4.7 AK_create_header()

```
AK_header* AK_create_header (
    char * attribute_name,
    int type,
    int integrity,
    char * constr_name,
    char * contr_code )
```

Function that creates header and initialize integrity, constraint name and constraint code with parameter values of function.

Author

Matija Novak

Parameters

<i>name</i>	name of the attribute
<i>type</i>	type of the attribute
<i>integrity</i>	standard integrity constraint
<i>constr_name</i>	extra integrity constraint name
<i>contr_code</i>	extra integrity constraint code

Returns

[AK_header](#)**5.18.4.8 AK_delete_block()**

```
int AK_delete_block (
    int address )
```

Function that deletes a block by a given block address (resets the header and data). Types, integrities, constraint names, constraint codes are set to "AK_free" values. In tuple dictionary type, address and size are set to FREE_INT values. Data of block is set to FREE_CHAR.

Author

Markus Schatten

Parameters

<i>address</i>	address of the block to be deleted
----------------	------------------------------------

Returns

returns EXIT_SUCCESS if deletion successful, else EXIT_ERROR

5.18.4.9 AK_delete_extent()

```
int AK_delete_extent (
    int begin,
    int end )
```

Function that deletes an extent between the first and the last block.

Author

Dejan Sambolić

Parameters

<i>begin</i>	address of extent's first block
<i>end</i>	address of extent's last block

Returns

EXIT_SUCCESS if extent has been successfully deleted, EXIT_ERROR otherwise

5.18.4.10 AK_delete_segment()

```
int AK_delete_segment (
    char * name,
    int type )
```

Author

Mislav Ćakariæ

Parameters

<i>name</i>	name of the segment
<i>type</i>	type of the segment

Returns

EXIT_SUCCESS if extent has been successfully deleted, EXIT_ERROR otherwise

5.18.4.11 AK_get_allocation_set()

```
int AK_get_allocation_set (
    int * allocationSet,
    int fromWhere,
    int gaplength,
    int numRequestedBlocks,
    AK_allocation_set_mode mode,
    int target )
```

Function prepare demanded sets from allocation table.

Author

dv

Parameters

<i>allocationSet</i>	Pointer to array which will be filled and represent the allocation set
<i>fromWhere</i>	Has meaning only if mode is SEQUENCE. It describes from which address searching starts.
<i>gaplength</i>	Tells how many used blocks can be tolerated in allocation set
<i>numRequestedBlocks</i>	Tells how many AK_free blocks have been requested
<i>mode</i>	Defines how to obtain set of indexes to AK_free addresses
<i>target</i>	Has meaning just if mode is AROUND: set will be as close as possible to the requested target address from both sides

Returns

the first element of the allocation set

5.18.4.12 AK_get_extent()

```
int* AK_get_extent (
    int start_address,
    int desired_size,
    AK_allocation_set_mode * mode,
    int border,
    int target,
    AK_header * header,
    int gl )
```

Function that allocates new extent of blocks. Number of blocks is not ordered as well as a way of search for them.

Author

dv

Parameters

<i>start_address</i>	address (block number) to start searching for sufficient space
<i>desired_size</i>	number of desired blocks
<i>AK_allocation_set_mode</i>	a way of trying to find AK_free space. Can be one of: allocationSEQUENCE, allocationUPPER, allocationLOWER, allocationAROUND
<i>border</i>	number of allocated blocks gap
<i>target</i>	block address around which other blocks have to be searched
<i>header</i>	pointer to header that should be written to the new extent (all blocks)
<i>int</i>	gl gap size

Returns

pointer to set of allocated block addresses

vars for loop [for]

if some blocks are not successfully allocated, which means that the extend allocation has FAILED

5.18.4.13 AK_increase_extent()

```
int* AK_increase_extent (
    int start_address,
    int add_size,
    AK_allocation_set_mode * mode,
    int border,
    int target,
    AK_header * header,
    int gl )
```

Function that allocates a new blocks for increasing extent size.

Author

dv

Parameters

<i>start_address</i>	first address of extent that is subject of increasing
<i>add_size</i>	number how many new blocks is to be added to existing extent
<i>AK_allocation_set_mode</i>	a way of trying to find AK_free space. Can be one of: allocationSEQUENCE, allocationUPPER, allocationLOWER, allocationAROUND
<i>border</i>	number of allocated blocks gap
<i>target</i>	block address around which other blocks have to be searched
<i>header</i>	pointer to header that should be written to the new extent (all blocks)
<i>int</i>	gl gap size

Returns

pointer to set of allocated block addresses

5.18.4.14 AK_init_allocation_table()

```
int AK_init_allocation_table ( )
```

Function that initializes the allocation table, writes it to the disk and caches it in memory.

Author

dv

Returns

EXIT_SUCCESS if the file has been written to disk, EXIT_ERROR otherwise

5.18.4.15 AK_init_block()

```
AK_block* AK_init_block ( )
```

Function that initializes new block.

Author

Markus Schatten , rearranged by dv

Returns

pointer to block allocated in memory

5.18.4.16 AK_init_db_file()

```
int AK_init_db_file (
    int size )
```

Function that initializes a new database file named DB_FILE. It opens database file. New block is allocated. In this block type of header is set to FREE_INT, attribute names are set to FREE_CHAR, integrities are set to FREE_INT, constraint names are set to FREE_CHAR, constraint names and codes are set to FREE_CHAR. Type, address and size of tuples are set to FREE_INT. Data in block is set to FREE_CHAR. Type of block is BLOCK_TYPE_FREE, it is not chained and id of last tuple is 0.

Author

Markus Schatten

Parameters

<i>size</i>	size of new file in in blocks
-------------	-------------------------------

Returns

EXIT_SUCCESS if the file has been written to disk, EXIT_ERROR otherwise

5.18.4.17 AK_init_disk_manager()

```
int AK_init_disk_manager ( )
```

Author

Markus Schatten

Returns

Function that calls functions [AK_init_db_file\(\)](#) and [AK_init_system_catalog\(\)](#) to initialize disk manager. It also calls [AK_allocate_array_currently_accessed_blocks\(\)](#) to allocate memory needed for thread-safe reading and writing to disk.

5.18.4.18 AK_init_system_catalog()

```
int AK_init_system_catalog ( )
```

Function that initializes the system catalog. Headers for system tables are defined. Segments for those system tables are allocated. Above function [AK_register_system_tables\(\)](#) to register system tables.

Author

Miroslav Policki

Returns

EXIT_SUCCESS if the system catalog has been successfully initialized, EXIT_ERROR otherwise

5.18.4.19 AK_init_system_tables_catalog()

```
int AK_init_system_tables_catalog (
    int relation,
    int attribute,
    int index,
    int view,
    int sequence,
    int function,
    int function_arguments,
    int trigger,
    int trigger_conditions,
    int db,
    int db_obj,
    int user,
    int group,
    int user_group,
    int user_right,
    int group_right,
    int constraint,
    int constraintNull,
    int constraintCheck,
    int constraintUnique,
    int reference )
```

Function that initialises the sytem table catalog and writes the result in first (0) block in db_file. Catalog block, catalog header name, catalog header address are allocated. Address, type, chained_with and AK_free_space attributes are initialized. Names of various database elements are written in block.

Author

Matija Novak

Parameters

<i>relation</i>	address of system table of relation in db_file
<i>attribute</i>	address of system table of attribute in db_file
<i>index</i>	address of system table of index in db_file
<i>view</i>	address of system table of view in db_file
<i>sequence</i>	address of system table of sequence in db_file
<i>function</i>	address of system table of function in db_file
<i>function_arguments</i>	address of system table of function_arguments in db_file
<i>trigger</i>	address of system table of trigger in db_file
<i>trigger_conditions</i>	address of system table of trigger_conditions in db_file
<i>db</i>	address of system table of db in db_file
<i>db_obj</i>	address of system table of db_obj in db_file
<i>user</i>	address of system table of user in db_file
<i>group</i>	address of system table of group in db_file
<i>user_group</i>	address of system table of users associated with groups in db_file
<i>user_right</i>	address of system table of user right in db_file
<i>group_right</i>	address of system table of group right in db_file
<i>constraint</i>	address of system table of constraint in db_file
<i>constraintNull</i>	address of system table of constraintNull in db_file
<i>constraintCheck</i>	system table address for check constraint
<i>reference</i>	address of system table of reference in db_file

Returns

EXIT_SUCCESS if initialization was succesful if not returns EXIT_ERROR

first header attribute of catalog_block

second attribute of catalog_block

initialize other elements of block (adress, type, chained_with, AK_free_space)

using as an address for the first AK_free space in block->data

merge catalog_heder with heders created before

5.18.4.20 AK_insert_entry()

```
void AK_insert_entry (
    AK_block * block_address,
    int type,
    void * entry_data,
    int i )
```

Function that inserts an entry in tuple_dict and data of a block. Address, type and size of catalog_tuple_dict are set. Free space of block is also set.

Author

Matija Novak

Parameters

<i>block_adress</i>	adress of a block in which we want insert data
<i>type</i>	type of entry_data
<i>entry_data</i>	(char) data which is inserted, can be int but must first be converted to char
<i>i</i>	(int) adress in tuple_dict array (example block_address->tuple_dict[i])

Returns

No return value because it gets the address of an block like a function parameter and works directly with the original block

copy data into bloc->data on start position bloc->AK_free_space

address of entry data in block->data

calculate next AK_free space for the next entry data

sizeof(entry_data)+1);/(sizeof(int)); no need for "+strlen(entry_data)" while "+1" is like "new line"

type of entry data

size of entry data

copy tuple_dict to block->tuple_dict[i] must use & becouse tuple_dict[i] is value and catalog_tuple_dict adress

5.18.4.21 AK_memset_int()

```
void AK_memset_int (
    void * block,
    int value,
    size_t num )
```

Function that sets the first num ints of a block of memory to the specified value.

Author

Miroslav Policki

Parameters

<i>block</i>	pointer to the block of memory to fill
<i>value</i>	int value to be set
<i>num</i>	number of ints in the block of memory to be set

Returns

No return value

5.18.4.22 AK_new_extent()

```
int AK_new_extent (
    int start_address,
    int old_size,
    int extent_type,
    AK_header * header )
```

Function that allocates new extent of blocks. If argument "old_size" is 0 than size of extent is INITIAL_EXTENT_SIZE. Otherwise, resize factor is set according to type of extent. If writing of block is successful, number of blocks is incremented.

Author

Nikola Bakoš, updated by Dino Laktašić (fixed header BUG), refurbished by dv

Parameters

<i>start_address</i>	address (block number) to start searching for sufficient space
<i>old_size</i>	size of previous extent in same segment (in blocks)
<i>extent_type</i>	type of extent (can be one of: SEGMENT_TYPE_SYSTEM_TABLE, SEGMENT_TYPE_TABLE, SEGMENT_TYPE_INDEX, SEGMENT_TYPE_TRANSACTION, SEGMENT_TYPE_TEMP)
<i>header</i>	pointer to header that should be written to the new extent (all blocks)

Returns

address (block number) of new extent if successful, EXIT_ERROR otherwise

5.18.4.23 AK_new_segment()

```
int AK_new_segment (
    char * name,
    int type,
    AK_header * header )
```

Function that allocates new segment of extents. In this phase of implementation, only extents containing INITIAL_EXTENT_SIZE blocks can be allocated. If extent is successfully allocated, number of allocated extents is incremented and function goes to next block after allocated extent. Otherwise, function moves to INITIAL_EXTENT_SIZE blocks. In that way function gets either first block of new extent or some block in that extent which will not be AK_free.

Author

Tomislav Fotak, refurbished by dv

Parameters

<i>name</i>	(character pointer) name of segment
<i>type</i>	segment type (possible values: SEGMENT_TYPE_SYSTEM_TABLE, SEGMENT_TYPE_TABLE, SEGMENT_TYPE_INDEX, SEGMENT_TYPE_TRANSACTION, SEGMENT_TYPE_TEMP)
<i>header</i>	(header pointer) pointer to header that should be written to the new extent (all blocks)

Returns

EXIT_SUCCESS for success or EXIT_ERROR if some error occurs

start address for segment because we can not allocate segment in block 0

5.18.4.24 AK_print_block()

```
int AK_print_block (
    AK_block * block,
    int num,
    char * gg,
    FILE * fpp )
```

Function that dumps a block.

Author

dv

Returns

nothing

5.18.4.25 AK_read_block()

```
AK_block* AK_read_block (
    int address )
```

Function that reads a block at a given address (block number less than db_file_size). New block is allocated. Database file is opened. Position is set to provided address block. At the end function reads file from that position. Completely thread-safe.

Author

Markus Schatten, updated by dv and Domagoj Šitum (thread-safe enabled)

Parameters

<i>address</i>	block number (address)
----------------	------------------------

Returns

pointer to block allocated in memory

5.18.4.26 AK_read_block_for_testing()

```
void* AK_read_block_for_testing (
    void * address )
```

This function is only for testing. It has to be there, because pthread_create only accepts void* function_name (void *) function format. So AK_read_block is no-go for pthread_create.

Author

Domagoj Šitum

5.18.4.27 AK_register_system_tables()

```
int AK_register_system_tables (
    int relation,
    int attribute,
    int index,
    int view,
    int sequence,
    int function,
    int function_arguments,
    int trigger,
    int trigger_conditions,
    int db,
```

```

int db_obj,
int user,
int group,
int user_group,
int user_right,
int group_right,
int constraint,
int constraintNull,
int constraintCheck,
int constraintUnique,
int reference )

```

Function that registers system tables. Block at the given address is read. Various data from function arguments are written in block about different database elements.

Author

Unknown

Parameters

<i>relation</i>	relation in database
<i>attribute</i>	attribute in database
<i>index</i>	index in database
<i>view</i>	view in database
<i>sequence</i>	sequence in database
<i>function</i>	function in database
<i>function_arguments</i>	functional_arguments in database
<i>trigger</i>	trigger in database
<i>trigger_conditions</i>	trigger conditions in database
<i>db</i>	database
<i>db_obj</i>	database object
<i>user</i>	user in database
<i>group</i>	group in database
<i>user_group</i>	user associated with group in database
<i>user_right</i>	user right in database
<i>group_right</i>	group right in database
<i>constraint</i>	constraint in database
<i>constraintNull</i>	Null constraint in database
<i>constraintCheck</i>	Check constraint in database
<i>reference</i>	reference database

Returns

EXIT_SUCCESS

5.18.4.28 AK_thread_safe_block_access_test()

```

TestResult AK_thread_safe_block_access_test ( )

```

This function tests thread safe reading and writing to blocks. There is N writing and N reading threads, which are going through iterations. Each reading thread should read the data (character) that was set by last writing thread.

Author

Domagoj Šitum

5.18.4.29 AK_write_block()

```
int AK_write_block (
    AK_block * block )
```

Function that writes a block to the DB file. Database file is opened. Position is set to provided address block. Block is written to provided address. Completely thread-safe.

Author

Markus Schatten, updated by Domagoj Šitum (thread-safe enabled)

Parameters

<i>block</i>	poiner to block allocated in memory to write
--------------	----------------------------------------------

Returns

EXIT_SUCCESS if successful, EXIT_ERROR otherwise

5.18.4.30 AK_write_block_for_testing()

```
void* AK_write_block_for_testing (
    void * block )
```

This function is only for testing. It has to be there, because pthread_create only accepts void* function_name (void *) function format. So AK_write_block is no-go for pthread_create.

Author

Domagoj Šitum

5.18.4.31 fsize()

```
int fsize (
    FILE * fp )
```

Helper function to determine file size.

Returns

file size

5.18.5 Variable Documentation

5.18.5.1 AK_allocationbit

AK_allocationbit

Global variable that holds allocation bit-vector.

Author

dv

5.18.5.2 db

db

Variable that defines the DB file file handle.

Author

Markus Schatten

5.18.5.3 db_file_size

db_file_size

Variable that defines the size of the DB file (in blocks)

Author

Markus Schatten

5.19 file/blobs.c File Reference

```
#include <stdio.h>
#include <stdlib.h>
#include <dirent.h>
#include <sys/types.h>
#include <sys/stat.h>
#include <unistd.h>
#include <fcntl.h>
#include <errno.h>
#include "../dm/dbman.h"
#include "../auxi/configuration.h"
#include "blobs.h"
Include dependency graph for blobs.c:
```

Functions

- [AK_File_Metadata](#) [AK_File_Metadata_malloc](#) ()
- char * [AK_GUID](#) ()
Function that generates GUID.
- int [AK_folder_exists](#) (char *foldername)
Function that checks if folder blobs already exists.
- int [AK_mkdir](#) (const char *path)
Function that creates new folder.
- int [AK_copy](#) (const char *from, const char *to)
- char * [AK_concat](#) (char *s1, char *s2)
Function for AK_concatinating 2 strings.
- char * [AK_clear_all_newline](#) (char *s)
- int [AK_check_folder_blobs](#) ()
Function that checks if folder blobs exists.
- void [AK_split_path_file](#) (char **p, char **f, char *pf)
Function that splits a path from filename.
- int [AK_write_metadata](#) (char *oid, [AK_File_Metadata](#) meta)
- [AK_File_Metadata](#) [AK_read_metadata](#) (char *oid)
- char * [AK_lo_import](#) (char *filepath)
Function that imports large objects to database.
- int [AK_lo_export](#) (char *oid, char *filepath)
Function that retrieves large objects.
- int [AK_lo_unlink](#) (char *oid)
Function that deletes large objects.
- [TestResult](#) [AK_lo_test](#) ()
Tests.

Variables

- int **success** = 0
- int **failed** = 0

5.19.1 Detailed Description

Provides functions for manipulations of binary large objects

5.19.2 Function Documentation

5.19.2.1 [AK_check_folder_blobs](#)()

```
int AK_check_folder_blobs ( )
```

Function that checks if folder blobs exists.

Author

Samuel Picek

Returns

OID (object ID)

5.19.2.2 AK_concat()

```
char* AK_concat (
    char * s1,
    char * s2 )
```

Function for AK_concatinating 2 strings.

Author

Samuel Picek

Returns

returns new string

5.19.2.3 AK_folder_exists()

```
int AK_folder_exists (
    char * foldername )
```

Function that checks if folder blobs already exists.

Author

Samuel Picek

Returns

returns 0 for true and 1 for false

5.19.2.4 AK_GUID()

```
char* AK_GUID ( )
```

Function that generates GUID.

Author

Samuel Picek

Returns

returns globally universal identifier based on kernel implementation

5.19.2.5 AK_lo_export()

```
int AK_lo_export (
    char * oid,
    char * filepath )
```

Function that retrieves large objects.

Author

Samuel Picek

Returns

returns 0 for true and 1 for false

5.19.2.6 AK_lo_import()

```
char* AK_lo_import (
    char * filepath )
```

Function that imports large objects to database.

Author

Samuel Picek

Returns

OID (object ID)

5.19.2.7 AK_lo_test()

```
TestResult AK_lo_test ( )
```

Tests.

Author

Samuel Picek

5.19.2.8 AK_lo_unlink()

```
int AK_lo_unlink (
    char * oid )
```

Function that deletes large objects.

Author

Samuel Picek

Returns

OID (object ID)

5.19.2.9 AK_mkdir()

```
int AK_mkdir (
    const char * path )
```

Function that creates new folder.

Author

Samuel Picek

Returns

returns 0 for true and 1 for false

5.19.2.10 AK_split_path_file()

```
void AK_split_path_file (
    char ** p,
    char ** f,
    char * pf )
```

Function that splits a path from filename.

Author

Samuel Picek

Returns

void

5.20 file/blobs.h File Reference

```
#include "../auxi/test.h"
#include "table.h"
#include "fileio.h"
#include "id.h"
```

Include dependency graph for blobs.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [_file_metadata](#)

Typedefs

- typedef struct [_file_metadata](#) **AK_Metadata**
- typedef struct [_file_metadata](#) * **AK_File_Metadata**

Functions

- [AK_File_Metadata AK_File_Metadata_malloc](#) ()
- int [AK_mkdir](#) (const char *path)
Function that creates new folder.
- int **AK_copy** (const char *from, const char *to)
- char * [AK_concat](#) (char *s1, char *s2)
Function for AK_concatinating 2 strings.
- char * **AK_clear_all_newline** (char *str)
- void [AK_split_path_file](#) (char **p, char **f, char *pf)
Function that splits a path from filename.
- char * [AK_GUID](#) ()
Function that generates GUID.
- int [AK_folder_exists](#) (char *foldername)
Function that checks if folder blobs already exists.
- int [AK_check_folder_blobs](#) ()
Function that checks if folder blobs exists.
- int **AK_write_metadata** (char *oid, [AK_File_Metadata](#) meta)
- [AK_File_Metadata AK_read_metadata](#) (char *oid)
- char * [AK_lo_import](#) (char *filepath)
Function that imports large objects to database.
- int [AK_lo_export](#) (char *oid, char *filepath)
Function that retrieves large objects.
- int [AK_lo_unlink](#) (char *oid)
Function that deletes large objects.
- [TestResult AK_lo_test](#) ()
Tests.

5.20.1 Detailed Description

Provides data structures, functions and defines for manipulating blobs

5.20.2 Function Documentation

5.20.2.1 AK_check_folder_blobs()

```
int AK_check_folder_blobs ( )
```

Function that checks if folder blobs exists.

Author

Samuel Picek

Returns

OID (object ID)

5.20.2.2 AK_concat()

```
char* AK_concat (
    char * s1,
    char * s2 )
```

Function for AK_concatinating 2 strings.

Author

Samuel Picek

Returns

returns new string

5.20.2.3 AK_folder_exists()

```
int AK_folder_exists (
    char * foldername )
```

Function that checks if folder blobs already exists.

Author

Samuel Picek

Returns

returns 0 for true and 1 for false

5.20.2.4 AK_GUID()

```
char* AK_GUID ( )
```

Function that generates GUID.

Author

Samuel Picek

Returns

returns globally universal identifier based on kernel implementation

5.20.2.5 AK_lo_export()

```
int AK_lo_export (
    char * oid,
    char * filepath )
```

Function that retrieves large objects.

Author

Samuel Picek

Returns

returns 0 for true and 1 for false

5.20.2.6 AK_lo_import()

```
char* AK_lo_import (
    char * filepath )
```

Function that imports large objects to database.

Author

Samuel Picek

Returns

OID (object ID)

5.20.2.7 AK_lo_test()

```
TestResult AK_lo_test ( )
```

Tests.

Author

Samuel Picek

5.20.2.8 AK_lo_unlink()

```
int AK_lo_unlink (
    char * oid )
```

Function that deletes large objects.

Author

Samuel Picek

Returns

OID (object ID)

5.20.2.9 AK_mkdir()

```
int AK_mkdir (
    const char * path )
```

Function that creates new folder.

Author

Samuel Picek

Returns

returns 0 for true and 1 for false

5.20.2.10 AK_split_path_file()

```
void AK_split_path_file (
    char ** p,
    char ** f,
    char * pf )
```

Function that splits a path from filename.

Author

Samuel Picek

Returns

void

5.21 file/fileio.c File Reference

```
#include "fileio.h"
```

Include dependency graph for fileio.c:

Functions

- void [AK_Insert_New_Element_For_Update](#) (int newtype, void *data, char *table, char *attribute_name, struct [list_node](#) *ElementBefore, int newconstraint)

!! YOU PROBABLY DON'T WANT TO USE THIS FUNCTION !! - Use [AK_Update_Existing_Element](#) or [AK_Insert↔_New_Element](#) instead. Function inserts new element after some element, to insert on first place give list as before element. New element is allocated. Type, data, attribute name and constraint of new elements are set according to function arguments. Pointers are changed so that before element points to new element.
- void [AK_Update_Existing_Element](#) (int newtype, void *data, char *table, char *attribute_name, struct [list_node](#) *ElementBefore)

Used to add a constraint attribute which will define what element gets updated when the operation is executed.
- void [AK_Insert_New_Element](#) (int newtype, void *data, char *table, char *attribute_name, struct [list_node](#) *ElementBefore)

Used to add a new element after some element, to insert on first place give list as before element. It calls function [AK_Insert_New_Element_For_Update](#).
- int [AK_insert_row_to_block](#) (struct [list_node](#) *row_root, [AK_block](#) *temp_block)

Function inserts one row into some block. Firstly it checks whether block contains attributes from the list. Then data, type, size and last_tuple_id are put in temp_block.
- int [AK_insert_row](#) (struct [list_node](#) *row_root)

Function inserts a one row into table. Firstly it is checked whether inserted row would violate reference integrity. Then it is checked in which table should row be inserted. If there is no AK_free space for new table, new extent is allocated. New block is allocated on given address. Row is inserted in this block and dirty flag is set to BLOCK_DIRTY.
- void [AK_update_row_from_block](#) ([AK_block](#) *temp_block, struct [list_node](#) *row_root)

Function updates row from table in given block.
- void [AK_delete_row_from_block](#) ([AK_block](#) *temp_block, struct [list_node](#) *row_root)

Function deletes row from table in given block. Given list of elements is firstly back-upped.
- int [AK_delete_update_segment](#) (struct [list_node](#) *row_root, int del)

Function updates or deletes the whole segment of an table. Addresses for given table are fetched. For each block in extent row is updated or deleted according to operator del.
- int [AK_delete_row](#) (struct [list_node](#) *row_root)

Function deletes rows.
- void [AK_delete_row_by_id](#) (int id, char *tableName)

Function deletes row by id.
- int [AK_update_row](#) (struct [list_node](#) *row_root)

Function updates rows of some table.
- [TestResult AK_fileio_test](#) ()

5.21.1 Detailed Description

Provides functions for file input/output

5.21.2 Function Documentation

5.21.2.1 AK_delete_row()

```
int AK_delete_row (
    struct list_node * row_root )
```

Function deletes rows.

Author

Matija Novak, Dejan Frankovic (added referential integrity)

Parameters

<i>row_root</i>	elements of one row @returs EXIT_SUCCESS if success
-----------------	-----------------------------------------------------

5.21.2.2 AK_delete_row_by_id()

```
void AK_delete_row_by_id (
    int id,
    char * tableName )
```

Function deletes row by id.

Author

Dražen Bandić

Parameters

<i>id</i>	id of row
<i>tableName</i>	name of table to delete the row

5.21.2.3 AK_delete_row_from_block()

```
void AK_delete_row_from_block (
```

```

    AK_block * temp_block,
    struct list_node * row_root )

```

Function deletes row from table in given block. Given list of elements is firstly back-upped.

Author

Matija Novak, updated by Dino Laktašić, changed by Davorin Vukelic, updated by Mario Peroković

Parameters

<i>temp_block</i>	block to work with
<i>row_list</i>	list of elements which contain data for delete or update

Returns

No return value

5.21.2.4 AK_delete_update_segment()

```

int AK_delete_update_segment (
    struct list_node * row_root,
    int del )

```

Function updates or deletes the whole segment of an table. Addresses for given table atr fetched. For each block in extent row is updated or deleted according to operator del.

Author

Matija Novak, updated by Matija Šestak (function now uses caching)

Parameters

<i>row_root</i>	elements of one row
<i>del</i>	- DELETE or UPDATE

Returns

EXIT_SUCCESS if success

5.21.2.5 AK_Insert_New_Element()

```

void AK_Insert_New_Element (
    int newtype,

```

```

void * data,
char * table,
char * attribute_name,
struct list_node * ElementBefore )

```

Used to add a new element after some element, to insert on first place give list as before element. It calls function AK_Insert_New_Element_For_Update.

Author

Matija Novak, changed by Dino Laktašić

Parameters

<i>newtype</i>	type of the data
<i>data</i>	the data
<i>table</i>	table name
<i>attribute_name</i>	attribute name
<i>element</i>	element after we which insert the new element
<i>constraint</i>	is NEW_VALUE

Returns

No return value

5.21.2.6 AK_Insert_New_Element_For_Update()

```

void AK_Insert_New_Element_For_Update (
    int newtype,
    void * data,
    char * table,
    char * attribute_name,
    struct list_node * ElementBefore,
    int newconstraint )

```

!! YOU PROBABLY DON'T WANT TO USE THIS FUNCTION !! - Use AK_Update_Existing_Element or AK_Insert↵_New_Element instead. Function inserts new element after some element, to insert on first place give list as before element. New element is allocated. Type, data, attribute name and constraint of new elemets are set according to function arguments. Pointers are changed so that before element points to new element.

Author

Matija Novak

Parameters

<i>newtype</i>	type of the data
<i>data</i>	the data
<i>table</i>	table name
<i>attribute_name</i>	attribute name
<i>element</i>	element after we which insert the new element
<i>constraint</i>	NEW_VALUE if data is new value, SEARCH_CONSTRAINT if data is constraint to search for

Returns

No return value

5.21.2.7 AK_insert_row()

```
int AK_insert_row (
    struct list_node * row_root )
```

Function inserts a one row into table. Firstly it is checked whether inserted row would violate reference integrity. Then it is checked in which table should row be inserted. If there is no AK_free space for new table, new extent is allocated. New block is allocated on given address. Row is inserted in this block and dirty flag is set to BLOCK_↔DIRTY.

Author

Matija Novak, updated by Matija Šestak (function now uses caching), updated by Dejan Frankovic (added reference check), updated by Dino Laktašić (removed variable AK_free, variable table initialized using memset)

Parameters

<i>row_root</i>	list of elements which contain data of one row
-----------------	------------------------------------------------

Returns

EXIT_SUCCESS if success else EXIT_ERROR

5.21.2.8 AK_insert_row_to_block()

```
int AK_insert_row_to_block (
    struct list_node * row_root,
    AK_block * temp_block )
```

Function inserts one row into some block. Firstly it checks whether block contains attributes from the list. Then data, type, size and last_tuple_id are put in temp_block.

Author

Matija Novak, updated by Dino Laktašić

Parameters

<i>row_root</i>	list of elements to insert
<i>temp_block</i>	block in which we insert data

Returns

EXIT SUCCES if success

5.21.2.9 AK_Update_Existing_Element()

```
void AK_Update_Existing_Element (
    int newtype,
    void * data,
    char * table,
    char * attribute_name,
    struct list_node * ElementBefore )
```

Used to add a constraint attribute which will define what element gets updated when the operation is executed.

Author

Igor Rinkovec

Parameters

<i>newtype</i>	type of the data
<i>data</i>	the data
<i>table</i>	table name
<i>attribute_name</i>	attribute name
<i>element</i>	element after we which insert the new element
<i>constraint</i>	is NEW_VALUE

Returns

No return value

5.21.2.10 AK_update_row()

```
int AK_update_row (
    struct list_node * row_root )
```

Function updates rows of some table.

Author

Matija Novak, Dejan Frankovic (added referential integrity)

Parameters

<i>row_root</i>	elements of one row
-----------------	---------------------

Returns

EXIT_SUCCESS if success

5.21.2.11 AK_update_row_from_block()

```
void AK_update_row_from_block (
    AK_block * temp_block,
    struct list_node * row_root )
```

Function updates row from table in given block.

Author

Matija Novak, updated by Dino Laktašić, updated by Mario Peroković - separated from deletion

Parameters

<i>temp_block</i>	block to work with
<i>row_list</i>	list of elements which contain data for delete or update

Returns

No return value

5.22 file/fileio.h File Reference

```
#include "../auxi/test.h"
#include "../auxi/constants.h"
#include "../sql/cs/reference.h"
#include "../mm/memoman.h"
#include "../rec/recovery.h"
#include "../rec/archive_log.h"
#include "../rec/redo_log.h"
```

Include dependency graph for fileio.h: This graph shows which files directly or indirectly include this file:

Functions

- void [AK_Insert_New_Element_For_Update](#) (int newtype, void *data, char *table, char *attribute_name, struct [list_node](#) *ElementBefore, int newconstraint)
!! YOU PROBABLY DON'T WANT TO USE THIS FUNCTION !! - Use AK_Update_Existing_Element or AK_Insert_↔_New_Element instead. Function inserts new element after some element, to insert on first place give list as before element. New element is allocated. Type, data, attribute name and constraint of new elemets are set according to function arguments. Pointers are changed so that before element points to new element.
- void [AK_Insert_New_Element](#) (int newtype, void *data, char *table, char *attribute_name, struct [list_node](#) *ElementBefore)
Used to add a new element after some element, to insert on first place give list as before element. It calls function AK_Insert_New_Element_For_Update.

- int [AK_insert_row_to_block](#) (struct [list_node](#) *row_root, [AK_block](#) *temp_block)
Function inserts one row into some block. Firstly it checks whether block contains attributes from the list. Then data, type, size and last_tuple_id are put in temp_block.
- int [AK_insert_row](#) (struct [list_node](#) *row_root)
Function inserts a one row into table. Firstly it is checked whether inserted row would violate reference integrity. Then it is checked in which table should row be inserted. If there is no AK_free space for new table, new extent is allocated. New block is allocated on given address. Row is inserted in this block and dirty flag is set to BLOCK_DIRTY.
- void [AK_update_row_from_block](#) ([AK_block](#) *temp_block, struct [list_node](#) *row_root)
Function updates row from table in given block.
- void [AK_delete_row_from_block](#) ([AK_block](#) *temp_block, struct [list_node](#) *row_root)
Function deletes row from table in given block. Given list of elements is firstly back-upped.
- int [AK_delete_update_segment](#) (struct [list_node](#) *row_root, int del)
Function updates or deletes the whole segment of an table. Addresses for given table are fetched. For each block in extent row is updated or deleted according to operator del.
- int [AK_delete_row](#) (struct [list_node](#) *row_root)
Function deletes rows.
- int [AK_update_row](#) (struct [list_node](#) *row_root)
Function updates rows of some table.
- [TestResult](#) [AK_fileio_test](#) ()
- void [AK_delete_row_by_id](#) (int id, char *tableName)
Function deletes row by id.

5.22.1 Detailed Description

Header file provides functions and defines for file input/output

5.22.2 Function Documentation

5.22.2.1 AK_delete_row()

```
int AK_delete_row (
    struct list\_node * row_root )
```

Function deletes rows.

Author

Matija Novak, Dejan Frankovic (added referential integrity)

Parameters

<i>row_root</i>	elements of one row @returns EXIT_SUCCESS if success
-----------------	------------------------------------------------------

5.22.2.2 AK_delete_row_by_id()

```
void AK_delete_row_by_id (
    int id,
    char * tableName )
```

Function deletes row by id.

Author

Dražen Bandić

Parameters

<i>id</i>	id of row
<i>tableName</i>	name of table to delete the row

5.22.2.3 AK_delete_row_from_block()

```
void AK_delete_row_from_block (
    AK_block * temp_block,
    struct list_node * row_root )
```

Function deletes row from table in given block. Given list of elements is firstly back-upped.

Author

Matija Novak, updated by Dino Laktašić, changed by Davorin Vukelic, updated by Mario Peroković

Parameters

<i>temp_block</i>	block to work with
<i>row_list</i>	list of elements which contain data for delete or update

Returns

No return value

5.22.2.4 AK_delete_update_segment()

```
int AK_delete_update_segment (
    struct list_node * row_root,
    int del )
```

Function updates or deletes the whole segment of an table. Addresses for given table atr fetched. For each block in extent row is updated or deleted according to operator del.

Author

Matija Novak, updated by Matija Šestak (function now uses caching)

Parameters

<i>row_root</i>	elements of one row
<i>del</i>	- DELETE or UPDATE

Returns

EXIT_SUCCESS if success

5.22.2.5 AK_Insert_New_Element()

```
void AK_Insert_New_Element (
    int newtype,
    void * data,
    char * table,
    char * attribute_name,
    struct list_node * ElementBefore )
```

Used to add a new element after some element, to insert on first place give list as before element. It calls function AK_Insert_New_Element_For_Update.

Author

Matija Novak, changed by Dino Laktašić

Parameters

<i>newtype</i>	type of the data
<i>data</i>	the data
<i>table</i>	table name
<i>attribute_name</i>	attribute name
<i>element</i>	element after we which insert the new element
<i>constraint</i>	is NEW_VALUE

Returns

No return value

5.22.2.6 AK_Insert_New_Element_For_Update()

```
void AK_Insert_New_Element_For_Update (
    int newtype,
```

```

void * data,
char * table,
char * attribute_name,
struct list_node * ElementBefore,
int newconstraint )

```

!! YOU PROBABLY DON'T WANT TO USE THIS FUNCTION !! - Use AK_Update_Existing_Element or AK_Insert↵_New_Element instead. Function inserts new element after some element, to insert on first place give list as before element. New element is allocated. Type, data, attribute name and constraint of new elemets are set according to function arguments. Pointers are changed so that before element points to new element.

Author

Matija Novak

Parameters

<i>newtype</i>	type of the data
<i>data</i>	the data
<i>table</i>	table name
<i>attribute_name</i>	attribute name
<i>element</i>	element after we which insert the new element
<i>constraint</i>	NEW_VALUE if data is new value, SEARCH_CONSTRAINT if data is constraint to search for

Returns

No return value

5.22.2.7 AK_insert_row()

```

int AK_insert_row (
    struct list_node * row_root )

```

Function inserts a one row into table. Firstly it is checked whether inserted row would violite reference integrity. Then it is checked in which table should row be inserted. If there is no AK_free space for new table, new extent is allocated. New block is allocated on given address. Row is inserted in this block and dirty flag is set to BLOCK_↵DIRTY.

Author

Matija Novak, updated by Matija Šestak (function now uses caching), updated by Dejan Frankovic (added reference check), updated by Dino Laktašić (removed variable AK_free, variable table initialized using memset)

Parameters

<i>row_root</i>	list of elements which contain data of one row
-----------------	------------------------------------------------

Returns

EXIT_SUCCESS if success else EXIT_ERROR

5.22.2.8 AK_insert_row_to_block()

```
int AK_insert_row_to_block (
    struct list_node * row_root,
    AK_block * temp_block )
```

Function inserts one row into some block. Firstly it checks whether block contains attributes from the list. Then data, type, size and last_tuple_id are put in temp_block.

Author

Matija Novak, updated by Dino Laktašić

Parameters

<i>row_root</i>	list of elements to insert
<i>temp_block</i>	block in which we insert data

Returns

EXIT_SUCCESS if success

5.22.2.9 AK_update_row()

```
int AK_update_row (
    struct list_node * row_root )
```

Function updates rows of some table.

Author

Matija Novak, Dejan Frankovic (added referential integrity)

Parameters

<i>row_root</i>	elements of one row
-----------------	---------------------

Returns

EXIT_SUCCESS if success

5.22.2.10 AK_update_row_from_block()

```
void AK_update_row_from_block (
    AK_block * temp_block,
    struct list_node * row_root )
```

Function updates row from table in given block.

Author

Matija Novak, updated by Dino Laktašić, updated by Mario Peroković - separated from deletion

Parameters

<i>temp_block</i>	block to work with
<i>row_list</i>	list of elements which contain data for delete or update

Returns

No return value

5.23 file/files.c File Reference

```
#include "files.h"
#include <pthread.h>
Include dependency graph for files.c:
```

Functions

- int [AK_initialize_new_segment](#) (char *name, int type, [AK_header](#) *header)
Function that initializes a new segment and writes its start and finish address in system catalog table. For creting new table, index, temporary table, etc. call this function.
- int [AK_initialize_new_index_segment](#) (char *name, char *table_id, int attr_id, [AK_header](#) *header)
Function that initializes a new segment and writes its start and finish address in system catalog table. For creting new table, index, temporary table, etc. call this function.
- [TestResult AK_files_test](#) ()
Test function.

Variables

- pthread_mutex_t **fileMut** = PTHREAD_MUTEX_INITIALIZER

5.23.1 Detailed Description

Header file provides functions for file management

5.23.2 Function Documentation

5.23.2.1 AK_files_test()

```
TestResult AK_files_test ( )
```

Test function.

Author

Unknown

Returns

No return value

5.23.2.2 AK_initialize_new_index_segment()

```
int AK_initialize_new_index_segment (
    char * name,
    char * table_id,
    int attr_id,
    AK_header * header )
```

Function that initializes a new segment and writes its start and finish address in system catalog table. For creting new table, index, temporary table, etc. call this function.

Author

Tomislav Fotak, updated by Matija Šestak (function now uses caching), reused by Lovro Predovan

Parameters

<i>name</i>	segment name
<i>type</i>	segment type
<i>header</i>	pointer to header that should be written to the new extent (all blocks)

Returns

start address of new segment

5.23.2.3 AK_initialize_new_segment()

```
int AK_initialize_new_segment (
    char * name,
    int type,
    AK_header * header )
```

Function that initializes a new segment and writes its start and finish address in system catalog table. For creting new table, index, temporary table, etc. call this function.

Author

Tomislav Fotak, updated by Matija Šestak (function now uses caching)

Parameters

<i>name</i>	segment name
<i>type</i>	segment type
<i>header</i>	pointer to header that should be written to the new extent (all blocks)

Returns

start address of new segment

5.24 file/files.h File Reference

```
#include "../auxi/test.h"
#include "id.h"
#include "../auxi/mempro.h"
```

Include dependency graph for files.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_initialize_new_segment](#) (char *name, int type, [AK_header](#) *header)
Function that initializes a new segment and writes its start and finish address in system catalog table. For creting new table, index, temporary table, etc. call this function.
- int [AK_initialize_new_index_segment](#) (char *name, char *table_id, int attr_id, [AK_header](#) *header)
Function that initializes a new segment and writes its start and finish address in system catalog table. For creting new table, index, temporary table, etc. call this function.
- [TestResult AK_files_test](#) ()
Test function.

5.24.1 Detailed Description

Header file that provides functions and defines for file management

5.24.2 Function Documentation

5.24.2.1 AK_files_test()

```
TestResult AK_files_test ( )
```

Test function.

Author

Unknown

Returns

No return value

5.24.2.2 AK_initialize_new_index_segment()

```
int AK_initialize_new_index_segment (
    char * name,
    char * table_id,
    int attr_id,
    AK_header * header )
```

Function that initializes a new segment and writes its start and finish address in system catalog table. For creting new table, index, temporary table, etc. call this function.

Author

Tomislav Fotak, updated by Matija Šestak (function now uses caching), reused by Lovro Predovan

Parameters

<i>name</i>	segment name
<i>type</i>	segment type
<i>header</i>	pointer to header that should be written to the new extent (all blocks)

Returns

start address of new segment

5.24.2.3 AK_initialize_new_segment()

```
int AK_initialize_new_segment (
    char * name,
    int type,
    AK_header * header )
```

Function that initializes a new segment and writes its start and finish address in system catalog table. For creting new table, index, temporary table, etc. call this function.

Author

Tomislav Fotak, updated by Matija Šestak (function now uses caching)

Parameters

<i>name</i>	segment name
<i>type</i>	segment type
<i>header</i>	pointer to header that should be written to the new extent (all blocks)

Returns

start address of new segment

5.25 file/filesearch.c File Reference

```
#include "filesearch.h"
```

Include dependency graph for filesearch.c:

Functions

- [search_result AK_search_unsorted](#) (char *szRelation, [search_params](#) *aspParams, int iNum_search_↵
params)
Function that searches through unsorted values of multiple attributes in a segment. Only tuples that are equal on all given attribute values are returned (A == 1 AND B == 7 AND ...). SEARCH_RANGE is inclusive. Only one value (or range) per attribute allowed - use [search_params.pData_lower](#) for SEARCH_PARTICULAR. Supported types for SEARCH_RANGE: TYPE_INT, TYPE_FLOAT, TYPE_NUMBER, TYPE_DATE, TYPE_DATETIME, TYPE_TIME. Do not provide the wrong data types in the array of search parameters. There is no way to test for that and it could cause a memory access violation.
- void [AK_deallocate_search_result](#) ([search_result](#) srResult)
Function that deallocates memory used by the search result returned by AK_search_unsorted.
- [TestResult AK_filesearch_test](#) ()
Function that tests file search.

5.25.1 Detailed Description

Provides functions for file searching

5.25.2 Function Documentation

5.25.2.1 AK_deallocate_search_result()

```
void AK_deallocate_search_result (
    search_result srResult )
```

Function that deallocates memory used by the search result returned by AK_search_unsorted.

Author

Miroslav Policki

Parameters

<i>srResult</i>	search result
-----------------	---------------

Returns

No return value

5.25.2.2 AK_filesearch_test()

```
TestResult AK_filesearch_test ( )
```

Function that tests file search.

Author

Miroslav Policki

Returns

No return value

5.25.2.3 AK_search_unsorted()

```
search_result AK_search_unsorted (
    char * szRelation,
    search_params * aspParams,
    int iNum_search_params )
```

Function that searches through unsorted values of multiple attributes in a segment. Only tuples that are equal on all given attribute values are returned (A == 1 AND B == 7 AND ...). SEARCH_RANGE is inclusive. Only one value (or range) per attribute allowed - use [search_params.pData_lower](#) for SEARCH_PARTICULAR. Supported types for SEARCH_RANGE: TYPE_INT, TYPE_FLOAT, TYPE_NUMBER, TYPE_DATE, TYPE_DATETIME, TYPE_TIME. Do not provide the wrong data types in the array of search parameters. There is no way to test for that and it could cause a memory access violation.

Author

Miroslav Policki

Parameters

<i>szRelation</i>	relation name
<i>aspParams</i>	array of search parameters
<i>iNum_search_params</i>	number of search parameters

Returns

[search_result](#) structure defined in [filesearch.h](#). Use [AK_deallocate_search_result](#) to deallocate.

iterate through all the blocks

count number of attributes in segment/relation

determine index of attributes on which search will be performed

if any of the provided attributes are not found in the relation, return empty result

in every tuple, for all required attributes, compare attribute value with searched-for value and store matched tuple addresses

5.26 file/filesearch.h File Reference

```
#include "../auxi/test.h"
#include "../mm/memoman.h"
#include "files.h"
#include "../auxi/mempro.h"
```

Include dependency graph for filesearch.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [search_params](#)

*Structure that contains attribute name, lower and upper data value, special(NULL or *) which is input for AK_equisearch_unsorted and AK_rangesearch_unsorted.*

- struct [search_result](#)

Structure which represents search result of AK_equisearch_unsorted and AK_rangesearch_unsorted.

Macros

- `#define SEARCH_NULL 0`
- `#define SEARCH_ALL 1`
- `#define SEARCH_PARTICULAR 2`
- `#define SEARCH_RANGE 3`

Functions

- [search_result AK_search_unsorted](#) (char *szRelation, [search_params](#) *aspParams, int iNum_search_↵
params)
Function that searches through unsorted values of multiple attributes in a segment. Only tuples that are equal on all given attribute values are returned (A == 1 AND B == 7 AND ...). SEARCH_RANGE is inclusive. Only one value (or range) per attribute allowed - use [search_params.pData_lower](#) for SEARCH_PARTICULAR. Supported types for SEARCH_RANGE: TYPE_INT, TYPE_FLOAT, TYPE_NUMBER, TYPE_DATE, TYPE_DATETIME, TYPE_TIME. Do not provide the wrong data types in the array of search parameters. There is no way to test for that and it could cause a memory access violation.
- void [AK_deallocate_search_result](#) ([search_result](#) srResult)
Function that deallocates memory used by the search result returned by AK_search_unsorted.
- [TestResult AK_filesearch_test](#) ()
Function that tests file search.

5.26.1 Detailed Description

Header file provides data structures, functions and defines for file searching

5.26.2 Function Documentation

5.26.2.1 AK_deallocate_search_result()

```
void AK_deallocate_search_result (
    search\_result srResult )
```

Function that deallocates memory used by the search result returned by AK_search_unsorted.

Author

Miroslav Policki

Parameters

<i>srResult</i>	search result
-----------------	---------------

Returns

No return value

5.26.2.2 AK_filesearch_test()

```
TestResult AK_filesearch_test ( )
```

Function that tests file search.

Author

Miroslav Policki

Returns

No return value

5.26.2.3 AK_search_unsorted()

```
search_result AK_search_unsorted (
    char * szRelation,
    search_params * aspParams,
    int iNum_search_params )
```

Function that searches through unsorted values of multiple attributes in a segment. Only tuples that are equal on all given attribute values are returned (A == 1 AND B == 7 AND ...). SEARCH_RANGE is inclusive. Only one value (or range) per attribute allowed - use [search_params.pData_lower](#) for SEARCH_PARTICULAR. Supported types for SEARCH_RANGE: TYPE_INT, TYPE_FLOAT, TYPE_NUMBER, TYPE_DATE, TYPE_DATETIME, TYPE_TIME. Do not provide the wrong data types in the array of search parameters. There is no way to test for that and it could cause a memory access violation.

Author

Miroslav Policki

Parameters

<i>szRelation</i>	relation name
<i>aspParams</i>	array of search parameters
<i>iNum_search_params</i>	number of search parameters

Returns

[search_result](#) structure defined in [filesearch.h](#). Use [AK_deallocate_search_result](#) to deallocate.

iterate through all the blocks

count number of attributes in segment/relation

determine index of attributes on which search will be performed

if any of the provided attributes are not found in the relation, return empty result

in every tuple, for all required attributes, compare attribute value with searched-for value and store matched tuple addresses

5.27 file/filesort.h File Reference

```
#include "../auxi/test.h"
#include "../mm/memoman.h"
#include "table.h"
#include "files.h"
#include "fileio.h"
#include "../auxi/mempro.h"
```

Include dependency graph for filesort.h: This graph shows which files directly or indirectly include this file:

Macros

- `#define DATA_ROW_SIZE 200`
Constant declaring size of data to be compared.
- `#define DATA_TUPLE_SIZE 500`
Constant declaring size of data to be copied.

Functions

- `int AK_get_total_headers (AK_block *iBlock)`
Function that returns the total number of headers in the block.
- `int AK_get_header_number (AK_block *iBlock, char *attribute_name)`
Function that returns the number of header in the block which to sort.
- `int AK_get_num_of_tuples (AK_block *iBlock)`
Function that returns tuples number in block.
- `int AK_sort_segment (char *srcTable, char *destTable, struct list_node *attributes)`
Function that sorts a segment.
- `void AK_reset_block (AK_block *block)`
Function that resets block.
- `void AK_block_sort (AK_block *iBlock, char *atr_name)`
Function that sorts the given block.
- `TestResult AK_filesort_test ()`

5.27.1 Detailed Description

Header file that provides functions and defines for file sorting

5.27.2 Function Documentation

5.27.2.1 AK_block_sort()

```
void AK_block_sort (
    AK_block * iBlock,
    char * attribute_name )
```

Function that sorts the given block.

Author

Bakoš Nikola

Version

v1.0

Parameters

<i>iBlock</i>	block to be sorted
---------------	--------------------

Returns

No return value

5.27.2.2 AK_get_header_number()

```
int AK_get_header_number (
    AK_block * iBlock,
    char * attribute_name )
```

Function that returns the number of header in the block which to sort.

Author

Unknown

Returns

number of attribute in header (0 - MAX_ATTRIBUTES). USE in tuple_dict[num]...

5.27.2.3 AK_get_num_of_tuples()

```
int AK_get_num_of_tuples (
    AK_block * iBlock )
```

Function that returns tuples number in block.

Author

Unknown

Returns

tuples number in block

5.27.2.4 AK_get_total_headers()

```
int AK_get_total_headers (
    AK_block * iBlock )
```

Function that returns the total number of headers in the block.

Author

Unknown

Returns

number of attribute in header (0 - MAX_ATTRIBUTES). USE in tuple_dict[num]...

5.27.2.5 AK_reset_block()

```
void AK_reset_block (
    AK_block * block )
```

Function that resets block.

Author

Unknown

Parameters

<i>block</i>	block to be resetted
--------------	----------------------

Returns

No return value

5.27.2.6 AK_sort_segment()

```
int AK_sort_segment (
    char * srcTable,
    char * destTable,
    struct list_node * attributes )
```

Function that sorts a segment.

Author

Tomislav Bobinac, updated by Filip Žmuk

Todo Make it to suport multiple sort atributes and ASC|DESC ordering

Returns

No return value.

Author

Tomislav Bobinac, updated by Filip Žmuk

Todo Make it to suport multiple sort atributes and ASC|DESC ordering

Returns

No return value.

5.28 file/id.c File Reference

```
#include "id.h"
```

Include dependency graph for id.c:

Functions

- int [AK_get_id](#) ()
Function that fetches unique ID for any object, stored in a sequence.
- char [AK_get_table_id](#) (char *tableName)
Function that fetches unique ID for any object, stored in sequence based on table name.
- [TestResult AK_id_test](#) ()
Function for testing getting ID's.

5.28.1 Detailed Description

Provides functions for creating id of objects

5.28.2 Function Documentation

5.28.2.1 AK_get_id()

```
int AK_get_id ( )
```

Function that fetches unique ID for any object, stored in a sequence.

Author

Saša Vukšić, updated by Mislav Čakarić, changed by Mario Peroković, now uses AK_update_row, updated by Nenad Makar

Returns

objectID

5.28.2.2 AK_get_table_id()

```
char AK_get_table_id (
    char * tableName )
```

Function that fetches unique ID for any object, stored in sequence based on table name.

Author

Lovro Predovan

Returns

objectID in string(char) format

5.28.2.3 AK_id_test()

```
TestResult AK_id_test ( )
```

Function for testing getting ID's.

Author

Mislav Čakarić, updated by Nenad Makar

Returns

No return value

5.29 file/id.h File Reference

```
#include "../auxi/test.h"
#include "table.h"
#include "fileio.h"
#include "../auxi/mempro.h"
```

Include dependency graph for id.h: This graph shows which files directly or indirectly include this file:

Macros

- `#define ID_START_VALUE 100`
Constant declaring start value of id.

Functions

- `int AK_get_id ()`
Function that fetches unique ID for any object, stored in a sequence.
- `TestResult AK_id_test ()`
Function for testing getting ID's.

5.29.1 Detailed Description

Provides functions and defines for creating id of objects

5.29.2 Function Documentation

5.29.2.1 AK_get_id()

```
int AK_get_id ( )
```

Function that fetches unique ID for any object, stored in a sequence.

Author

Saša Vukšić, updated by Mislav Čakarić, changed by Mario Peroković, now uses AK_update_row, updated by Nenad Makar

Returns

objectID

5.29.2.2 AK_id_test()

```
TestResult AK_id_test ( )
```

Function for testing getting ID's.

Author

Mislav Čakarić, updated by Nenad Makar

Returns

No return value

5.30 file/idx/bitmap.c File Reference

```
#include "bitmap.h"
#include "../auxi/iniparser.h"
Include dependency graph for bitmap.c:
```

Functions

- int [AK_If_ExistOp](#) (struct [list_node](#) *L, char *ele)
Function that examines whether list L contains operator ele.
- void [AK_create_Index_Table](#) (char *tblName, struct [list_node](#) *attributes)
Function that reads table on which we create index and call functions for creating index Elements that will be in index are put in list [indexLista](#) and [headerAttributes](#). According to those elements new indexes are created.
- void [AK_create_Index](#) (char *tblName, char *tblNameIndex, char *attributeName, int positionTbl, int num↵
Attributes, [AK_header](#) *headerIndex)
Function that loads index table with the value of particular attribute.
- [list_ad](#) * [AK_get_attribute](#) (char *indexName, char *attribute)
Function that gets addresses of the particular attribute from bitmap index. It fetches addresses of indexes and header of index table. Using while loop it goes through index and gets necessary data. That data is put in a list called [add_root](#).
- void [AK_print_Att_Test](#) ([list_ad](#) *list)
Function that prints the list of addresses.
- [list_ad](#) * [AK_get_Attribute](#) (char *tableName, char *attributeName, char *attributeValue)
Function that fetches the values from the bitmap index if there is one for a given table. It should be started when we are making selection on the table with bitmap index.
- void [AK_update](#) (int addBlock, int addTd, char *tableName, char *attributeName, char *attributeValue, char *newAttributeValue)
Function that updates the index, only on values that already exist. If there is no value in bitmap index or bitmap index on this value, warning is showed to the user. Otherwise, bitmap index is updated with new attribute value.
- void [AK_add_to_bitmap_index](#) (char *tableName, char *attributeName)
Function that writes the new value in block when index is updated.
- void [AK_print_Header_Test](#) (char *tblName)
Function that tests printing header of table.
- void [AK_delete_bitmap_index](#) (char *indexName)
Function that deletes bitmap index based on the name of index.
- [TestResult](#) [AK_bitmap_test](#) ()
Function that creates test table and makes index on test table, also prints original tables indexes tables and indexes, tests updating into tables.

5.30.1 Detailed Description

Provides functions for bitmap indexes

5.30.2 Function Documentation

5.30.2.1 [AK_add_to_bitmap_index\(\)](#)

```
void AK_add_to_bitmap_index (
    char * tableName,
    char * attributeName )
```

Function that writes the new value in block when index is updated.

Function that updates the index. Function deletes and recreates the index values again if different number of params is detected.

Author

Saša Vukšić

Parameters

<i>block</i>	block to write on
--------------	-------------------

Returns

EXIT_SUCESS when write operation is successful, otherwise EXIT_ERROR

Author

Lovro Predovan

Function that updates the index. Function deletes and recreates the index values again if different number of params is detected

Parameters

<i>tableName</i>	name of table
<i>attributeName</i>	name of attribute
<i>newAttributeValue</i>	new value of updated attribute

Returns

No return value

5.30.2.2 AK_bitmap_test()

```
TestResult AK_bitmap_test ( )
```

Function that creates test table and makes index on test table, also prints original tables indexes tables and indexes, tests updating into tables.

Author

Saša Vukšić updated by Lovro Predovan

Returns

No return value

5.30.2.3 AK_create_Index()

```
void AK_create_Index (
    char * tblName,
    char * tblNameIndex,
    char * attributeName,
    int positionTbl,
    int numAtributes,
    AK_header * headerIndex )
```

Function that loads index table with the value of particular attribute.

Author

Saša Vukšić, Lovro Predovan

Parameters

<i>tblName</i>	source table
<i>tblNameIndex</i>	new name of index table
<i>attributeName</i>	attribute on which we make index
<i>positionTbl</i>	position of attribute in header of table
<i>numAtributes</i>	number of attributes in table
<i>headerIndex</i>	header of index table

Returns

No return value

5.30.2.4 AK_create_Index_Table()

```
void AK_create_Index_Table (
    char * tblName,
    struct list_node * attributes )
```

Function that reads table on which we create index and call functions for creating index Elements that will be in index are put in list indexLista and headerAttributes. According to those elements new indexes are created.

Author

Saša Vukšić, Lovro Predovan

Parameters

<i>tblName</i>	name of table
<i>attributes</i>	list of attributes on which we will create indexes

Returns

No return value

5.30.2.5 AK_delete_bitmap_index()

```
void AK_delete_bitmap_index (
    char * indexName )
```

Function that deletes bitmap index based on the name of index.

Author

Lovro Predovan

Parameters

<i>Bitmap</i>	index table name
---------------	------------------

Returns

No return value

5.30.2.6 AK_get_attribute()

```
list_ad* AK_get_attribute (
    char * indexName,
    char * attribute )
```

Function that gets addresses of the particular attribute from bitmap index. It fetches addresses of indexes and header of index table. Using while loop it goes through index and gets necessary data. That data is put in a list called add_root.

Author

Saša Vukšić, Lovro Predovan

Parameters

<i>indexName</i>	name of index
<i>attribute</i>	name of attribute

Returns

list of addresses

5.30.2.7 AK_get_Attribute()

```
list_ad* AK_get_Attribute (
    char * tableName,
    char * attributeName,
    char * attributeValue )
```

Function that fetches the values from the bitmap index if there is one for a given table. It should be started when we are making selection on the table with bitmap index.

Author

Saša Vukšić

Parameters

<i>tableName</i>	name of table
<i>attributeValue</i>	value of attribute

Returns

list of adresses

5.30.2.8 AK_If_ExistOp()

```
int AK_If_ExistOp (
    struct list_node * L,
    char * ele )
```

Function that examines whether list L contains operator ele.

Author

Saša Vukšić

Parameters

<i>L</i>	list of elements
<i>ele</i>	operator to be found in list

Returns

1 if operator ele is found in list, otherwise 0

5.30.2.9 AK_print_Att_Test()

```
void AK_print_Att_Test (
    list_ad * list )
```

Function that prints the list of addresses.

Author

Saša Vukšić, Lovro Predovan

Parameters

<i>list</i>	list of addresses
-------------	-------------------

Returns

No return value

5.30.2.10 AK_print_Header_Test()

```
void AK_print_Header_Test (
    char * tblName )
```

Function that tests printing header of table.

Author

Saša Vukšić

Parameters

<i>tblName</i>	name of table who's header we are printing
----------------	--------------------------------------------

Returns

No return value

5.30.2.11 AK_update()

```
void AK_update (
    int addBlock,
    int addTd,
    char * tableName,
```

```
char * attributeName,
char * attributeValue,
char * newAttributeValue )
```

Function that updates the index, only on values that already exist. If there is no value in bitmap index or bitmap index on this value, warning is showed to the user. Otherwise, bitmap index is updated with new attribute value.

Author

Saša Vukšić

Parameters

<i>addBlock</i>	adress of block
<i>addTD</i>	adress of tuple dict
<i>tableName</i>	name of table
<i>attributeName</i>	name of attribute
<i>attributeValue</i>	value of attribute
<i>newAttributeValue</i>	new value of updated attribute

Returns

No return value

5.31 file/idx/bitmap.h File Reference

```
#include "../auxi/test.h"
#include "../mm/memoman.h"
#include "index.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../file/files.h"
#include "../auxi/mempro.h"
```

Include dependency graph for bitmap.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_If_ExistOp](#) (struct [list_node](#) *L, char *ele)
Function that examines whether list L contains operator ele.
- void [AK_create_Index_Table](#) (char *tblName, struct [list_node](#) *attributes)
Function that reads table on which we create index and call functions for creating index Elements that will be in index are put in list indexLista and headerAttributes. According to those elements new indexes are created.
- void [AK_print_Header_Test](#) (char *tblName)
Function that tests printing header of table.
- void [AK_create_Index](#) (char *tblName, char *tblNameIndex, char *attributeName, int positionTbl, int num↔Attributes, [AK_header](#) *headerIndex)
Function that loads index table with the value of particular attribute.
- [list_ad](#) * [AK_get_attribute](#) (char *indexName, char *attribute)
Function that gets adresses of the particular attribute from bitmap index. It fetches addresses of indexes and header of index table. Using while loop it goes through index and gets necessary data. That data is put in a list called add_root.

- void **AK_create_List_Address_Test** ()
- void **AK_print_Att_Test** (list_ad *list)
Function that prints the list of addresses.
- list_ad * **AK_get_Attribute** (char *tableName, char *attributeName, char *attributeValue)
Function that fetches the values from the bitmap index if there is one for a given table. It should be started when we are making selection on the table with bitmap index.
- void **AK_update** (int addBlock, int addTd, char *tableName, char *attributeName, char *attributeValue, char *newAttributeValue)
Function that updates the index, only on values that already exist. If there is no value in bitmap index or bitmap index on this value, warning is showed to the user. Otherwise, bitmap index is updated with new attribute value.
- int **AK_write_block** (AK_block *block)
Function that writes the new value in block when index is updated.
- **TestResult AK_bitmap_test** ()
Function that creates test table and makes index on test table, also prints original tables indexes tables and indexes, tests updating into tables.
- void **AK_delete_bitmap_index** (char *indexName)
Function that deletes bitmap index based on the name of index.
- void **AK_add_to_bitmap_index** (char *tableName, char *attributeName)
Function that updates the index. Function deletes and recreates the index values again if different number of params is detected.

5.31.1 Detailed Description

Header file that declares functions

5.31.2 Function Documentation

5.31.2.1 AK_add_to_bitmap_index()

```
void AK_add_to_bitmap_index (
    char * tableName,
    char * attributeName )
```

Function that updates the index. Function deletes and recreates the index values again if different number of params is detected.

Author

Lovro Predovan

Parameters

<i>tableName</i>	name of table
<i>attributeName</i>	name of attribute
<i>newAttributeValue</i>	new value of updated attribute

Returns

No return value

Function that updates the index. Function deletes and recreates the index values again if different number of params is detected.

Author

Saša Vukšić

Parameters

<i>block</i>	block to write on
--------------	-------------------

Returns

EXIT_SUCESS when write operation is successful, otherwise EXIT_ERROR

Author

Lovro Predovan

Function that updates the index. Function deletes and recreates the index values again if different number of params is detected

Parameters

<i>tableName</i>	name of table
<i>attributeName</i>	name of attribute
<i>newAttributeValue</i>	new value of updated attribute

Returns

No return value

5.31.2.2 AK_bitmap_test()

```
TestResult AK_bitmap_test ( )
```

Function that creates test table and makes index on test table, also prints original tables indexes tables and indexes, tests updating into tables.

Author

Saša Vukšić updated by Lovro Predovan

Returns

No return value

5.31.2.3 AK_create_Index()

```
void AK_create_Index (
    char * tblName,
    char * tblNameIndex,
    char * attributeName,
    int positionTbl,
    int numAttributes,
    AK_header * headerIndex )
```

Function that loads index table with the value of particular attribute.

Author

Saša Vukšić, Lovro Predovan

Parameters

<i>tblName</i>	source table
<i>tblNameIndex</i>	new name of index table
<i>attributeName</i>	attribute on which we make index
<i>positionTbl</i>	position of attribute in header of table
<i>numAttributes</i>	number of attributes in table
<i>headerIndex</i>	header of index table

Returns

No return value

5.31.2.4 AK_create_Index_Table()

```
void AK_create_Index_Table (
    char * tblName,
    struct list_node * attributes )
```

Function that reads table on which we create index and call functions for creating index Elements that will be in index are put in list indexLista and headerAttributes. According to those elements new indexes are created.

Author

Saša Vukšić, Lovro Predovan

Parameters

<i>tblName</i>	name of table
<i>attributes</i>	list of attributes on which we will create indexes

Returns

No return value

5.31.2.5 AK_delete_bitmap_index()

```
void AK_delete_bitmap_index (
    char * indexName )
```

Function that deletes bitmap index based on the name of index.

Author

Lovro Predovan

Parameters

<i>Bitmap</i>	index table name
---------------	------------------

Returns

No return value

5.31.2.6 AK_get_attribute()

```
list_ad* AK_get_attribute (
    char * indexName,
    char * attribute )
```

Function that gets addresses of the particular attribute from bitmap index. It fetches addresses of indexes and header of index table. Using while loop it goes through index and gets necessary data. That data is put in a list called add_root.

Author

Saša Vukšić, Lovro Predovan

Parameters

<i>indexName</i>	name of index
<i>attribute</i>	name of attribute

Returns

list of addresses

5.31.2.7 AK_get_Attribute()

```
list_ad* AK_get_Attribute (
    char * tableName,
    char * attributeName,
    char * attributeValue )
```

Function that fetches the values from the bitmap index if there is one for a given table. It should be started when we are making selection on the table with bitmap index.

Author

Saša Vukšić

Parameters

<i>tableName</i>	name of table
<i>attributeValue</i>	value of attribute

Returns

list of adresses

5.31.2.8 AK_If_ExistOp()

```
int AK_If_ExistOp (
    struct list_node * L,
    char * ele )
```

Function that examines whether list L contains operator ele.

Author

Saša Vukšić

Parameters

<i>L</i>	list of elements
<i>ele</i>	operator to be found in list

Returns

1 if operator ele is found in list, otherwise 0

5.31.2.9 AK_print_Att_Test()

```
void AK_print_Att_Test (
    list_ad * list )
```

Function that prints the list of addresses.

Author

Saša Vukšić, Lovro Predovan

Parameters

<i>list</i>	list of addresses
-------------	-------------------

Returns

No return value

5.31.2.10 AK_print_Header_Test()

```
void AK_print_Header_Test (
    char * tblName )
```

Function that tests printing header of table.

Author

Saša Vukšić

Parameters

<i>tblName</i>	name of table who's header we are printing
----------------	--------------------------------------------

Returns

No return value

5.31.2.11 AK_update()

```
void AK_update (
    int addBlock,
    int addTd,
    char * tableName,
```



```
char * attributeName,
char * attributeValue,
char * newAttributeValue )
```

Function that updates the index, only on values that already exist. If there is no value in bitmap index or bitmap index on this value, warning is showed to the user. Otherwise, bitmap index is updated with new attribute value.

Author

Saša Vukšić

Parameters

<i>addBlock</i>	address of block
<i>addTD</i>	address of tuple dict
<i>tableName</i>	name of table
<i>attributeName</i>	name of attribute
<i>attributeValue</i>	value of attribute
<i>newAttributeValue</i>	new value of updated attribute

Returns

No return value

5.31.2.12 AK_write_block()

```
int AK_write_block (
    AK_block * block )
```

Function that writes the new value in block when index is updated.

Author

Saša Vukšić

Parameters

<i>block</i>	block to write on
--------------	-------------------

Returns

EXIT_SUCCESS when write operation is successful, otherwise EXIT_ERROR

Function that writes the new value in block when index is updated.

Author

Markus Schatten, updated by Domagoj Šitum (thread-safe enabled)

Parameters

<i>block</i>	pointer to block allocated in memory to write
--------------	-----------------------------------------------

Returns

EXIT_SUCCESS if successful, EXIT_ERROR otherwise

5.32 file/idx/btree.c File Reference

```
#include "btree.h"
```

Include dependency graph for btree.c:

Functions

- int [AK_btree_create](#) (char *tblName, struct [list_node](#) *attributes, char *indexName)
Function that creates new btree index on integer attribute in table.
- int [AK_btree_delete](#) (char *indexName)
- void [AK_btree_search_delete](#) (char *indexName, int *searchValue, int *endRange, int *toDo)
Function that searches or deletes a value in btree index.
- int [AK_btree_insert](#) (char *indexName, int *insertValue, int *insertTd, int *insertBlock)
- [TestResult](#) [AK_btree_test](#) ()

5.32.1 Detailed Description

Header file that provides functions for BTree indices

5.32.2 Function Documentation

5.32.2.1 AK_btree_create()

```
int AK_btree_create (  
    char * tblName,  
    struct list\_node * attributes,  
    char * indexName )
```

Function that creates new btree index on integer attribute in table.

Author

Andelko Spevec

Parameters

<i>tblName</i>	- name of the table on which we are creating index
<i>attributes</i>	- attribute on which we are creating index
<i>indexName</i>	- name of the index

5.32.2.2 AK_btree_search_delete()

```
void AK_btree_search_delete (
    char * indexName,
    int * searchValue,
    int * endRange,
    int * toDo )
```

Function that searches or deletes a value in btree index.

Author

Andelko Spevec

Parameters

<i>indexName</i>	- name of the index
<i>searchValue</i>	- value that we are searching in the index
<i>endRange</i>	- if 0 search is for 0 value, else searching in range
<i>toDo</i>	- if 0 we just search else we delete the element if we find it

5.33 file/idx/btree.h File Reference

```
#include "../auxi/test.h"
#include "index.h"
#include "../file/table.h"
#include "../auxi/constants.h"
#include "../auxi/configuration.h"
#include "../auxi/mempro.h"
```

Include dependency graph for btree.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [btree_node](#)
- struct [root_info](#)

Macros

- `#define B 3`
- `#define ORDER 6`
- `#define LEAF 0`
- `#define NODE 1`

Functions

- int [AK_btree_create](#) (char *tblName, struct [list_node](#) *attributes, char *indexName)
Function that creates new btree index on integer attribute in table.
- int [AK_btree_delete](#) (char *indexName)
- void [AK_btree_search_delete](#) (char *indexName, int *searchValue, int *endRange, int *toDo)
Function that searches or deletes a value in btree index.
- int [AK_btree_insert](#) (char *indexName, int *insertValue, int *insertTd, int *insertBlock)
- [TestResult](#) [AK_btree_test](#) ()

5.33.1 Detailed Description

Header file that provides data structures, functions and defines for BTree indices

5.33.2 Function Documentation

5.33.2.1 AK_btree_create()

```
int AK_btree_create (
    char * tblName,
    struct list\_node * attributes,
    char * indexName )
```

Function that creates new btree index on integer attribute in table.

Author

Andelko Spevec

Parameters

<i>tblName</i>	- name of the table on which we are creating index
<i>attributes</i>	- attribute on which we are creating index
<i>indexName</i>	- name of the index

5.33.2.2 AK_btree_search_delete()

```
void AK_btree_search_delete (
    char * indexName,
    int * searchValue,
    int * endRange,
    int * toDo )
```

Function that searches or deletes a value in btree index.

Author

Andelko Spevec

Parameters

<i>indexName</i>	- name of the index
<i>searchValue</i>	- value that we are searching in the index
<i>endRange</i>	- if 0 search is for 0 value, else searching in range
<i>toDo</i>	- if 0 we just search else we delete the element if we find it

5.34 file/idx/hash.c File Reference

```
#include "hash.h"
```

Include dependency graph for hash.c:

Functions

- `int AK_elem_hash_value (struct list_node *elem)`
Function that computes a hash value from varchar or integer.
- `struct_add * AK_insert_bucket_to_block (char *indexName, char *data, int type)`
Function that inserts a bucket to block.
- `void AK_update_bucket_in_block (struct_add *add, char *data)`
Function that updates a bucket in block.
- `void AK_change_hash_info (char *indexName, int modulo, int main_bucket_num, int hash_bucket_num)`
Function that changes a info of hash index.
- `hash_info * AK_get_hash_info (char *indexName)`
Function that fetches the info for hash index.
- `struct_add * AK_get_nth_main_bucket_add (char *indexName, int n)`
Function that fetches nth main bucket.
- `void AK_insert_in_hash_index (char *indexName, int hashValue, struct_add *add)`
Function that inserts a record in hash bucket.
- `struct_add * AK_find_delete_in_hash_index (char *indexName, struct list_node *values, int delete)`
Function that fetches or deletes a record from hash index.
- `struct_add * AK_find_in_hash_index (char *indexName, struct list_node *values)`
Function that fetches a record from the hash index.
- `void AK_delete_in_hash_index (char *indexName, struct list_node *values)`
Function that deletes a record from the hash index.
- `int AK_create_hash_index (char *tblName, struct list_node *attributes, char *indexName)`
Function that creates a hash index.
- `void AK_delete_hash_index (char *indexName)`
- `TestResult AK_hash_test ()`
Function that tests hash index.

5.34.1 Detailed Description

Provides functions for Hash indices

5.34.2 Function Documentation

5.34.2.1 AK_change_hash_info()

```
void AK_change_hash_info (
    char * indexName,
    int modulo,
    int main_bucket_num,
    int hash_bucket_num )
```

Function that changes a info of hash index.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>modulo</i>	value for modulo hash function
<i>main_bucket_num</i>	number of main buckets
<i>hash_bucket_num</i>	number of hash buckets

Returns

No return value

5.34.2.2 AK_create_hash_index()

```
int AK_create_hash_index (
    char * tblName,
    struct list_node * attributes,
    char * indexName )
```

Function that creates a hash index.

Author

Mislav Čakarić

Parameters

<i>tblName</i>	name of table for which the index is being created
<i>indexName</i>	name of index
<i>attributes</i>	list of attributes over which the index is being created

Returns

success or error

5.34.2.3 AK_delete_in_hash_index()

```
void AK_delete_in_hash_index (
    char * indexName,
    struct list_node * values )
```

Function that deletes a record from the hash index.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>values</i>	list of values (one row) to search in hash index

Returns

No return value

5.34.2.4 AK_elem_hash_value()

```
int AK_elem_hash_value (
    struct list_node * elem )
```

Function that computes a hash value from varchar or integer.

Author

Mislav Čakarić

Parameters

<i>elem</i>	element of row for wich value is to be computed
-------------	-------------------------------------------------

Returns

hash value

5.34.2.5 AK_find_delete_in_hash_index()

```
struct_add* AK_find_delete_in_hash_index (
    char * indexName,
    struct list_node * values,
    int delete )
```

Function that fetches or deletes a record from hash index.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>values</i>	list of values (one row) to search in hash index
<i>delete</i>	if delete is 0 then record is only read otherwise it's deleted from hash index

Returns

address structure with data where the record is in table

5.34.2.6 AK_find_in_hash_index()

```
struct_add* AK_find_in_hash_index (
    char * indexName,
    struct list_node * values )
```

Function that fetches a record from the hash index.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>values</i>	list of values (one row) to search in hash index

Returns

address structure with data where the record is in table

5.34.2.7 AK_get_hash_info()

```
hash_info* AK_get_hash_info (
    char * indexName )
```

Function that fetches the info for hash index.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
------------------	---------------

Returns

info bucket with info data for hash index

5.34.2.8 AK_get_nth_main_bucket_add()

```
struct_add* AK_get_nth_main_bucket_add (
    char * indexName,
    int n )
```

Function that fetches nth main bucket.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>n</i>	number of main bucket

Returns

address structure with data where the bucket is stored

5.34.2.9 AK_hash_test()

```
TestResult AK_hash_test ( )
```

Function that tests hash index.

Author

Mislav Čakarić

Returns

No return value

5.34.2.10 AK_insert_bucket_to_block()

```
struct_add* AK_insert_bucket_to_block (
    char * indexName,
    char * data,
    int type )
```

Function that inserts a bucket to block.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>data</i>	content of bucket stored in char array
<i>type</i>	type of bucket (MAIN_BUCKET or HASH_BUCKET)

Returns

address structure with data where the bucket is stored

5.34.2.11 AK_insert_in_hash_index()

```
void AK_insert_in_hash_index (
    char * indexName,
    int hashValue,
    struct_add * add )
```

Function that inserts a record in hash bucket.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>hashValue</i>	hash value of record that is being inserted
<i>add</i>	address structure with data where the hash bucket is stored

Returns

No return value

5.34.2.12 AK_update_bucket_in_block()

```
void AK_update_bucket_in_block (  
    struct_add * add,  
    char * data )
```

Function that updates a bucket in block.

Author

Mislav Čakarić

Parameters

<i>add</i>	address of where the bucket is stored
<i>data</i>	content of bucket stored in char array

Returns

No return value

5.35 file/idx/hash.h File Reference

```
#include "../auxi/test.h"  
#include "index.h"  
#include "../file/table.h"  
#include "../auxi/constants.h"  
#include "../auxi/configuration.h"  
#include "../files.h"  
#include "../auxi/mempro.h"
```

Include dependency graph for hash.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [hash_info](#)

Structure for defining a hash info element.

- struct [bucket_elem](#)

Structure for defining a single bucket element.

- struct [main_bucket](#)

Structure for defining main bucket for table hashing.

- struct [hash_bucket](#)

Structure for hash bucket for table hashing.

Functions

- int [AK_elem_hash_value](#) (struct [list_node](#) *elem)

Function that computes a hash value from varchar or integer.

- struct [add](#) * [AK_insert_bucket_to_block](#) (char *indexName, char *data, int type)

Function that inserts a bucket to block.

- void [AK_update_bucket_in_block](#) (struct [add](#) *add, char *data)

Function that updates a bucket in block.

- void [AK_change_hash_info](#) (char *indexName, int modulo, int main_bucket_num, int hash_bucket_num)

Function that changes a info of hash index.

- [hash_info](#) * [AK_get_hash_info](#) (char *indexName)

Function that fetches the info for hash index.

- struct [add](#) * [AK_get_nth_main_bucket_add](#) (char *indexName, int n)

Function that fetches nth main bucket.

- void [AK_insert_in_hash_index](#) (char *indexName, int hashValue, struct [add](#) *add)

Function that inserts a record in hash bucket.

- struct [add](#) * [AK_find_delete_in_hash_index](#) (char *indexName, struct [list_node](#) *values, int delete)

Function that fetches or deletes a record from hash index.

- struct [add](#) * [AK_find_in_hash_index](#) (char *indexName, struct [list_node](#) *values)

Function that fetches a record from the hash index.

- void [AK_delete_in_hash_index](#) (char *indexName, struct [list_node](#) *values)

Function that deletes a record from the hash index.

- int [AK_create_hash_index](#) (char *tblName, struct [list_node](#) *attributes, char *indexName)

Function that creates a hash index.

- void [AK_delete_hash_index](#) (char *indexName)

- [TestResult](#) [AK_hash_test](#) ()

Function that tests hash index.

5.35.1 Detailed Description

Header file that provides data structures, functions and defines for Hash indices

5.35.2 Function Documentation

5.35.2.1 AK_change_hash_info()

```
void AK_change_hash_info (
    char * indexName,
    int modulo,
    int main_bucket_num,
    int hash_bucket_num )
```

Function that changes a info of hash index.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>modulo</i>	value for modulo hash function
<i>main_bucket_num</i>	number of main buckets
<i>hash_bucket_num</i>	number of hash buckets

Returns

No return value

5.35.2.2 AK_create_hash_index()

```
int AK_create_hash_index (
    char * tblName,
    struct list_node * attributes,
    char * indexName )
```

Function that creates a hash index.

Author

Mislav Čakarić

Parameters

<i>tblName</i>	name of table for which the index is being created
<i>indexName</i>	name of index
<i>attributes</i>	list of attributes over which the index is being created

Returns

success or error

5.35.2.3 AK_delete_in_hash_index()

```
void AK_delete_in_hash_index (
    char * indexName,
    struct list_node * values )
```

Function that deletes a record from the hash index.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>values</i>	list of values (one row) to search in hash index

Returns

No return value

5.35.2.4 AK_elem_hash_value()

```
int AK_elem_hash_value (
    struct list_node * elem )
```

Function that computes a hash value from varchar or integer.

Author

Mislav Čakarić

Parameters

<i>elem</i>	element of row for wich value is to be computed
-------------	-------------------------------------------------

Returns

hash value

5.35.2.5 AK_find_delete_in_hash_index()

```
struct_add* AK_find_delete_in_hash_index (
    char * indexName,
    struct list_node * values,
    int delete )
```

Function that fetches or deletes a record from hash index.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>values</i>	list of values (one row) to search in hash index
<i>delete</i>	if delete is 0 then record is only read otherwise it's deleted from hash index

Returns

address structure with data where the record is in table

5.35.2.6 AK_find_in_hash_index()

```
struct_add* AK_find_in_hash_index (
    char * indexName,
    struct list_node * values )
```

Function that fetches a record from the hash index.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>values</i>	list of values (one row) to search in hash index

Returns

address structure with data where the record is in table

5.35.2.7 AK_get_hash_info()

```
hash_info* AK_get_hash_info (
    char * indexName )
```

Function that fetches the info for hash index.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
------------------	---------------

Returns

info bucket with info data for hash index

5.35.2.8 AK_get_nth_main_bucket_add()

```
struct_add* AK_get_nth_main_bucket_add (
    char * indexName,
    int n )
```

Function that fetches nth main bucket.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>n</i>	number of main bucket

Returns

address structure with data where the bucket is stored

5.35.2.9 AK_hash_test()

```
TestResult AK_hash_test ( )
```

Function that tests hash index.

Author

Mislav Čakarić

Returns

No return value

5.35.2.10 AK_insert_bucket_to_block()

```
struct_add* AK_insert_bucket_to_block (
    char * indexName,
    char * data,
    int type )
```

Function that inserts a bucket to block.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>data</i>	content of bucket stored in char array
<i>type</i>	type of bucket (MAIN_BUCKET or HASH_BUCKET)

Returns

address structure with data where the bucket is stored

5.35.2.11 AK_insert_in_hash_index()

```
void AK_insert_in_hash_index (
    char * indexName,
    int hashValue,
    struct_add * add )
```

Function that inserts a record in hash bucket.

Author

Mislav Čakarić

Parameters

<i>indexName</i>	name of index
<i>hashValue</i>	hash value of record that is being inserted
<i>add</i>	address structure with data where the hash bucket is stored

Returns

No return value

5.35.2.12 AK_update_bucket_in_block()

```
void AK_update_bucket_in_block (
    struct_add * add,
    char * data )
```

Function that updates a bucket in block.

Author

Mislav Čakarić

Parameters

<i>add</i>	address of where the bucket is stored
<i>data</i>	content of bucket stored in char array

Returns

No return value

5.36 file/idx/index.c File Reference

```
#include "index.h"
#include <stdlib.h>
#include "../auxi/mempro.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../file/files.h"
Include dependency graph for index.c:
```

Functions

- void [AK_InitializelistAd](#) ([list_ad](#) *L)
Function that initialises a linked list.
- [element_ad](#) [AK_Get_First_elementAd](#) ([list_ad](#) *L)
Function that finds the first node of linked list.
- [element_ad](#) [AK_Get_Last_elementAd](#) ([list_ad](#) *L)
Function that finds the last node of linked list.
- [element_ad](#) [AK_Get_Next_elementAd](#) ([element_ad](#) Currentelement_op)
Function that finds the next node of a node in linked list.
- [element_ad](#) [AK_Get_Previous_elementAd](#) ([element_ad](#) Currentelement_op, [element_ad](#) L)
Function that finds the previous node of a node in linked list.
- int [AK_Get_Position_Of_elementAd](#) ([element_ad](#) Searchedelement_op, [list_ad](#) *L)
Function that finds the position of a node in linked list.
- void [AK_Delete_elementAd](#) ([element_ad](#) Deletedelement_op, [list_ad](#) *L)
Function that deletes a node from a linked list.
- void [AK_Delete_All_elementsAd](#) ([list_ad](#) *L)
Function that deletes all nodes in a linked list.

- void [AK_Insert_NewelementAd](#) (int addBlock, int indexTd, char *attName, [element_ad](#) elementBefore)
Function that inserts a new element into a linked list.
- int [AK_num_index_attr](#) (char *indexTblName)
Function that fetches the number of elements in a index table.
- int [AK_get_index_num_records](#) (char *indexTblName)
Determine number of rows in the table.
- struct [list_node](#) * [AK_get_index_tuple](#) (int row, int column, char *indexTblName)
Function that gets value in some row and column.
- int [AK_index_table_exist](#) (char *indexTblName)
Function that examines whether there is a table with the name "tblName" in the system catalog (AK_relation)
- [AK_header](#) * [AK_get_index_header](#) (char *indexTblName)
Function that gets index table header.
- void [AK_print_index_table](#) (char *indexTblName)
Function that prints out the index table.
- void [AK_index_test](#) ()
Test funtion for index structures(list) and printing table.

5.36.1 Detailed Description

Provides functions for indexes

5.36.2 Function Documentation

5.36.2.1 AK_Delete_All_elementsAd()

```
void AK_Delete_All_elementsAd (
    list\_ad * L )
```

Function that deletes all nodes in a linked list.

Author

Unknown

Parameters

L	list head
-------------------	-----------

Returns

No return value

5.36.2.2 AK_Delete_elementAd()

```
void AK_Delete_elementAd (
    element_ad Deletedelement_op,
    list_ad * L )
```

Function that deletes a node from a linked list.

Author

Unknown

Parameters

<i>Deletedelement_op</i>	- address of node to delete
<i>list_ad</i>	*L - list head

Returns

No return value

5.36.2.3 AK_Get_First_elementAd()

```
element_ad AK_Get_First_elementAd (
    list_ad * L )
```

Function that finds the first node of linked list.

Author

Unknown

Parameters

<i>list_ad</i>	*L linked list head
----------------	---------------------

Returns

Address of first node

5.36.2.4 AK_get_index_header()

```
AK_header* AK_get_index_header (
    char * indexTblName )
```

Function that gets index table header.

Author

Matija Šestak, modified for indexes by Lovro Predovan

1. Read addresses of extents
2. If there is no extents in the table, return -1
3. else read the first block
4. allocate array
5. copy table header to the array

Parameters

<i>*tblName</i>	table name
-----------------	------------

Returns

array of table header

5.36.2.5 AK_get_index_num_records()

```
int AK_get_index_num_records (  
    char * indexTblName )
```

Determine number of rows in the table.

Author

Matija Šestak, modified for indexes by Lovro Predovan

1. Read addresses of extents
2. If there is no extents in the table, return -1
3. For each extent from table
4. For each block in the extent
5. Get a block
6. Exit if there is no records in block
7. Count tuples in block
8. Return the number of tuples divided by number of attributes

Parameters

<i>*tableName</i>	table name
-------------------	------------

Returns

number of rows in the table

5.36.2.6 AK_get_index_tuple()

```
struct list_node * AK_get_index_tuple (
    int row,
    int column,
    char * indexTblName )
```

Function that gets value in some row and column.

Author

Matija Šestak, modified for indexes by Lovro Predovan

Parameters

<i>row</i>	zero-based row index
<i>column</i>	zero-based column index
<i>*tblName</i>	table name

Returns

value in the list

5.36.2.7 AK_Get_Last_elementAd()

```
element_ad AK_Get_Last_elementAd (
    list_ad * L )
```

Function that finds the last node of linked list.

Author

Unknown

Parameters

<i>list_ad</i>	*L linked list head
----------------	---------------------

Returns

Address of last node or 0 if list is empty

5.36.2.8 AK_Get_Next_elementAd()

```
element_ad AK_Get_Next_elementAd (
    element_ad Currentelement_op )
```

Function that finds the next node of a node in linked list.

Author

Unknown

Parameters

<i>Currentelement_op</i>	address of current node
--------------------------	-------------------------

Returns

Address of next node or 0 if current node is last in list

5.36.2.9 AK_Get_Position_Of_elementAd()

```
int AK_Get_Position_Of_elementAd (  
    element_ad Searchedelement_op,  
    list_ad * L )
```

Function that finds the position of a node in linked list.

Author

Unknown

Parameters

<i>Searchedelement_op</i>	address of current note
<i>*L</i>	linked list head

Returns

Integer value of current node's order in the list

5.36.2.10 AK_Get_Previous_elementAd()

```
element_ad AK_Get_Previous_elementAd (  
    element_ad Currentelement_op,  
    element_ad L )
```

Function that finds the previous node of a node in linked list.

Author

Unknown

Parameters

<i>Currentelement_op</i>	Address of current node
<i>L</i>	previous element

Returns

Address of previous node or 0 if the current node is the head or the list is empty

5.36.2.11 AK_index_table_exist()

```
int AK_index_table_exist (
    char * indexTblName )
```

Function that examines whether there is a table with the name "tblName" in the system catalog (AK_relation)

Author

Matija Šestak, modified for indexes by Lovro Predovan

Parameters

<i>tblName</i>	table name
----------------	------------

Returns

returns 1 if table exist or returns 0 if table does not exist

5.36.2.12 AK_index_test()

```
void AK_index_test ( )
```

Test funtion for index structures(list) and printing table.

Author

Lovro Predovan

Returns

No return value

5.36.2.13 AK_InitializelistAd()

```
void AK_InitializelistAd (
    list_ad * L )
```

Function that initialises a linked list.

Author

Unknown

Parameters

<i>list_ad</i>	*L linked list head
----------------	---------------------

Returns

No return value

5.36.2.14 AK_Insert_NewelementAd()

```
void AK_Insert_NewelementAd (
    int addBlock,
    int indexTd,
    char * attName,
    element_ad elementBefore )
```

Function that inserts a new element into a linked list.

Author

Unknown

Parameters

<i>addBlock</i>	address block
<i>indexTd</i>	index table destination
<i>*attname</i>	attribute name
<i>elementBefore</i>	address of the node after which the new node will be inserted

Returns

No return value

5.36.2.15 AK_num_index_attr()

```
int AK_num_index_attr (
    char * indexTblName )
```

Function that fetches the number of elements in a index table.

Author

Lovro Predovan

Parameters

<i>index</i>	table name
--------------	------------

Returns

No return value

5.36.2.16 AK_print_index_table()

```
void AK_print_index_table (
    char * indexTblName )
```

Function that prints out the index table.

Author

Matija Šestak, modified for indexes by Lovro Predovan

Parameters

<i>*tblName</i>	table name
-----------------	------------

Returns

No return value

5.37 file/idx/index.h File Reference

```
#include "../auxi/mempro.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../file/files.h"
```

Include dependency graph for index.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [struct_add](#)
Structure defining node address.
- struct [list_structure_ad](#)

Typedefs

- typedef struct [list_structure_ad](#) [list_structure_ad](#)
- typedef [list_structure_ad](#) * [element_ad](#)
- typedef [list_structure_ad](#) [list_ad](#)

Functions

- int [AK_index_table_exist](#) (char *indexTblName)
Function that examines whether there is a table with the name "tblName" in the system catalog (AK_relation)
- void [AK_print_index_table](#) (char *indexTblName)
Function that prints out the index table.
- struct [list_node](#) * [AK_get_index_tuple](#) (int row, int column, char *indexTblName)
Function that gets value in some row and column.
- int [AK_get_index_num_records](#) (char *indexTblName)
Determine number of rows in the table.
- int [AK_num_index_attr](#) (char *indexTblName)
Function that fetches the number of elements in a index table.
- void [AK_InitializelistAd](#) ([list_ad](#) *L)
Function that initialises a linked list.
- [element_ad](#) [AK_Get_First_elementAd](#) ([list_ad](#) *L)
Function that finds the first node of linked list.
- [element_ad](#) [AK_Get_Last_elementAd](#) ([list_ad](#) *L)
Function that finds the last node of linked list.
- [element_ad](#) [AK_Get_Next_elementAd](#) ([element_ad](#) Currentelement_op)
Function that finds the next node of a node in linked list.
- [element_ad](#) [AK_Get_Previous_elementAd](#) ([element_ad](#) Currentelement_op, [element_ad](#) L)
Function that finds the previous node of a node in linked list.
- int [AK_Get_Position_Of_elementAd](#) ([element_ad](#) Searchedelement_op, [list_ad](#) *L)
Function that finds the position of a node in linked list.
- void [AK_Delete_elementAd](#) ([element_ad](#) Deletedelement_op, [list_ad](#) *L)
Function that deletes a node from a linked list.
- void [AK_Delete_All_elementsAd](#) ([list_ad](#) *L)
Function that deletes all nodes in a linked list.
- void [AK_Insert_NewelementAd](#) (int addBlock, int indexTd, char *attName, [element_ad](#) elementBefore)
Function that inserts a new element into a linked list.
- void [AK_index_test](#) ()
Test funtion for index structures(list) and printing table.

5.37.1 Detailed Description

Header file that provides data structures, functions and defines for bitmap index

5.37.2 Function Documentation

5.37.2.1 AK_Delete_All_elementsAd()

```
void AK_Delete_All_elementsAd (
    list_ad * L )
```

Function that deletes all nodes in a linked list.

Author

Unknown

Parameters

<i>L</i>	list head
----------	-----------

Returns

No return value

5.37.2.2 AK_Delete_elementAd()

```
void AK_Delete_elementAd (
    element_ad Deletedelement_op,
    list_ad * L )
```

Function that deletes a node from a linked list.

Author

Unknown

Parameters

<i>Deletedelement_op</i>	- address of node to delete
<i>list_ad</i>	*L - list head

Returns

No return value

5.37.2.3 AK_Get_First_elementAd()

```
element_ad AK_Get_First_elementAd (
    list_ad * L )
```

Function that finds the first node of linked list.

Author

Unknown

Parameters

<i>list_ad</i>	*L linked list head
----------------	---------------------

Returns

Address of first node

5.37.2.4 AK_get_index_num_records()

```
int AK_get_index_num_records (
    char * indexTblName )
```

Determine number of rows in the table.

Author

Matija Šestak, modified for indexes by Lovro Predovan

1. Read addresses of extents
2. If there is no extents in the table, return -1
3. For each extent from table
4. For each block in the extent
5. Get a block
6. Exit if there is no records in block
7. Count tuples in block
8. Return the number of tuples divided by number of attributes

Parameters

* <i>tableName</i>	table name
--------------------	------------

Returns

number of rows in the table

5.37.2.5 AK_get_index_tuple()

```
struct list_node* AK_get_index_tuple (
    int row,
    int column,
    char * indexTblName )
```

Function that gets value in some row and column.

Author

Matija Šestak, modified for indexes by Lovro Predovan

Parameters

<i>row</i>	zero-based row index
<i>column</i>	zero-based column index
<i>*tblName</i>	table name

Returns

value in the list

5.37.2.6 AK_Get_Last_elementAd()

```
element_ad AK_Get_Last_elementAd (
    list_ad * L )
```

Function that finds the last node of linked list.

Author

Unknown

Parameters

<i>list_ad</i>	*L linked list head
----------------	---------------------

Returns

Address of last node or 0 if list is empty

5.37.2.7 AK_Get_Next_elementAd()

```
element_ad AK_Get_Next_elementAd (
    element_ad Currentelement_op )
```

Function that finds the next node of a node in linked list.

Author

Unknown

Parameters

<i>Currentelement_op</i>	address of current node
--------------------------	-------------------------

Returns

Address of next node or 0 if current node is last in list

5.37.2.8 AK_Get_Position_Of_elementAd()

```
int AK_Get_Position_Of_elementAd (  
    element_ad Searchedelement_op,  
    list_ad * L )
```

Function that finds the position of a node in linked list.

Author

Unknown

Parameters

<i>Searchedelement_op</i>	address of current note
<i>*L</i>	linked list head

Returns

Integer value of current node's order in the list

5.37.2.9 AK_Get_Previous_elementAd()

```
element_ad AK_Get_Previous_elementAd (  
    element_ad Currentelement_op,  
    element_ad L )
```

Function that finds the previous node of a node in linked list.

Author

Unknown

Parameters

<i>Currentelement_op</i>	Address of current node
<i>L</i>	previous element

Returns

Address of previous node or 0 if the current node is the head or the list is empty

5.37.2.10 AK_index_table_exist()

```
int AK_index_table_exist (
    char * indexTblName )
```

Function that examines whether there is a table with the name "tblName" in the system catalog (AK_relation)

Author

Matija Šestak, modified for indexes by Lovro Predovan

Parameters

<i>tblName</i>	table name
----------------	------------

Returns

returns 1 if table exist or returns 0 if table does not exist

5.37.2.11 AK_index_test()

```
void AK_index_test ( )
```

Test funtion for index structures(list) and printing table.

Author

Lovro Predovan

Returns

No return value

5.37.2.12 AK_InitializelistAd()

```
void AK_InitializelistAd (
    list_ad * L )
```

Function that initialises a linked list.

Author

Unknown

Parameters

<i>list_ad</i>	*L linked list head
----------------	---------------------

Returns

No return value

5.37.2.13 AK_Insert_NewelementAd()

```
void AK_Insert_NewelementAd (
    int addBlock,
    int indexTd,
    char * attName,
    element_ad elementBefore )
```

Function that inserts a new element into a linked list.

Author

Unknown

Parameters

<i>addBlock</i>	address block
<i>indexTd</i>	index table destination
<i>*attname</i>	attribute name
<i>elementBefore</i>	address of the node after which the new node will be inserted

Returns

No return value

5.37.2.14 AK_num_index_attr()

```
int AK_num_index_attr (
    char * indexTblName )
```

Function that fetches the number of elements in a index table.

Author

Lovro Predovan

Parameters

<i>index</i>	table name
--------------	------------

Returns

No return value

5.37.2.15 AK_print_index_table()

```
void AK_print_index_table (
    char * indexTblName )
```

Function that prints out the index table.

Author

Matija Šestak, modified for indexes by Lovro Predovan

Parameters

<i>*tblName</i>	table name
-----------------	------------

Returns

No return value

5.38 file/sequence.c File Reference

```
#include "sequence.h"
```

Include dependency graph for sequence.c:

Functions

- int [AK_sequence_add](#) (char *name, int start_value, int increment, int max_value, int min_value, int cycle)
Function for adding sequence.
- int [AK_sequence_remove](#) (char *name)
Function for removing sequence.
- int [AK_sequence_current_value](#) (char *name)
Function that returns the current value of the sequence.
- int [AK_sequence_next_value](#) (char *name)
Function that returns the next value of the sequence and writes it in a system table as current value.
- int [AK_sequence_get_id](#) (char *name)
Function that fetches sequence id.
- int [AK_sequence_rename](#) (char *old_name, char *new_name)
Function that renames the sequence.
- int [AK_sequence_modify](#) (char *name, int start_value, int increment, int max_value, int min_value, int cycle)
Function for modifying a sequence.
- [TestResult AK_sequence_test](#) ()
Function used for sequences testing.

5.38.1 Detailed Description

Provides functions for sequences

5.38.2 Function Documentation

5.38.2.1 AK_sequence_add()

```
int AK_sequence_add (
    char * name,
    int start_value,
    int increment,
    int max_value,
    int min_value,
    int cycle )
```

Function for adding sequence.

Author

Boris Kišić

Parameters

<i>name</i>	name of the sequence
<i>start_value</i>	start value of the sequence
<i>increment</i>	increment of the sequence
<i>max_value</i>	maximum value of the sequence
<i>min_value</i>	minimum value of the sequence
<i>cycle</i>	0:non-cyclic sequence, 1:cyclic sequence

Returns

sequence_id or EXIT_ERROR

5.38.2.2 AK_sequence_current_value()

```
int AK_sequence_current_value (
    char * name )
```

Function that returns the current value of the sequence.

Author

Boris Kišić

Parameters

<i>name</i>	name of the sequence
-------------	----------------------

Returns

current_value or EXIT_ERROR

5.38.2.3 AK_sequence_get_id()

```
int AK_sequence_get_id (
    char * name )
```

Function that fetches sequence id.

Author

Ljubo Barać

Parameters

<i>name</i>	Name of the sequence
-------------	----------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.38.2.4 AK_sequence_modify()

```
int AK_sequence_modify (
    char * name,
    int start_value,
    int increment,
    int max_value,
    int min_value,
    int cycle )
```

Function for modifying a sequence.

Author

Boris Kišić fixed by Ljubo Barać

Parameters

<i>name</i>	Name of the sequence
<i>start_value</i>	start value of the sequence
<i>increment</i>	increment of the sequence
<i>max_value</i>	maximum value of the sequence
<i>min_value</i>	minimum value of the sequence
<i>cycle</i>	0:non-cyclic sequence, 1:cyclic sequence

Returns

EXIT_SUCCESS or EXIT_ERROR

5.38.2.5 AK_sequence_next_value()

```
int AK_sequence_next_value (
    char * name )
```

Function that returns the next value of the sequence and writes it in a system table as current value.

Author

Boris Kišić

Parameters

<i>name</i>	name of the sequence
-------------	----------------------

Returns

next_value or EXIT_ERROR

5.38.2.6 AK_sequence_remove()

```
int AK_sequence_remove (
    char * name )
```

Function for removing sequence.

Author

Boris Kišić

Parameters

<i>name</i>	name of the sequence
-------------	----------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.38.2.7 AK_sequence_rename()

```
int AK_sequence_rename (
    char * old_name,
    char * new_name )
```

Function that renames the sequence.

Author

Boris Kišić

Parameters

<i>old_name</i>	Name of the sequence to be renamed
<i>new_name</i>	New name of the sequence

Returns

EXIT_SUCCESS or EXIT_ERROR

5.38.2.8 AK_sequence_test()

```
TestResult AK_sequence_test ( )
```

Function used for sequences testing.

Author

Boris Kišić fixed by Ljubo Barać

Returns

No return value

5.39 file/sequence.h File Reference

```
#include "../auxi/test.h"
#include "table.h"
#include "id.h"
#include "fileio.h"
#include "../auxi/mempro.h"
```

Include dependency graph for sequence.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_sequence_add](#) (char *name, int start_value, int increment, int max_value, int min_value, int cycle)
Function for adding sequence.
- int [AK_sequence_remove](#) (char *name)
Function for removing sequence.
- int [AK_sequence_current_value](#) (char *name)
Function that returns the current value of the sequence.
- int [AK_sequence_next_value](#) (char *name)
Function that returns the next value of the sequence and writes it in a system table as current value.
- int [AK_sequence_rename](#) (char *old_name, char *new_name)
Function that renames the sequence.
- int [AK_sequence_modify](#) (char *name, int start_value, int increment, int max_value, int min_value, int cycle)
Function for modifying a sequence.
- int [AK_sequence_get_id](#) (char *name)
Function that fetches sequence id.
- [TestResult AK_sequence_test](#) ()
Function used for sequences testing.

5.39.1 Detailed Description

Header file that provides functions and defines for sequences

5.39.2 Function Documentation

5.39.2.1 AK_sequence_add()

```
int AK_sequence_add (
    char * name,
    int start_value,
    int increment,
    int max_value,
    int min_value,
    int cycle )
```

Function for adding sequence.

Author

Boris Kišić

Parameters

<i>name</i>	name of the sequence
<i>start_value</i>	start value of the sequence
<i>increment</i>	increment of the sequence
<i>max_value</i>	maximum value of the sequence
<i>min_value</i>	minimum value of the sequence
<i>cycle</i>	0:non-cyclic sequence, 1:cyclic sequence

Returns

sequence_id or EXIT_ERROR

5.39.2.2 AK_sequence_current_value()

```
int AK_sequence_current_value (
    char * name )
```

Function that returns the current value of the sequence.

Author

Boris Kišić

Parameters

<i>name</i>	name of the sequence
-------------	----------------------

Returns

current_value or EXIT_ERROR

5.39.2.3 AK_sequence_get_id()

```
int AK_sequence_get_id (
    char * name )
```

Function that fetches sequence id.

Author

Ljubo Barać

Parameters

<i>name</i>	Name of the sequence
-------------	----------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.39.2.4 AK_sequence_modify()

```
int AK_sequence_modify (
    char * name,
    int start_value,
    int increment,
    int max_value,
    int min_value,
    int cycle )
```

Function for modifying a sequence.

Author

Boris Kišić fixed by Ljubo Barać

Parameters

<i>name</i>	Name of the sequence
<i>start_value</i>	start value of the sequence
<i>increment</i>	increment of the sequence
<i>max_value</i>	maximum value of the sequence
<i>min_value</i>	minimum value of the sequence
<i>cycle</i>	0:non-cyclic sequence, 1:cyclic sequence

Returns

EXIT_SUCCESS or EXIT_ERROR

5.39.2.5 AK_sequence_next_value()

```
int AK_sequence_next_value (
    char * name )
```

Function that returns the next value of the sequence and writes it in a system table as current value.

Author

Boris Kišić

Parameters

<i>name</i>	name of the sequence
-------------	----------------------

Returns

next_value or EXIT_ERROR

5.39.2.6 AK_sequence_remove()

```
int AK_sequence_remove (
    char * name )
```

Function for removing sequence.

Author

Boris Kišić

Parameters

<i>name</i>	name of the sequence
-------------	----------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.39.2.7 AK_sequence_rename()

```
int AK_sequence_rename (
    char * old_name,
    char * new_name )
```

Function that renames the sequence.

/**

Author

Boris Kišić

Parameters

<i>old_name</i>	Name of the sequence to be renamed
<i>new_name</i>	New name of the sequence

Returns

EXIT_SUCCESS or EXIT_ERROR

Author

Boris Kišić

Parameters

<i>old_name</i>	Name of the sequence to be renamed
<i>new_name</i>	New name of the sequence

Returns

EXIT_SUCCESS or EXIT_ERROR

5.39.2.8 AK_sequence_test()

```
TestResult AK_sequence_test ( )
```

Function used for sequences testing.

Author

Boris Kišić fixed by Ljubo Barać

Returns

No return value

5.40 file/table.c File Reference

```
#include "../file/table.h"
Include dependency graph for table.c:
```

Functions

- [AK_create_table_parameter](#) * [AK_create_create_table_parameter](#) (int type, char *name)
- void [AK_create_table](#) (char *tblName, [AK_create_table_parameter](#) *parameters, int attribute_count)

Temporary function that creates table, and inserts an entry to the system_relation catalog.
- void [AK_temp_create_table](#) (char *table, [AK_header](#) *header, int type_segment)

Temporary function that creates table, and inserts an entry to the system_relation catalog.
- int [AK_num_attr](#) (char *tblName)

Functions that determines the number of attributes in the table.
- int [AK_get_num_records](#) (char *tblName)

Function that determines the number of rows in the table.
- [AK_header](#) * [AK_get_header](#) (char *tblName)

Function that fetches the table header.
- char * [AK_get_attr_name](#) (char *tblName, int index)

Function that fetches attribute name for some zero-based index.
- int [AK_get_attr_index](#) (char *tblName, char *attrName)

Function that fetches zero-based index for attribute.
- struct [list_node](#) * [AK_get_column](#) (int num, char *tblName)

Function that fetches all values in some column and put on the list.
- struct [list_node](#) * [AK_get_row](#) (int num, char *tblName)

Function that fetches all values in some row and put on the list.
- struct [list_node](#) * [AK_get_tuple](#) (int row, int column, char *tblName)

Function that fetches a value in some row and column.
- char * [AK_tuple_to_string](#) (struct [list_node](#) *tuple)

Function that converts tuple value to string.
- void [AK_print_row_spacer](#) (int col_len[], int length)

Function that prints row spacer.
- void [AK_print_row](#) (int col_len[], struct [list_node](#) *row)

Function that prints table row.
- int [AK_table_exist](#) (char *tblName)

Function that examines whether there is a table with the name "tblName" in the system catalog (AK_relation)
- void [AK_print_table](#) (char *tblName)

Function for printing table.
- void [AK_print_row_spacer_to_file](#) (int col_len[], int length)

Function that prints row spacer update by Luka Rajcevic.
- char * [get_row_attr_data](#) (int column, struct [list_node](#) *node)

Function that returns the value of an attribute from the row.
- void [AK_print_row_to_file](#) (int col_len[], struct [list_node](#) *row)

Function that prints the table row update by Luka Rajcevic.
- void [AK_print_table_to_file](#) (char *tblName)

Function that prints a table.
- int [AK_table_empty](#) (char *tblName)

Function that checks whether the table is empty.
- int [AK_get_table_obj_id](#) (char *table)

Function that fetches an obj_id of named table from AK_relation system table.

- int [AK_check_tables_scheme](#) ([AK_mem_block](#) *tbl1_temp_block, [AK_mem_block](#) *tbl2_temp_block, char *operator_name)
Function that checks if tables have the same relation schema.
- int [AK_rename](#) (char *old_table_name, char *old_attr, char *new_table_name, char *new_attr)
Function for renaming table and/or attribute in table (moved from rename.c)
- [TestResult AK_table_test](#) ()
Function for testing table abstraction.
- [TestResult AK_op_rename_test](#) ()
Function for renaming operator testing (moved from rename.c)

5.40.1 Detailed Description

Provides functions for table abstraction

5.40.2 Function Documentation

5.40.2.1 AK_check_tables_scheme()

```
int AK_check_tables_scheme (
    AK\_mem\_block * tbl1_temp_block,
    AK\_mem\_block * tbl2_temp_block,
    char * operator_name )
```

Function that checks if tables have the same relation schema.

Author

Dino Laktašić, abstracted from [difference.c](#) for use in [difference.c](#), [intersect.c](#) and [union.c](#) by Tomislav Mikulček

Parameters

<i>tbl1_temp_block</i>	first cache block of the first table
<i>tbl2_temp_block</i>	first cache block of the second table
<i>operator_name</i>	the name of operator, used for displaying error message

Returns

if success returns num of attributes in schema, else returns EXIT_ERROR

5.40.2.2 AK_create_table()

```
void AK_create_table (
    char * tblName,
```

```
AK_create_table_parameter * parameters,
int attribute_count )
```

Temporary function that creates table, and inserts an entry to the system_relation catalog.

Author

Matija Novak, updated by Dino Laktašić

Parameters

<i>table</i>	table name
<i>header</i>	AK_header of the new table
<i>type_segment</i>	type of the new segment

Returns

No return value

5.40.2.3 AK_get_attr_index()

```
int AK_get_attr_index (
    char * tblName,
    char * attrName )
```

Function that fetches zero-based index for attribute.

Author

Matija Šestak.

Parameters

<i>*tblName</i>	table name
<i>*attrName</i>	attribute name

Returns

zero-based index

5.40.2.4 AK_get_attr_name()

```
char* AK_get_attr_name (
    char * tblName,
    int index )
```

Function that fetches attribute name for some zero-based index.

Author

Matija Šestak.

Parameters

<i>*tblName</i>	table name
<i>index</i>	zero-based index

Returns

attribute name

5.40.2.5 AK_get_column()

```
struct list_node* AK_get_column (
    int num,
    char * tblName )
```

Function that fetches all values in some column and put on the list.

Author

Matija Šestak.

Parameters

<i>num</i>	zero-based column index
<i>*tblName</i>	table name

Returns

column values list

5.40.2.6 AK_get_header()

```
AK_header* AK_get_header (
    char * tblName )
```

Function that fetches the table header.

Author

Matija Šestak.

1. Read addresses of extents
2. If there is no extents in the table, return 0
3. else read the first block
4. allocate array
5. copy table header to the array

Parameters

<i>*tblName</i>	table name
-----------------	------------

Returns

array of table header

5.40.2.7 AK_get_num_records()

```
int AK_get_num_records (
    char * tblName )
```

Function that determines the number of rows in the table.

Author

Matija Šestak.

1. Read addresses of extents
2. If there is no extents in the table, return EXIT_WARNING
3. For each extent from table
4. For each block in the extent
5. Get a block
6. Exit if there is no records in block
7. Count tuples in block
8. Return the number of tuples divided by number of attributes

Parameters

<i>*tableName</i>	table name
-------------------	------------

Returns

number of rows in the table

5.40.2.8 AK_get_row()

```
struct list_node* AK_get_row (
    int num,
    char * tblName )
```

Function that fetches all values in some row and put on the list.

Author

Markus Schatten, Matija Šestak.

Parameters

<i>num</i>	zero-based row index
*	tblName table name

Returns

row values list

5.40.2.9 AK_get_table_obj_id()

```
int AK_get_table_obj_id (  
    char * table )
```

Function that fetches an *obj_id* of named table from AK_relation system table.

Author

Dejan Frankovic

Parameters

<i>*table</i>	table name
---------------	------------

Returns

obj_id of the table or EXIT_ERROR if there is no table with that name

5.40.2.10 AK_get_tuple()

```
struct list_node* AK_get_tuple (  
    int row,  
    int column,  
    char * tblName )
```

Function that fetches a value in some row and column.

Author

Matija Šestak.

Parameters

<i>row</i>	zero-based row index
<i>column</i>	zero-based column index
<i>*tblName</i>	table name

Returns

value in the list

5.40.2.11 AK_num_attr()

```
int AK_num_attr (
    char * tblName )
```

Functions that determines the number of attributes in the table.

Author

Matija Šestak.

1. Read addresses of extents
2. If there is no extents in the table, return EXIT_WARNING
3. else read the first block
4. while header tuple exists in the block, increment num_attr

Parameters

*	tblName table name
---	--------------------

Returns

number of attributes in the table

5.40.2.12 AK_op_rename_test()

```
TestResult AK_op_rename_test ( )
```

Function for renaming operator testing (moved from rename.c)

Author

Mislav Čakarić, edited by Ljubo Barać

Returns

No return value

5.40.2.13 AK_print_row()

```
void AK_print_row (
    int col_len[],
    struct list_node * row )
```

Function that prints table row.

Author

Dino Laktašić

Parameters

<i>col_len[]</i>	array of max lengths for each attribute
<i>*row</i>	list with row elements

Returns

No return value

5.40.2.14 AK_print_row_spacer()

```
void AK_print_row_spacer (
    int col_len[],
    int length )
```

Function that prints row spacer.

Author

Dino Laktašić.

Parameters

<i>col_len[]</i>	max lengths for each attribute cell
<i>length</i>	total table width

Returns

printed row spacer

5.40.2.15 AK_print_row_spacer_to_file()

```
void AK_print_row_spacer_to_file (
    int col_len[],
    int length )
```

Function that prints row spacer update by Luka Rajcevic.

Author

Dino Laktašić.

Parameters

<i>col_len[]</i>	max lengths for each attribute cell
<i>length</i>	total table width

Returns

printed row spacer

5.40.2.16 AK_print_row_to_file()

```
void AK_print_row_to_file (
    int col_len[],
    struct list_node * row )
```

Function that prints the table row update by Luka Rajcevic.

Author

Dino Laktašić

Parameters

<i>col_len[]</i>	array of max lengths for each attribute
<i>*row</i>	list with row elements

Returns

No return value

5.40.2.17 AK_print_table()

```
void AK_print_table (
    char * tblName )
```

Function for printing table.

Author

Dino Laktašić and Mislav Čakarić (replaced old print table function by new one)

Parameters

<i>*tblName</i>	table name
-----------------	------------

Returns

No return value

5.40.2.18 AK_print_table_to_file()

```
void AK_print_table_to_file (
    char * tblName )
```

Function that prints a table.

Author

Dino Laktašić and Mislav Čakarić (replaced old print table function by new one) update by Luka Rajcevic

Parameters

<i>*tblName</i>	table name
-----------------	------------

Returns

No return value update by Anto Tomaš (corrected the AK_DeleteAll_L3 function)

5.40.2.19 AK_rename()

```
int AK_rename (
    char * old_table_name,
    char * old_attr,
    char * new_table_name,
    char * new_attr )
```

Function for renaming table and/or attribute in table (moved from rename.c)

Author

Mislav Čakarić edited by Ljubo Barać

Parameters

<i>old_table_name</i>	old name of the table
<i>new_table_name</i>	new name of the table
<i>old_attr</i>	name of the attribute to rename
<i>new_attr</i>	new name for the attribute to rename

Returns

EXIT_ERROR or EXIT_SUCCESS

5.40.2.20 AK_table_empty()

```
int AK_table_empty (
    char * tblName )
```

Function that checks whether the table is empty.

Author

Matija Šestak.

Parameters

<i>*tblName</i>	table name
-----------------	------------

Returns

true/false

5.40.2.21 AK_table_exist()

```
int AK_table_exist (
    char * tblName )
```

Function that examines whether there is a table with the name "tblName" in the system catalog (AK_relation)

Author

Jurica Hlevnjak

Parameters

<i>tblName</i>	table name
----------------	------------

Returns

returns 1 if table exist or returns 0 if table does not exist

5.40.2.22 AK_table_test()

```
TestResult AK_table_test ( )
```

Function for testing table abstraction.

Author

Unknown

Returns

No return value

@update by Ana-Marija Balen - added getRow function to the test

5.40.2.23 AK_temp_create_table()

```
void AK_temp_create_table (
    char * table,
    AK_header * header,
    int type_segment )
```

Temporary function that creates table, and inserts an entry to the system_relation catalog.

Author

Matija Novak, updated by Dino Laktašić

Parameters

<i>table</i>	table name
<i>header</i>	AK_header of the new table
<i>type_segment</i>	type of the new segment

Returns

No return value

5.40.2.24 AK_tuple_to_string()

```
char* AK_tuple_to_string (
    struct list_node * tuple )
```

Function that converts tuple value to string.

Author

Matija Šestak.

Parameters

<i>*tuple</i>	tuple in the list
---------------	-------------------

Returns

tuple value as a string

5.40.2.25 get_row_attr_data()

```
char* get_row_attr_data (
    int column,
    struct list_node * node )
```

Function that returns the value of an attribute from the row.

Author

Leon Palać

Parameters

<i>column</i>	index of column attribute
<i>*row</i>	list with row elements

Returns

atribute data

5.41 file/table.h File Reference

```
#include "../auxi/test.h"
#include "../mm/memoman.h"
#include "../auxi/mempro.h"
#include <time.h>
#include "../sql/drop.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../file/sequence.h"
#include "../auxi/constants.h"
#include "test.h"
#include "../dm/dbman.h"
```

Include dependency graph for table.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [AK_create_table_struct](#)

Typedefs

- typedef struct [AK_create_table_struct](#) **AK_create_table_parameter**

Functions

- [AK_create_table_parameter](#) * **AK_create_create_table_parameter** (int type, char *name)
- void [AK_create_table](#) (char *tblName, [AK_create_table_parameter](#) *parameters, int attribute_count)

Temporary function that creates table, and inserts an entry to the system_relation catalog.
- void [AK_temp_create_table](#) (char *table, [AK_header](#) *header, int type_segment)

Temporary function that creates table, and inserts an entry to the system_relation catalog.
- int [AK_num_attr](#) (char *tblName)

Functions that determines the number of attributes in the table.
- int [AK_get_num_records](#) (char *tblName)

Function that determines the number of rows in the table.
- [AK_header](#) * [AK_get_header](#) (char *tblName)

Function that fetches the table header.
- char * [AK_get_attr_name](#) (char *tblName, int index)

Function that fetches attribute name for some zero-based index.
- int [AK_get_attr_index](#) (char *tblName, char *attrName)

Function that fetches zero-based index for attribute.
- struct [list_node](#) * [AK_get_column](#) (int num, char *tblName)

Function that fetches all values in some column and put on the list.
- struct [list_node](#) * [AK_get_row](#) (int num, char *tblName)

Function that fetches all values in some row and put on the list.
- struct [list_node](#) * [AK_get_tuple](#) (int row, int column, char *tblName)

Function that fetches a value in some row and column.
- char * [AK_tuple_to_string](#) (struct [list_node](#) *tuple)

Function that converts tuple value to string.
- void [AK_print_row_spacer](#) (int col_len[], int length)

Function that prints row spacer.
- void [AK_print_row](#) (int col_len[], struct [list_node](#) *row)

Function that prints table row.
- void [AK_print_table](#) (char *tblName)

Function for printing table.
- void [AK_print_row_spacer_to_file](#) (int col_len[], int length)

Function that prints row spacer update by Luka Rajcevic.
- void [AK_print_row_to_file](#) (int col_len[], struct [list_node](#) *row)

Function that prints the table row update by Luka Rajcevic.
- void [AK_print_table_to_file](#) (char *tblName)

Function that prints a table.
- int [AK_table_empty](#) (char *tblName)

Function that checks whether the table is empty.
- int [AK_get_table_obj_id](#) (char *table)

Function that fetches an obj_id of named table from AK_relation system table.
- int [AK_check_tables_scheme](#) ([AK_mem_block](#) *tbl1_temp_block, [AK_mem_block](#) *tbl2_temp_block, char *operator_name)

Function that checks if tables have the same relation schema.
- char * [get_row_attr_data](#) (int column, struct [list_node](#) *node)

Function that returns the value of an attribute from the row.

- [TestResult AK_table_test \(\)](#)
Function for testing table abstraction.
- `int AK_rename (char *old_table_name, char *old_attr, char *new_table_name, char *new_attr)`
Function for renaming table and/or attribute in table (moved from rename.c)
- [TestResult AK_op_rename_test \(\)](#)
Function for renaming operator testing (moved from rename.c)

5.41.1 Detailed Description

Header file that provides data structures, functions and defines for table abstraction

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5.41.2 Function Documentation

5.41.2.1 AK_check_tables_scheme()

```
int AK_check_tables_scheme (
    AK_mem_block * tbl1_temp_block,
    AK_mem_block * tbl2_temp_block,
    char * operator_name )
```

Function that checks if tables have the same relation schema.

Author

Dino Laktašić, abstracted from [difference.c](#) for use in [difference.c](#), [intersect.c](#) and [union.c](#) by Tomislav Mikulček

Parameters

<i>tbl1_temp_block</i>	first cache block of the first table
<i>tbl2_temp_block</i>	first cache block of the second table
<i>operator_name</i>	the name of operator, used for displaying error message

Returns

if success returns num of attributes in schema, else returns EXIT_ERROR

5.41.2.2 AK_create_table()

```
void AK_create_table (
    char * tblName,
    AK_create_table_parameter * parameters,
    int attribute_count )
```

Temporary function that creates table, and inserts an entry to the system_relation catalog.

Author

Matija Novak, updated by Dino Laktašić

Parameters

<i>table</i>	table name
<i>header</i>	AK_header of the new table
<i>type_segment</i>	type of the new segment

Returns

No return value

5.41.2.3 AK_get_attr_index()

```
int AK_get_attr_index (
    char * tblName,
    char * attrName )
```

Function that fetches zero-based index for attribute.

Author

Matija Šestak.

Parameters

<i>*tblName</i>	table name
<i>*attrName</i>	attribute name

Returns

zero-based index

5.41.2.4 AK_get_attr_name()

```
char* AK_get_attr_name (
    char * tblName,
    int index )
```

Function that fetches attribute name for some zero-based index.

Author

Matija Šestak.

Parameters

<i>*tblName</i>	table name
<i>index</i>	zero-based index

Returns

attribute name

5.41.2.5 AK_get_column()

```
struct list_node* AK_get_column (
    int num,
    char * tblName )
```

Function that fetches all values in some column and put on the list.

Author

Matija Šestak.

Parameters

<i>num</i>	zero-based column index
<i>*tblName</i>	table name

Returns

column values list

5.41.2.6 AK_get_header()

```
AK_header* AK_get_header (
    char * tblName )
```

Function that fetches the table header.

Author

Matija Šestak.

1. Read addresses of extents
2. If there is no extents in the table, return 0
3. else read the first block
4. allocate array
5. copy table header to the array

Parameters

<i>*tblName</i>	table name
-----------------	------------

Returns

array of table header

5.41.2.7 AK_get_num_records()

```
int AK_get_num_records (
    char * tblName )
```

Function that determines the number of rows in the table.

Author

Matija Šestak.

1. Read addresses of extents
2. If there is no extents in the table, return EXIT_WARNING
3. For each extent from table
4. For each block in the extent
5. Get a block
6. Exit if there is no records in block
7. Count tuples in block
8. Return the number of tuples divided by number of attributes

Parameters

<i>*tableName</i>	table name
-------------------	------------

Returns

number of rows in the table

5.41.2.8 AK_get_row()

```
struct list_node* AK_get_row (
    int num,
    char * tblName )
```

Function that fetches all values in some row and put on the list.

Author

Markus Schatten, Matija Šestak.

Parameters

<i>num</i>	zero-based row index
<i>*</i>	tblName table name

Returns

row values list

5.41.2.9 AK_get_table_obj_id()

```
int AK_get_table_obj_id (
    char * table )
```

Function that fetches an obj_id of named table from AK_relation system table.

Author

Dejan Frankovic

Parameters

<i>*table</i>	table name
---------------	------------

Returns

obj_id of the table or EXIT_ERROR if there is no table with that name

5.41.2.10 AK_get_tuple()

```
struct list_node* AK_get_tuple (
    int row,
    int column,
    char * tblName )
```

Function that fetches a value in some row and column.

Author

Matija Šestak.

Parameters

<i>row</i>	zero-based row index
<i>column</i>	zero-based column index
<i>*tblName</i>	table name

Returns

value in the list

5.41.2.11 AK_num_attr()

```
int AK_num_attr (
    char * tblName )
```

Functions that determines the number of attributes in the table.

Author

Matija Šestak.

1. Read addresses of extents
2. If there is no extents in the table, return EXIT_WARNING
3. else read the first block
4. while header tuple exists in the block, increment num_attr

Parameters

<i>*</i>	tblName table name
----------	--------------------

Returns

number of attributes in the table

5.41.2.12 AK_op_rename_test()

```
TestResult AK_op_rename_test ( )
```

Function for renaming operator testing (moved from rename.c)

Author

Mislav Čakarić, edited by Ljubo Barać

Returns

No return value

5.41.2.13 AK_print_row()

```
void AK_print_row (
    int col_len[],
    struct list_node * row )
```

Function that prints table row.

Author

Dino Laktašić

Parameters

<i>col_len[]</i>	array of max lengths for each attribute
<i>*row</i>	list with row elements

Returns

No return value

5.41.2.14 AK_print_row_spacer()

```
void AK_print_row_spacer (
    int col_len[],
    int length )
```

Function that prints row spacer.

Author

Dino Laktašić.

Parameters

<i>col_len[]</i>	max lengths for each attribute cell
<i>length</i>	total table width

Returns

printed row spacer

5.41.2.15 AK_print_row_spacer_to_file()

```
void AK_print_row_spacer_to_file (
    int col_len[],
    int length )
```

Function that prints row spacer update by Luka Rajcevic.

Author

Dino Laktašić.

Parameters

<i>col_len[]</i>	max lengths for each attribute cell
<i>length</i>	total table width

Returns

printed row spacer

5.41.2.16 AK_print_row_to_file()

```
void AK_print_row_to_file (
    int col_len[],
    struct list_node * row )
```

Function that prints the table row update by Luka Rajcevic.

Author

Dino Laktašić

Parameters

<i>col_len[]</i>	array of max lengths for each attribute
<i>*row</i>	list with row elements

Returns

No return value

5.41.2.17 AK_print_table()

```
void AK_print_table (
    char * tblName )
```

Function for printing table.

Author

Dino Laktašić and Mislav Čakarić (replaced old print table function by new one)

Parameters

<i>*tblName</i>	table name
-----------------	------------

Returns

No return value

5.41.2.18 AK_print_table_to_file()

```
void AK_print_table_to_file (
    char * tblName )
```

Function that prints a table.

Author

Dino Laktašić and Mislav Čakarić (replaced old print table function by new one) update by Luka Rajcevic

Parameters

<i>*tblName</i>	table name
-----------------	------------

Returns

No return value update by Anto Tomaš (corrected the AK_DeleteAll_L3 function)

5.41.2.19 AK_rename()

```
int AK_rename (
    char * old_table_name,
```

```

char * old_attr,
char * new_table_name,
char * new_attr )

```

Function for renaming table and/or attribute in table (moved from rename.c)

Author

Mislav Čakarić edited by Ljubo Barać

Parameters

<i>old_table_name</i>	old name of the table
<i>new_table_name</i>	new name of the table
<i>old_attr</i>	name of the attribute to rename
<i>new_attr</i>	new name for the attribute to rename

Returns

EXIT_ERROR or EXIT_SUCCESS

5.41.2.20 AK_table_empty()

```

int AK_table_empty (
    char * tblName )

```

Function that checks whether the table is empty.

Author

Matija Šestak.

Parameters

<i>*tblName</i>	table name
-----------------	------------

Returns

true/false

5.41.2.21 AK_table_test()

```

TestResult AK_table_test ( )

```

Function for testing table abstraction.

Author

Unknown

Returns

No return value

@update by Ana-Marija Balen - added getRow function to the test

5.41.2.22 AK_temp_create_table()

```
void AK_temp_create_table (
    char * table,
    AK_header * header,
    int type_segment )
```

Temporary function that creates table, and inserts an entry to the system_relation catalog.

Author

Matija Novak, updated by Dino Laktašić

Parameters

<i>table</i>	table name
<i>header</i>	AK_header of the new table
<i>type_segment</i>	type of the new segment

Returns

No return value

5.41.2.23 AK_tuple_to_string()

```
char* AK_tuple_to_string (
    struct list_node * tuple )
```

Function that converts tuple value to string.

Author

Matija Šestak.

Parameters

<i>*tuple</i>	tuple in the list
---------------	-------------------

Returns

tuple value as a string

5.41.2.24 get_row_attr_data()

```
char* get_row_attr_data (
    int column,
    struct list_node * node )
```

Function that returns the value of an attribute from the row.

Author

Leon Palaić

Parameters

<i>column</i>	index of column attribute
<i>*row</i>	list with row elements

Returns

atribute data

5.42 mm/memoman.c File Reference

```
#include "memoman.h"
#include "../dm/dbman.h"
Include dependency graph for memoman.c:
```

Functions

- int [AK_cache_block](#) (int num, [AK_mem_block](#) *mem_block)
Function that caches a block into the memory.
- int [AK_cache_AK_malloc](#) ()
Function that initializes the global cache memory (variable db_cache)
- int [AK_redo_log_AK_malloc](#) ()
Function that initializes the global redo log memory (variable redo_log)
- int [AK_find_available_result_block](#) ()
Function that finds the available block for result caching in a circular array.
- unsigned long [AK_generate_result_id](#) (unsigned char *str)
Function that generates a unique hash identifier for each cached result by using djb2 algorithm.
- void [AK_cache_result](#) (char *srcTable, [AK_block](#) *temp_block, [AK_header](#) header[])
Function that caches the fetched result block in memory.
- int [AK_query_mem_AK_malloc](#) ()

- Function that initializes the global query memory (variable query_mem)*

 - void [AK_query_mem_AK_free](#) ()
- Function that releases the global query memory (variable query_mem)*

 - int [AK_memoman_init](#) ()
- Function that initializes the memory manager (cache, redo log and query memory)*

 - [AK_mem_block](#) * [AK_get_block](#) (int num)
- Function that reads a block from the memory. If the block is cached, returns the cached block. Else uses AK_↔ cache_block to read the block to cache and then returns it.*

 - int [AK_release_oldest_cache_block](#) ()
- Functions that flushes the oldest block to disk and recalculates the next block to remove.*

 - int [AK_mem_block_modify](#) ([AK_mem_block](#) *mem_block, int dirty)
- Function that modifies the "dirty" bit of a block, and update the timestamps accordingly.*

 - int [AK_refresh_cache](#) ()
- Function that re-reads all the blocks from the disk.*

 - [table_addresses](#) * [AK_get_index_segment_addresses](#) (char *segmentName)
- Function for getting a index segment address.*

 - [table_addresses](#) * [AK_get_segment_addresses](#) (char *segmentName)
- Function for getting a relation segment address.*

 - [table_addresses](#) * [AK_get_segment_addresses_internal](#) (char *tableName, char *segmentName)
- Function for getting addresses of some table.*

 - int [AK_get_system_table_address](#) (const char *name)
- Function that gets the address of a system table by name.*

 - [table_addresses](#) * [AK_get_table_addresses](#) (char *table)
- Function for getting addresses of some table.*

 - [table_addresses](#) * [AK_get_index_addresses](#) (char *index)
- Function for getting addresses of some index.*

 - int [AK_find_AK_free_space](#) ([table_addresses](#) *addresses)
- Function that finds AK_free space in some block between block addresses. It's made for insert_row()*

 - int [AK_init_new_extent](#) (char *table_name, int extent_type)
- Function that extends the segment.*

 - int [AK_flush_cache](#) ()
- Function that flushes memory blocks to disk file.*

 - [TestResult](#) [AK_memoman_test](#) ()
 - [TestResult](#) [AK_memoman_test2](#) ()

5.42.1 Detailed Description

Defines functions for the memory manager of Kalashnikov DB

5.42.2 Function Documentation

5.42.2.1 AK_cache_AK_malloc()

```
int AK_cache_AK_malloc ( )
```

Function that initializes the global cache memory (variable db_cache)

Author

Markus Schatten, Matija Šestak(revised)

Returns

EXIT_SUCCESS if the cache memory has been initialized, EXIT_ERROR otherwise

5.42.2.2 AK_cache_block()

```
int AK_cache_block (
    int num,
    AK_mem_block * mem_block )
```

Function that caches a block into the memory.

Author

Nikola Bakoš, Matija Šestak(revised)

Parameters

<i>num</i>	block number (address)
<i>mem_block</i>	address of memmory block

Returns

EXIT_SUCCESS if the block has been successfully read into memory, EXIT_ERROR otherwise

read the block from the given address

set dirty bit in mem_block struct

get the timestamp

set timestamp_read

set timestamp_last_change

5.42.2.3 AK_cache_result()

```
void AK_cache_result (
    char * srcTable,
    AK_block * temp_block,
    AK_header header[] )
```

Function that caches the fetched result block in memory.

Author

Mario Novoselec

5.42.2.4 AK_find_AK_free_space()

```
int AK_find_AK_free_space (
    table_addresses * addresses )
```

Function that finds AK_free space in some block between block addresses. It's made for insert_row()

Author

Matija Novak, updated by Matija Šestak(function now uses caching)

Parameters

<i>address</i>	addresses of extents
----------------	----------------------

Returns

address of the block to write in

5.42.2.5 AK_find_available_result_block()

```
int AK_find_available_result_block ( )
```

Function that finds the available block for result caching in a circular array.

Author

Mario Novoselec

Returns

available_index

5.42.2.6 AK_flush_cache()

```
int AK_flush_cache ( )
```

Function that flushes memory blocks to disk file.

Author

Matija Šestak, updated by Antonio Martinović

Returns

EXIT_SUCCESS

if block form cache can not be writed to DB file -> EXIT_ERROR

block is clean after successfully writing it to disk

5.42.2.7 AK_generate_result_id()

```
unsigned long AK_generate_result_id (
    unsigned char * str )
```

Function that generates a unique hash identifier for each cached result by using djb2 algorithm.

Author

Mario Novoselec

Returns

hash

5.42.2.8 AK_get_block()

```
AK_mem_block* AK_get_block (
    int num )
```

Function that reads a block from the memory. If the block is cached, returns the cached block. Else uses AK_↔ cache_block to read the block to cache and then returns it.

Author

Tomislav Fotak, updated by Matija Šestak, Antonio Martinović

Parameters

<i>num</i>	block number (address)
------------	------------------------

Returns

segment start address

found cached! we're done here

while looking for block we also want to find an empty block in case that the actual block is not found then there is no need to run through the blocks twice

created new cache block for specified address

no free cache blocks found, we need to clear some now

no cache for you

5.42.2.9 AK_get_index_addresses()

```
table_addresses* AK_get_index_addresses (
    char * index )
```

Function for getting addresses of some index.

Author

Mislav Čakarić

Parameters

<i>index</i>	index name that you search for
--------------	--------------------------------

Returns

structure [table_addresses](#) witch contains start and end addresses of table extents, when form and to are 0 you are on the end of addresses

5.42.2.10 AK_get_index_segment_addresses()

```
table_addresses* AK_get_index_segment_addresses (
    char * segmentName )
```

Function for getting a index segment address.

@Author Antonio Martinović

Parameters

<i>segmentName</i>	table name that you search for
--------------------	--------------------------------

Returns

structure [table_addresses](#) witch contains start and end addresses of table extents, when form and to are 0 you are on the end of addresses

5.42.2.11 AK_get_segment_addresses()

```
table_addresses* AK_get_segment_addresses (
    char * segmentName )
```

Function for getting a relation segment address.

Function for getting a index segment address.

@Author Antonio Martinović

Parameters

<i>segmentName</i>	table name that you search for
--------------------	--------------------------------

Returns

structure [table_addresses](#) witch contains start and end addresses of table extents, when form and to are 0 you are on the end of addresses

5.42.2.12 AK_get_segment_addresses_internal()

```
table_addresses* AK_get_segment_addresses_internal (
    char * tableName,
    char * segmentName )
```

Function for getting addresses of some table.

Author

Matija Novak, updated by Matija Šestak, Mislav Čakarić, Antonio Martinović

Parameters

<i>tableName</i>	table name that you search for
<i>segmentName</i>	segment name

Returns

structure [table_addresses](#) witch contains start and end addresses of table extents, when form and to are 0 you are on the end of addresses

5.42.2.13 AK_get_system_table_address()

```
int AK_get_system_table_address (
    const char * name )
```

Function that gets the address of a system table by name.

Author

Matija Novak, updated by Matija Šestak, Mislav Čakarić, Antonio Martinović

Parameters

<i>name</i>	of system table
-------------	-----------------

Returns

table address

5.42.2.14 AK_get_table_addresses()

```
table\_addresses\* AK_get_table_addresses (
    char * table )
```

Function for getting addresses of some table.

Author

Mislav Čakarić

Parameters

<i>table</i>	table name that you search for
--------------	--------------------------------

Returns

structure [table_addresses](#) witch contains start and end addresses of table extents, when form and to are 0 you are on the end of addresses

5.42.2.15 AK_init_new_extent()

```
int AK_init_new_extent (
    char * table_name,
    int extent_type )
```

Function that extends the segment.

Author

Nikola Bakoš, updated by Matija Šestak (function now uses caching), updated by Mislav Čakarić, updated by Dino Laktašić

Parameters

<i>table_name</i>	name of segment to extent
<i>extent_type</i>	type of extent (can be one of: SEGMENT_TYPE_SYSTEM_TABLE, SEGMENT_TYPE_TABLE, SEGMENT_TYPE_INDEX, SEGMENT_TYPE_TRANSACTION, SEGMENT_TYPE_TEMP)

Returns

address of new extent, otherwise EXIT_ERROR

!! to correct header BUG iterate through header from 0 to N-th block while there is

5.42.2.16 AK_mem_block_modify()

```
int AK_mem_block_modify (
    AK_mem_block * mem_block,
    int dirty )
```

Function that modifies the "dirty" bit of a block, and update the timestamps accordingly.

Author

Alen Novosel.

5.42.2.17 AK_memoman_init()

```
int AK_memoman_init ( )
```

Function that initializes the memory manager (cache, redo log and query memory)

Author

Miroslav Policki

Returns

EXIT_SUCCESS if the query memory manager has been initialized, EXIT_ERROR otherwise

5.42.2.18 AK_query_mem_AK_free()

```
void AK_query_mem_AK_free ( )
```

Function that releases the global query memory (variable query_mem)

Author

Elvis Popović

5.42.2.19 AK_query_mem_AK_malloc()

```
int AK_query_mem_AK_malloc ( )
```

Function that initializes the global query memory (variable query_mem)

Author

Matija Novak

Returns

EXIT_SUCCESS if the query memory has been initialized, EXIT_ERROR otherwise

allocate memory for global variable query_mem

allocate memory for variable query_mem_lib which is used in query_mem->parsed

allocate memory for variable query_mem_dict which is used in query_mem->dictionary

allocate memory for variable query_mem_result which is used in query_mem->result

5.42.2.20 AK_redo_log_AK_malloc()

```
int AK_redo_log_AK_malloc ( )
```

Function that initializes the global redo log memory (variable redo_log)

Author

Dejan Sambolić updated by Dražen Bandić, updated by Tomislav Turek

Returns

EXIT_SUCCESS if the redo log memory has been initialized, EXIT_ERROR otherwise

5.42.2.21 AK_refresh_cache()

```
int AK_refresh_cache ( )
```

Function that re-reads all the blocks from the disk.

Author

Matija Šestak.

Returns

EXIT_SUCCESS

5.42.2.22 AK_release_oldest_cache_block()

```
int AK_release_oldest_cache_block ( )
```

Functions that flushes the oldest block to disk and recalculates the next block to remove.

Author

Antonio Martinović

Returns

index of flushed cache block

if block form cache can not be writed to DB file -> EXIT_ERROR

block is clean after successfully writing it to disk

5.43 mm/memoman.h File Reference

```
#include "../auxi/test.h"  
#include "../dm/dbman.h"  
#include "../auxi/mempro.h"
```

Include dependency graph for memoman.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [AK_mem_block](#)
Structure that defines a block of data in memory.
- struct [AK_db_cache](#)
Structure that defines global cache memory.
- struct [AK_command_recovery_struct](#)
recovery structure used to recover commands from binary file
- struct [AK_redo_log](#)
Structure that defines global redo log.
- struct [AK_query_mem_lib](#)
Structure that defines global query memory for libraries.
- struct [AK_query_mem_dict](#)
Structure that defines global query memory for data dictionaries.
- struct [AK_results](#)
Structure used for in-memory result caching.
- struct [AK_query_mem_result](#)
Structure that defines global query memory for results.
- struct [AK_query_mem](#)
Structure that defines global query memory.

Functions

- void [AK_cache_result](#) (char *srcTable, [AK_block](#) *temp_block, [AK_header](#) header[])
Function that caches the fetched result block in memory.
- int [AK_find_available_result_block](#) ()
Function that finds the available block for result caching in a circular array.
- unsigned long [AK_generate_result_id](#) (unsigned char *str)
Function that generates a unique hash identifier for each cached result by using djb2 algorithm.
- int [AK_cache_block](#) (int num, [AK_mem_block](#) *mem_block)
Function that caches a block into the memory.
- int [AK_cache_AK_malloc](#) ()
Function that initializes the global cache memory (variable db_cache)
- int [AK_redo_log_AK_malloc](#) ()
Function that initializes the global redo log memory (variable redo_log)
- int [AK_query_mem_AK_malloc](#) ()
Function that initializes the global query memory (variable query_mem)
- void [AK_query_mem_AK_free](#) ()
Function that releases the global query memory (variable query_mem)
- int [AK_memoman_init](#) ()
Function that initializes the memory manager (cache, redo log and query memory)
- [AK_mem_block](#) * [AK_get_block](#) (int num)
Function that reads a block from the memory. If the block is cached, returns the cached block. Else uses [AK_cache_block](#) to read the block to cache and then returns it.
- int [AK_release_oldest_cache_block](#) ()
Functions that flushes the oldest block to disk and recalculates the next block to remove.
- int [AK_mem_block_modify](#) ([AK_mem_block](#) *mem_block, int dirty)
Function that modifies the "dirty" bit of a block, and update the timestamps accordingly.
- int [AK_refresh_cache](#) ()
Function that re-reads all the blocks from the disk.

- [table_addresses](#) * [AK_get_segment_addresses_internal](#) (char *tableName, char *segmentName)
Function for getting addresses of some table.
- [table_addresses](#) * [AK_get_segment_addresses](#) (char *segmentName)
Function for getting a index segment address.
- [table_addresses](#) * [AK_get_index_segment_addresses](#) (char *segmentName)
Function for getting a index segment address.
- [table_addresses](#) * [AK_get_table_addresses](#) (char *table)
Function for getting addresses of some table.
- [table_addresses](#) * [AK_get_index_addresses](#) (char *index)
Function for getting addresses of some index.
- int [AK_find_AK_free_space](#) ([table_addresses](#) *addresses)
Function that finds AK_free space in some block between block addresses. It's made for insert_row()
- int [AK_init_new_extent](#) (char *table_name, int extent_type)
Function that extends the segment.
- int [AK_flush_cache](#) ()
Function that flushes memory blocks to disk file.
- [TestResult](#) [AK_memoman_test](#) ()
- [TestResult](#) [AK_memoman_test2](#) ()

Variables

- [AK_db_cache](#) * [db_cache](#)
Variable that defines the db cache.
- [AK_redo_log](#) * [redo_log](#)
Variable that defines the global redo log.
- [AK_query_mem](#) * [query_mem](#)
Variable that defines the global query memory.

5.43.1 Detailed Description

Header file that contains data structures, defines and functions for the memory manager of Kalashnikov DB

5.43.2 Function Documentation

5.43.2.1 [AK_cache_AK_malloc\(\)](#)

```
int AK_cache_AK_malloc ( )
```

Function that initializes the global cache memory (variable [db_cache](#))

Author

Markus Schatten, Matija Šestak(revised)

Returns

EXIT_SUCCESS if the cache memory has been initialized, EXIT_ERROR otherwise

5.43.2.2 AK_cache_block()

```
int AK_cache_block (
    int num,
    AK_mem_block * mem_block )
```

Function that caches a block into the memory.

Author

Nikola Bakoš, Matija Šestak(revised)

Parameters

<i>num</i>	block number (address)
<i>mem_block</i>	address of memmory block

Returns

EXIT_SUCCESS if the block has been successfully read into memory, EXIT_ERROR otherwise

read the block from the given address

set dirty bit in mem_block struct

get the timestamp

set timestamp_read

set timestamp_last_change

5.43.2.3 AK_cache_result()

```
void AK_cache_result (
    char * srcTable,
    AK_block * temp_block,
    AK_header header[ ] )
```

Function that caches the fetched result block in memory.

Author

Mario Novoselec

5.43.2.4 AK_find_AK_free_space()

```
int AK_find_AK_free_space (
    table_addresses * addresses )
```

Function that finds AK_free space in some block between block addresses. It's made for insert_row()

Author

Matija Novak, updated by Matija Šestak(function now uses caching)

Parameters

<i>address</i>	addresses of extents
----------------	----------------------

Returns

address of the block to write in

5.43.2.5 AK_find_available_result_block()

```
int AK_find_available_result_block ( )
```

Function that finds the available block for result caching in a circular array.

Author

Mario Novoselec

Returns

available_index

5.43.2.6 AK_flush_cache()

```
int AK_flush_cache ( )
```

Function that flushes memory blocks to disk file.

Author

Matija Šestak, updated by Antonio Martinović

Returns

EXIT_SUCCESS

if block form cache can not be writed to DB file -> EXIT_ERROR

block is clean after successfully writing it to disk

5.43.2.7 AK_generate_result_id()

```
unsigned long AK_generate_result_id (
    unsigned char * str )
```

Function that generates a unique hash identifier for each cached result by using djb2 algorithm.

Author

Mario Novoselec

Returns

hash

5.43.2.8 AK_get_block()

```
AK_mem_block* AK_get_block (
    int num )
```

Function that reads a block from the memory. If the block is cached, returns the cached block. Else uses AK_↔ cache_block to read the block to cache and then returns it.

Author

Tomislav Fotak, updated by Matija Šestak, Antonio Martinović

Parameters

<i>num</i>	block number (address)
------------	------------------------

Returns

segment start address

found cached! we're done here

while looking for block we also want to find an empty block in case that the actual block is not found then there is no need to run through the blocks twice

created new cache block for specified address

no free cache blocks found, we need to clear some now

no cache for you

5.43.2.9 AK_get_index_addresses()

```
table_addresses* AK_get_index_addresses (
    char * index )
```

Function for getting addresses of some index.

Author

Mislav Čakarić

Parameters

<i>index</i>	index name that you search for
--------------	--------------------------------

Returns

structure [table_addresses](#) witch contains start and end addresses of table extents, when form and to are 0 you are on the end of addresses

5.43.2.10 AK_get_index_segment_addresses()

```
table_addresses* AK_get_index_segment_addresses (
    char * segmentName )
```

Function for getting a index segment address.

@Author Antonio Martinović

Parameters

<i>segmentName</i>	table name that you search for
--------------------	--------------------------------

Returns

structure [table_addresses](#) witch contains start and end addresses of table extents, when form and to are 0 you are on the end of addresses

5.43.2.11 AK_get_segment_addresses()

```
table_addresses* AK_get_segment_addresses (
    char * segmentName )
```

Function for getting a index segment address.

@Author Antonio Martinović

Parameters

<i>segmentName</i>	table name that you search for
--------------------	--------------------------------

Returns

structure [table_addresses](#) witch contains start and end addresses of table extents, when form and to are 0 you are on the end of addresses

Function for getting a index segment address.

@Author Antonio Martinović

Parameters

<i>segmentName</i>	table name that you search for
--------------------	--------------------------------

Returns

structure [table_addresses](#) witch contains start and end addresses of table extents, when form and to are 0 you are on the end of addresses

5.43.2.12 AK_get_segment_addresses_internal()

```
table_addresses* AK_get_segment_addresses_internal (
    char * tableName,
    char * segmentName )
```

Function for getting addresses of some table.

Author

Matija Novak, updated by Matija Šestak, Mislav Čakarić, Antonio Martinović

Parameters

<i>tableName</i>	table name that you search for
<i>segmentName</i>	segment name

Returns

structure [table_addresses](#) witch contains start and end addresses of table extents, when form and to are 0 you are on the end of addresses

5.43.2.13 AK_get_table_addresses()

```
table_addresses* AK_get_table_addresses (
    char * table )
```

Function for getting addresses of some table.

Author

Mislav Čakarić

Parameters

<i>table</i>	table name that you search for
--------------	--------------------------------

Returns

structure [table_addresses](#) witch contains start and end addresses of table extents, when from and to are 0 you are on the end of addresses

5.43.2.14 AK_init_new_extent()

```
int AK_init_new_extent (
    char * table_name,
    int extent_type )
```

Function that extends the segment.

Author

Nikola Bakoš, updated by Matija Šestak (function now uses caching), updated by Mislav Čakarić, updated by Dino Laktašić

Parameters

<i>table_name</i>	name of segment to extent
<i>extent_type</i>	type of extent (can be one of: SEGMENT_TYPE_SYSTEM_TABLE, SEGMENT_TYPE_TABLE, SEGMENT_TYPE_INDEX, SEGMENT_TYPE_TRANSACTION, SEGMENT_TYPE_TEMP)

Returns

address of new extent, otherwise EXIT_ERROR

!! to correct header BUG iterate through header from 0 to N-th block while there is

5.43.2.15 AK_mem_block_modify()

```
int AK_mem_block_modify (
    AK_mem_block * mem_block,
    int dirty )
```

Function that modifies the "dirty" bit of a block, and update the timestamps accordingly.

Author

Alen Novosel.

5.43.2.16 AK_memoman_init()

```
int AK_memoman_init ( )
```

Function that initializes the memory manager (cache, redo log and query memory)

Author

Miroslav Policki

Returns

EXIT_SUCCESS if the query memory manager has been initialized, EXIT_ERROR otherwise

5.43.2.17 AK_query_mem_AK_free()

```
void AK_query_mem_AK_free ( )
```

Function that releases the global query memory (variable query_mem)

Author

Elvis Popović

5.43.2.18 AK_query_mem_AK_malloc()

```
int AK_query_mem_AK_malloc ( )
```

Function that initializes the global query memory (variable query_mem)

Author

Matija Novak

Returns

EXIT_SUCCESS if the query memory has been initialized, EXIT_ERROR otherwise

allocate memory for global variable query_mem

allocate memory for variable query_mem_lib which is used in query_mem->parsed

allocate memory for variable query_mem_dict which is used in query_mem->dictionary

allocate memory for variable query_mem_result which is used in query_mem->result

5.43.2.19 AK_redo_log_AK_malloc()

```
int AK_redo_log_AK_malloc ( )
```

Function that initializes the global redo log memory (variable redo_log)

Author

Dejan Sambolić updated by Dražen Bandić, updated by Tomislav Turek

Returns

EXIT_SUCCESS if the redo log memory has been initialized, EXIT_ERROR otherwise

5.43.2.20 AK_refresh_cache()

```
int AK_refresh_cache ( )
```

Function that re-reads all the blocks from the disk.

Author

Matija Šestak.

Returns

EXIT_SUCCESS

5.43.2.21 AK_release_oldest_cache_block()

```
int AK_release_oldest_cache_block ( )
```

Functions that flushes the oldest block to disk and recalculates the next block to remove.

Author

Antonio Martinović

Returns

index of flushed cache block

if block form cache can not be writed to DB file -> EXIT_ERROR

block is clean after successfully writing it to disk

5.44 opti/query_optimization.c File Reference

```
#include "query_optimization.h"
Include dependency graph for query_optimization.c:
```

Functions

- void [AK_print_optimized_query](#) (struct [list_node](#) *list_query)
Function that prints optimization table for testing purposes.
- struct [list_node](#) * [AK_execute_rel_eq](#) (struct [list_node](#) *list_query, const char rel_eq, const char *FLAGS)
Function that calls and executes relation equivalence RELATION EQUIVALENCE RULES FLAGS c - commutation a - associativity p - projection s - selection
- struct [list_node](#) * [AK_query_optimization](#) (struct [list_node](#) *list_query, const char *FLAGS, const int DIFF↔_PLANS)
Function that executes all relational equivalences provided by FLAGS (one or more), if DIFF_PLANS turned on execute permutations without repetition on given RA list from SQL parser output.
- [TestResult AK_query_optimization_test](#) ()

Variables

- int **error_message** =0

5.44.1 Detailed Description

Provides functions for general query optimization

5.44.2 Function Documentation

5.44.2.1 AK_execute_rel_eq()

```
struct list_node* AK_execute_rel_eq (
    struct list_node * list_query,
    const char rel_eq,
    const char * FLAGS )
```

Function that calls and executes relation equivalence
RELATION EQUIVALENCE RULES
FLAGS c - commutation
a - associativity p - projection s - selection

Author

Dino Laktašić.

Parameters

*list_query	RA expresion list where we need to apply relational equivalences rules
rel_eq	rel_eq to execute
*FLAGS	flags for relation equivalences (execute rel_eq for given flags)

Returns

returns struct list_node (RA expresion list) optimized by given relational equivalence rule

5.44.2.2 AK_print_optimized_query()

```
void AK_print_optimized_query (
    struct list_node * list_query )
```

Function that prints optimization table for testing purposes.

Author

Dino Laktašić.

Parameters

*list_query	optimized RA expresion list
-------------	-----------------------------

Returns

list output

5.44.2.3 AK_query_optimization()

```
struct list_node* AK_query_optimization (
    struct list_node * list_query,
    const char * FLAGS,
    const int DIFF_PLANS )
```

Function that executes all relational equivalences provided by FLAGS (one or more), if DIFF_PLANS turned on execute permutations without repetition on given RA list from SQL parser output.

Author

Dino Laktašić.

Parameters

<i>*list_query</i>	RA expresion list where we need to apply relational equivalences rules
<i>*FLAGS</i>	flags for relation equivalences (execute rel_eq for given flags)

Returns

returns AK_list (RA expresion list) optimized by all relational equivalence rules provided by FLAGS (commented code can be edited so AK_list can return the list of lists (lists of different optimization plans), with permutation switched on (DIFF_PLANS = 1) time for execution will be significantly increased Current implementation without uncommenting code doesn't produce list of list, it rather apply all permutations on the same list

For futher development consider to implement cost estimation for given plan based on returned heuristicly optimized list

5.44.2.4 AK_query_optimization_test()

```
TestResult AK_query_optimization_test ( )
```

Author

Dino Laktašić

Parameters

<i>Function</i>	for testing *list_query query to be optimized
-----------------	-----------------------------------------------

Returns

No return value

5.45 opti/query_optimization.h File Reference

```
#include "../auxi/test.h"
#include "rel_eq_comut.h"
```

```
#include "rel_eq_assoc.h"
#include "rel_eq_projection.h"
#include "rel_eq_selection.h"
#include "../auxi/mempro.h"
#include "../sql/view.h"
```

Include dependency graph for query_optimization.h: This graph shows which files directly or indirectly include this file:

Macros

- `#define MAX_PERMUTATION 24`
Constant declaring maximum number of permutations.

Functions

- `void AK_print_optimized_query (struct list_node *list_query)`
Function that prints optimization table for testing purposes.
- `struct list_node * AK_execute_rel_eq (struct list_node *list_query, const char rel_eq, const char *FLAGS)`
Function that calls and executes relation equivalence RELATION EQUIVALENCE RULES FLAGS c - commutation a - associativity p - projection s - selection
- `struct list_node * AK_query_optimization (struct list_node *list_query, const char *FLAGS, const int DIFF_PLANS)`
Function that executes all relational equivalences provided by FLAGS (one or more), if DIFF_PLANS turned on execute permutations without repetition on given RA list from SQL parser output.
- `TestResult AK_query_optimization_test ()`

5.45.1 Detailed Description

Header file that provides data structure, functions and defines for general query optimization

5.45.2 Function Documentation

5.45.2.1 AK_execute_rel_eq()

```
struct list_node* AK_execute_rel_eq (
    struct list_node * list_query,
    const char rel_eq,
    const char * FLAGS )
```

Function that calls and executes relation equivalence RELATION EQUIVALENCE RULES FLAGS c - commutation a - associativity p - projection s - selection

Author

Dino Laktašić.

Parameters

<i>*list_query</i>	RA expresion list where we need to apply relational equivalences rules
<i>rel_eq</i>	rel_eq to execute
<i>*FLAGS</i>	flags for relation equivalences (execute rel_eq for given flags)

Returns

returns struct [list_node](#) (RA expresion list) optimized by given relational equivalence rule

5.45.2.2 AK_print_optimized_query()

```
void AK_print_optimized_query (
    struct list\_node * list_query )
```

Function that prints optimization table for testing purposes.

Author

Dino Laktašić.

Parameters

<i>*list_query</i>	optimized RA expresion list
--------------------	-----------------------------

Returns

list output

5.45.2.3 AK_query_optimization()

```
struct list\_node* AK_query_optimization (
    struct list\_node * list_query,
    const char * FLAGS,
    const int DIFF_PLANS )
```

Function that executes all relational equivalences provided by FLAGS (one or more), if DIFF_PLANS turned on execute permutations without repetition on given RA list from SQL parser output.

Author

Dino Laktašić.

Parameters

<i>*list_query</i>	RA expresion list where we need to apply relational equivalences rules
<i>*FLAGS</i>	flags for relation equivalences (execute rel_eq for given flags)

Returns

returns AK_list (RA expresion list) optimized by all relational equivalence rules provided by FLAGS (commented code can be edited so AK_list can return the list of lists (lists of different optimization plans), with permutation switched on (DIFF_PLANS = 1) time for execution will be significantly increased Current implementation without uncommenting code doesn't produce list of list, it rather apply all permutations on the same list

For futher development consider to implement cost estimation for given plan based on returned heuristicly optimized list

5.45.2.4 AK_query_optimization_test()

```
TestResult AK_query_optimization_test ( )
```

Author

Dino Laktašić

Parameters

<i>Function</i>	for testing *list_query query to be optimized
-----------------	-----------------------------------------------

Returns

No return value

5.46 opti/rel_eq_assoc.c File Reference

```
#include "rel_eq_assoc.h"
#include "rel_eq_projection.h"
Include dependency graph for rel_eq_assoc.c:
```

Functions

- int [AK_compare](#) (const void *a, const void *b)
Function for Struct cost_eval comparison.
- struct [list_node](#) * [AK_rel_eq_assoc](#) (struct [list_node](#) *list_rel_eq)
Main function for generation of RA expresion according to associativity equivalence rules.
- void [AK_print_rel_eq_assoc](#) (struct [list_node](#) *list_rel_eq)
Function for printing RA expresion struct [list_node](#).
- [TestResult](#) [AK_rel_eq_assoc_test](#) ()
Function for testing relational equivalences regarding associativity.

5.46.1 Detailed Description

Provides functions for relational equivalences regarding associativity

5.46.2 Function Documentation

5.46.2.1 AK_compare()

```
int AK_compare (
    const void * a,
    const void * b )
```

Function for Struct cost_eval comparison.

Author

Dino Laktašić

Parameters

<i>*a</i>	first value
<i>*b</i>	second value

Returns

returns result of comparison

5.46.2.2 AK_print_rel_eq_assoc()

```
void AK_print_rel_eq_assoc (
    struct list_node * list_rel_eq )
```

Function for printing RA expresion struct [list_node](#).

Author

Dino Laktašić.

Parameters

<i>*list_rel_eq</i>	RA expresion as the struct list_node
---------------------	------------------------------------------------------

Returns

optimised RA expression as the struct [list_node](#)

5.46.2.3 AK_rel_eq_assoc()

```
struct list_node* AK_rel_eq_assoc (
    struct list_node * list_rel_eq )
```

Main function for generation of RA expression according to associativity equivalence rules.

Author

Dino Laktašić.

Parameters

<i>*list_rel_eq</i>	RA expression as the struct list_node
---------------------	-------------------------------------------------------

Returns

optimised RA expression as the struct [list_node](#)

5.46.2.4 AK_rel_eq_assoc_test()

```
TestResult AK_rel_eq_assoc_test ( )
```

Function for testing relational equivalences regarding associativity.

Author

Dino Laktašić.

Returns

No return value

5.47 opti/rel_eq_assoc.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../auxi/mempro.h"
#include "../auxi/auxiliary.h"
```

Include dependency graph for rel_eq_assoc.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [cost_eval_t](#)

Structure for cost estimation on relations. It contains value (number of rows in table) and data (used to store table name)

Typedefs

- typedef struct [cost_eval_t](#) **cost_eval**

Functions

- int [AK_compare](#) (const void *a, const void *b)
Function for Struct cost_eval comparison.
- struct [list_node](#) * [AK_rel_eq_assoc](#) (struct [list_node](#) *list_rel_eq)
Main function for generation of RA expresion according to associativity equivalence rules.
- void [AK_print_rel_eq_assoc](#) (struct [list_node](#) *list_rel_eq)
Function for printing RA expresion struct [list_node](#).
- [TestResult](#) [AK_rel_eq_assoc_test](#) ()
Function for testing relational equivalences regarding associativity.

5.47.1 Detailed Description

Header file that provides data structures, functions and defines for relational equivalences regarding associativity

5.47.2 Function Documentation

5.47.2.1 AK_compare()

```
int AK_compare (
    const void * a,
    const void * b )
```

Function for Struct cost_eval comparison.

Author

Dino Laktašić

Parameters

<i>*a</i>	first value
<i>*b</i>	second value

Returns

returns result of comparison

5.47.2.2 AK_print_rel_eq_assoc()

```
void AK_print_rel_eq_assoc (
    struct list_node * list_rel_eq )
```

Function for printing RA expression struct [list_node](#).

Author

Dino Laktašić.

Parameters

<i>*list_rel_eq</i>	RA expression as the struct list_node
---------------------	-------------------------------------------------------

Returns

optimised RA expression as the struct [list_node](#)

5.47.2.3 AK_rel_eq_assoc()

```
struct list_node* AK_rel_eq_assoc (
    struct list_node * list_rel_eq )
```

Main function for generation of RA expression according to associativity equivalence rules.

Author

Dino Laktašić.

Parameters

<i>*list_rel_eq</i>	RA expression as the struct list_node
---------------------	-------------------------------------------------------

Returns

optimised RA expression as the struct [list_node](#)

5.47.2.4 AK_rel_eq_assoc_test()

```
TestResult AK_rel_eq_assoc_test ( )
```

Function for testing relational equivalences regarding associativity.

Author

Dino Laktašić.

Returns

No return value

5.48 opti/rel_eq_comut.c File Reference

```
#include "rel_eq_comut.h"
```

Include dependency graph for rel_eq_comut.c:

Functions

- void [AK_print_rel_eq_comut](#) (struct [list_node](#) *list_rel_eq)
Function for printing optimized relation equivalence expression list regarding commutativity.
- struct [list_node](#) * [AK_rel_eq_comut](#) (struct [list_node](#) *list_rel_eq)
Main function for generating RA expresion according to commutativity equivalence rules.
- char * [AK_rel_eq_commute_with_theta_join](#) (char *cond, char *tblName)
Function that checks if the selection can commute with theta-join or product.
- [TestResult](#) [AK_rel_eq_comut_test](#) ()
Function that tests relational equivalences regarding commutativity.

5.48.1 Detailed Description

Provides functions for relational equivalences regarding commutativity

5.48.2 Function Documentation

5.48.2.1 AK_print_rel_eq_comut()

```
void AK_print_rel_eq_comut (
    struct list\_node * list_rel_eq )
```

Function for printing optimized relation equivalence expression list regarding commutativity.

Author

Davor Tomala

Parameters

<i>*list_rel_eq</i>	RA expresion as the struct list_node
---------------------	------------------------------------------------------

5.48.2.2 AK_rel_eq_commute_with_theta_join()

```
char* AK_rel_eq_commute_with_theta_join (
    char * cond,
    char * tblName )
```

Function that checks if the selection can commute with theta-join or product.

Author

Dino Laktašić.

1. For each token (delimited by " ") in selection condition first check if token represents attribute/s and is subset in the given table
2. If token is a subset set variable id to 1
3. else set id to 0, else make no changes to variable id
4. if token differs from "AND" and "OR" and id equals to 1 append current token to result condition
5. else if token equals to "AND" or "OR" and id equals to 1 and there are two added tokens add "AND" or "OR" to condition string
6. When exits from loop, return pointer to char array that contains new condition for a given table

Parameters

<i>*cond</i>	condition array that contains condition data
<i>*tblName</i>	name of the table

Returns

pointer to char array that contains new condition for a given table

5.48.2.3 AK_rel_eq_comut()

```
struct list_node* AK_rel_eq_comut (
    struct list_node * list_rel_eq )
```

Main function for generating RA expresion according to commutativity equivalence rules.

Author

Davor Tomala

Parameters

<code>*list_rel_eq</code>	RA expression as the struct list_node
---------------------------	-------------------------------------------------------

Returns

optimised RA expression as the struct [list_node](#)

5.48.2.4 AK_rel_eq_comut_test()

```
TestResult AK_rel_eq_comut_test ( )
```

Function that tests relational equivalences regarding commutativity.

Author

Dino Laktašić (AK_rel_eq_commute_with_theta_join), Davor Tomala (AK_rel_eq_comut)

Returns

No return vlaue

5.49 opti/rel_eq_comut.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../rel_eq_selection.h"
#include "../auxi/mempro.h"
#include "../auxi/auxiliary.h"
```

Include dependency graph for rel_eq_comut.h: This graph shows which files directly or indirectly include this file:

Functions

- void [AK_print_rel_eq_comut](#) (struct [list_node](#) *list_rel_eq)
Function for printing optimized relation equivalence expression list regarding commutativity.
- struct [list_node](#) * [AK_rel_eq_comut](#) (struct [list_node](#) *list_rel_eq)
Main function for generating RA expresion according to commutativity equivalence rules.
- char * [AK_rel_eq_commute_with_theta_join](#) (char *cond, char *tblName)
Function that checks if the selection can commute with theta-join or product.
- [TestResult](#) [AK_rel_eq_comut_test](#) ()
Function that tests relational equivalences regarding commutativity.

5.49.1 Detailed Description

Header file that provides data structures, functions and defines for relational equivalences regarding comutativity

5.49.2 Function Documentation

5.49.2.1 AK_print_rel_eq_comut()

```
void AK_print_rel_eq_comut (
    struct list\_node * list_rel_eq )
```

Function for printing optimized relation equivalence expression list regarding commutativity.

Author

Davor Tomala

Parameters

<i>*list_rel_eq</i>	RA expresion as the struct list_node
---------------------	------------------------------------------------------

5.49.2.2 AK_rel_eq_commute_with_theta_join()

```
char* AK_rel_eq_commute_with_theta_join (
    char * cond,
    char * tblName )
```

Function that checks if the selection can commute with theta-join or product.

Author

Dino Laktašić.

1. For each token (delimited by " ") in selection condition first check if token represents attribute/s and is subset in the given table
2. If token is a subset set variable id to 1
3. else set id to 0, else make no changes to variable id
4. if token differs from "AND" and "OR" and id equals to 1 append current token to result condition
5. else if token equals to "AND" or "OR" and id equals to 1 and there are two added tokens add "AND" or "OR" to condition string
6. When exits from loop, return pointer to char array that contains new condition for a given table

Parameters

<i>*cond</i>	condition array that contains condition data
<i>*tblName</i>	name of the table

Returns

pointer to char array that contains new condition for a given table

5.49.2.3 AK_rel_eq_comut()

```
struct list_node* AK_rel_eq_comut (
    struct list_node * list_rel_eq )
```

Main function for generating RA expresion according to commutativity equivalence rules.

Author

Davor Tomala

Parameters

<i>*list_rel_eq</i>	RA expresion as the struct list_node
---------------------	------------------------------------------------------

Returns

optimised RA expresion as the struct [list_node](#)

5.49.2.4 AK_rel_eq_comut_test()

```
TestResult AK_rel_eq_comut_test ( )
```

Function that tests relational equivalences regarding commutativity.

Author

Dino Laktašić (AK_rel_eq_commute_with_theta_join), Davor Tomala (AK_rel_eq_comut)

Returns

No return vlaue

5.50 opti/rel_eq_projection.c File Reference

```
#include "rel_eq_projection.h"
#include "../auxi/auxiliary.h"
Include dependency graph for rel_eq_projection.c:
```

Functions

- int [AK_rel_eq_is_subset](#) (struct [list_node](#) *list_elem_set, struct [list_node](#) *list_elem_subset)
Function that checks if some set of attributes is subset of larger set, used in cascading of the projections.
- int [AK_rel_eq_can_commute](#) (struct [list_node](#) *list_elem_attribs, struct [list_node](#) *list_elem_conds)
Function that checks if selection uses only attributes retained by the projection before commuting.
- struct [list_node](#) * [AK_rel_eq_get_attributes](#) (char *tblName)
Function that gets attributes for a given table and store them to the struct [list_node](#).
- char * [AK_rel_eq_projection_attributes](#) (char *attribs, char *tblName)
Function used for filtering and returning only those attributes from list of projection attributes that exist in the given table
- char * [AK_rel_eq_collect_cond_attributes](#) (struct [list_node](#) *list_elem)
Function used for filtering and returning only attributes from selection or theta_join condition.
- char * [AK_rel_eq_remove_duplicates](#) (char *attribs)
Function which removes duplicate attributes from attributes expresion.
- struct [list_node](#) * [AK_rel_eq_projection](#) (struct [list_node](#) *list_rel_eq)
Main function for generating RA expresion according to projection equivalence rules.
- void [AK_print_rel_eq_projection](#) (struct [list_node](#) *list_rel_eq)
Function for printing AK_list to the screen.
- [TestResult AK_rel_eq_projection_test](#) ()
Function for testing rel_eq_selection.

5.50.1 Detailed Description

Provides functions for for relational equivalences in projection

5.50.2 Function Documentation

5.50.2.1 [AK_print_rel_eq_projection\(\)](#)

```
void AK_print_rel_eq_projection (
    struct list\_node * list_rel_eq )
```

Function for printing AK_list to the screen.

Author

Dino Laktašić.

Parameters

<i>*list_rel_eq</i>	RA expresion as the AK_list
---------------------	-----------------------------

Returns

No return value

5.50.2.2 AK_rel_eq_can_commute()

```
int AK_rel_eq_can_commute (
    struct list_node * list_elem_attribs,
    struct list_node * list_elem_conds )
```

Function that checks if selection uses only attributes retained by the projection before commuting.

Author

Dino Laktašić.

1. Tokenize set of projection attributes and store them to the array
2. For each attribute in selection condition check if exists in array of projection attributes
3. if exists increment match variable and break
4. else continue checking until the final attribute is checked
5. if match variable value equals 0 than return 0
6. else if match variable value greater than EXIT_SUCCESS, return EXIT_FAILURE

Parameters

<i>list_elem_attribs</i>	list element containing projection data
<i>list_elem_conds</i>	list element containing selection condition data

Returns

EXIT_SUCCESS if selection uses only attributes retained by projection, else returns EXIT_FAILURE

5.50.2.3 AK_rel_eq_collect_cond_attributes()

```
char* AK_rel_eq_collect_cond_attributes (
    struct list_node * list_elem )
```

Function used for filtering and returning only attributes from selection or theta_join condition.

Author

Dino Laktašić.

Parameters

<i>list_elem</i>	list element that contains selection or theta_join condition data
------------------	-------------------------------------------------------------------

Returns

only attributes from selection or theta_join condition as the AK_list

5.50.2.4 AK_rel_eq_get_attributes()

```
struct list_node* AK_rel_eq_get_attributes (
    char * tblName )
```

Function that gets attributes for a given table and store them to the struct [list_node](#).

Author

Dino Laktašić.

1. Get the number of attributes in a given table
2. Get the table header for a given table
3. Initialize struct [list_node](#)
4. For each attribute in table header, insert attribute in struct [list_node](#) as new struct [list_node](#) element
5. return struct [list_node](#)

Parameters

<i>*tblName</i>	name of the table
-----------------	-------------------

Returns

struct [list_node](#)

5.50.2.5 AK_rel_eq_is_subset()

```
int AK_rel_eq_is_subset (
    struct list_node * list_elem_set,
    struct list_node * list_elem_subset )
```

Function that checks if some set of attributes is subset of larger set, used in cascading of the projections.

Author

Dino Laktašić. =====> Optimization plan using Relational Algebra Equivalences <=====

Equivalence rule that apply on every equivalent expresion generated by Query optimizer

Rules to implement Rule 1. projection comutes with selection that only uses attributes retained by the projection $p[L](s[L1](R)) = s[L1](p[L](R))$ Rule 2. only the last in a sequence of projection operations is needed, the others can be omitted. $p[L1] = p[L1](R)$ Rule 3a. distribution according to theta join, only if join includes attributes from $L1 \cup L2$ $p[L1 \cup L2](R1 \bowtie R2) = (p[L1](R1)) \bowtie (p[L2](R2))$ Rule 3b. Let $L1 \cup L2$ be attributes from $R1$ and $R2$, respectively. Let $L3$ be attributes from $R1$, but are not in $L1 \cup L2$ and let $L4$ be attributes from $R2$, but are not in $L1 \cup L2$. $p[L1 \cup L2](R1 \bowtie R2) = p[L1 \cup L2]((p[L1 \cup L3](R1)) \bowtie (p[L2 \cup L4](R2)))$ Rule 4. distribution according to union $p[L](R1 \cup R2) = (p[L](R1)) \cup (p[L](R2))$

Author

Dino Laktašić.

1. Tokenize set and subset of projection attributes and store each of them to it's own array
2. Check if the size of subset array is larger than the size of set array
3. if the subset array is larger return 0
4. else sort both arrays ascending
5. Compare the subset and set items at the same positions, starting from 0
6. if there is an item in the subset array that doesn't match attribute at the same position in the set array return 0
7. else continue comparing until final item in the subset array is reached
8. on loop exit return EXIT_SUCCESS

Parameters

<i>list_elem_set</i>	first list element containing projection attributes
<i>list_elem_subset</i>	second list element containing projection attributes

Returns

EXIT_SUCCESS if some set of attributes is subset of larger set, else returns EXIT_FAILURE

5.50.2.6 AK_rel_eq_projection()

```
struct list_node* AK_rel_eq_projection (
    struct list_node * list_rel_eq )
```

Main function for generating RA expresion according to projection equivalence rules.

Author

Dino Laktašić.

Parameters

<i>*list_rel_eq</i>	RA expresion as the AK_list
---------------------	-----------------------------

Returns

optimised RA expresion as the AK_list

5.50.2.7 AK_rel_eq_projection_attributes()

```
char* AK_rel_eq_projection_attributes (
    char * attrs,
    char * tblName )
```

Function used for filtering and returning only those attributes from list of projection attributes that exist in the given table

Author

Dino Laktašić.

1. Get the attributes for a given table and store them to the AK_list
2. Tokenize set of projection attributes and store them to the array
3. For each attribute in the array check if exists in the previously created AK_list
4. if exists append attribute to the dynamic atributes char array
5. return pointer to char array with stored attribute/s

Parameters

<i>*attrs</i>	projection attributes delimited by ";" (ATTR_DELIMITER)
<i>*tblName</i>	name of the table

Returns

filtered list of projection attributes as the AK_list

5.50.2.8 AK_rel_eq_projection_test()

```
TestResult AK_rel_eq_projection_test ( )
```

Function for testing rel_eq_selection.

Author

Dino Laktašić.

Returns

No return value

5.50.2.9 AK_rel_eq_remove_duplicates()

```
char* AK_rel_eq_remove_duplicates (
    char * attrs )
```

Function which removes duplicate attributes from attributes expresion.

Author

Dino Laktašić.

Parameters

<i>*attrs</i>	attributes from which to remove duplicates
---------------	--------------------------------------------

Returns

pointer to char array without duplicate attributes

5.51 opti/rel_eq_projection.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../auxi/mempro.h"
```

Include dependency graph for rel_eq_projection.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_rel_eq_is_subset](#) (struct [list_node](#) *list_elem_set, struct [list_node](#) *list_elem_subset)
Function that checks if some set of attributes is subset of larger set, used in cascading of the projections.
- int [AK_rel_eq_can_commute](#) (struct [list_node](#) *list_elem_attrs, struct [list_node](#) *list_elem_conds)
Function that checks if selection uses only attributes retained by the projection before commuting.
- struct [list_node](#) * [AK_rel_eq_get_attributes](#) (char *tblName)
Function that gets attributes for a given table and store them to the struct [list_node](#).
- char * [AK_rel_eq_projection_attributes](#) (char *attrs, char *tblName)
Function used for filtering and returning only those attributes from list of projection attributes that exist in the given table

- char * [AK_rel_eq_collect_cond_attributes](#) (struct [list_node](#) *list_elem)
Function used for filtering and returning only attributes from selection or theta_join condition.
- char * [AK_rel_eq_remove_duplicates](#) (char *attribs)
Function which removes duplicate attributes from attributes expresion.
- struct [list_node](#) * [AK_rel_eq_projection](#) (struct [list_node](#) *list_rel_eq)
Main function for generating RA expresion according to projection equivalence rules.
- void [AK_print_rel_eq_projection](#) (struct [list_node](#) *list_rel_eq)
Function for printing AK_list to the screen.
- [TestResult](#) [AK_rel_eq_projection_test](#) ()
Function for testing rel_eq_selection.

5.51.1 Detailed Description

Header file that provides data structures, functions and defines for relational equivalences in projection

5.51.2 Function Documentation

5.51.2.1 AK_print_rel_eq_projection()

```
void AK_print_rel_eq_projection (
    struct list\_node * list_rel_eq )
```

Function for printing AK_list to the screen.

Author

Dino Laktašić.

Parameters

<i>*list_rel_eq</i>	RA expresion as the AK_list
---------------------	-----------------------------

Returns

No return value

5.51.2.2 AK_rel_eq_can_commute()

```
int AK_rel_eq_can_commute (
    struct list\_node * list_elem_attribs,
    struct list\_node * list_elem_conds )
```

Function that checks if selection uses only attributes retained by the projection before commuting.

Author

Dino Laktašić.

1. Tokenize set of projection attributes and store them to the array
2. For each attribute in selection condition check if exists in array of projection attributes
3. if exists increment match variable and break
4. else continue checking until the final attribute is checked
5. if match variable value equals 0 than return 0
6. else if match variable value greater than EXIT_SUCCESS, return EXIT_FAILURE

Parameters

<i>list_elem_attrbs</i>	list element containing projection data
<i>list_elem_conds</i>	list element containing selection condition data

Returns

EXIT_SUCCESS if selection uses only attributes retained by projection, else returns EXIT_FAILURE

5.51.2.3 AK_rel_eq_collect_cond_attributes()

```
char* AK_rel_eq_collect_cond_attributes (
    struct list_node * list_elem )
```

Function used for filtering and returning only attributes from selection or theta_join condition.

Author

Dino Laktašić.

Parameters

<i>list_elem</i>	list element that contains selection or theta_join condition data
------------------	-------------------------------------------------------------------

Returns

only attributes from selection or theta_join condition as the AK_list

5.51.2.4 AK_rel_eq_get_attributes()

```
struct list_node* AK_rel_eq_get_attributes (
    char * tblName )
```

Function that gets attributes for a given table and store them to the struct [list_node](#).

Author

Dino Laktašić.

1. Get the number of attributes in a given table
2. Get the table header for a given table
3. Initialize struct `list_node`
4. For each attribute in table header, insert attribute in struct `list_node` as new struct `list_node` element
5. return struct `list_node`

Parameters

<i>*tblName</i>	name of the table
-----------------	-------------------

Returns

struct `list_node`

5.51.2.5 AK_rel_eq_is_subset()

```
int AK_rel_eq_is_subset (
    struct list_node * list_elem_set,
    struct list_node * list_elem_subset )
```

Function that checks if some set of attributes is subset of larger set, used in cascading of the projections.

Author

Dino Laktašić.

1. Tokenize set and subset of projection attributes and store each of them to it's own array
2. Check if the size of subset array is larger than the size of set array
3. if the subset array is larger return 0
4. else sort both arrays ascending
5. Compare the subset and set items at the same positions, starting from 0
6. if there is an item in the subset array that doesn't match attribute at the same position in the set array return 0
7. else continue comparing until final item in the subset array is reached
8. on loop exit return EXIT_SUCCESS

Parameters

<i>list_elem_set</i>	first list element containing projection attributes
<i>list_elem_subset</i>	second list element containing projection attributes

Returns

EXIT_SUCCESS if some set of attributes is subset of larger set, else returns EXIT_FAILURE

Author

Dino Laktašić. =====> Optimization plan using Relational Algebra Equivalences <=====

Equivalence rule that apply on every equivalent expresion generated by Query optimizer

Rules to implement Rule 1. projection comutes with selection that only uses attributes retained by the projection $p[L](s[L1](R)) = s[L1](p[L](R))$ Rule 2. only the last in a sequence of projection operations is needed, the others can be omitted. $p[L1] = p[L1](R)$ Rule 3a. distribution according to theta join, only if join includes attributes from $L1 \cup L2$ $p[L1 \cup L2](R1 \bowtie R2) = (p[L1](R1)) \bowtie (p[L2](R2))$ Rule 3b. Let $L1 \cup L2$ be attributes from $R1$ and $R2$, respectively. Let $L3$ be attributes from $R1$, but are not in $L1 \cup L2$ and let $L4$ be attributes from $R2$, but are not in $L1 \cup L2$. $p[L1 \cup L2](R1 \bowtie R2) = p[L1 \cup L2]((p[L1 \cup L3](R1)) \bowtie (p[L2 \cup L4](R2)))$ Rule 4. distribution according to union $p[L](R1 \cup R2) = (p[L](R1)) \cup (p[L](R2))$

Author

Dino Laktašić.

1. Tokenize set and subset of projection attributes and store each of them to it's own array
2. Check if the size of subset array is larger than the size of set array
3. if the subset array is larger return 0
4. else sort both arrays ascending
5. Compare the subset and set items at the same positions, starting from 0
6. if there is an item in the subset array that doesn't match attribute at the same position in the set array return 0
7. else continue comparing until final item in the subset array is ritched
8. on loop exit return EXIT_SUCCESS

Parameters

<i>list_elem_set</i>	first list element containing projection attributes
<i>list_elem_subset</i>	second list element containing projection attributes

Returns

EXIT_SUCCESS if some set of attributes is subset of larger set, else returns EXIT_FAILURE

5.51.2.6 AK_rel_eq_projection()

```
struct list_node* AK_rel_eq_projection (
    struct list_node * list_rel_eq )
```

Main function for generating RA expresion according to projection equivalence rules.

Author

Dino Laktašić.

Parameters

<i>*list_rel_eq</i>	RA expresion as the AK_list
---------------------	-----------------------------

Returns

optimised RA expresion as the AK_list

5.51.2.7 AK_rel_eq_projection_attributes()

```
char* AK_rel_eq_projection_attributes (
    char * attrs,
    char * tblName )
```

Function used for filtering and returning only those attributes from list of projection attributes that exist in the given table

Author

Dino Laktašić.

1. Get the attributes for a given table and store them to the AK_list
2. Tokenize set of projection attributes and store them to the array
3. For each attribute in the array check if exists in the previously created AK_list
4. if exists append attribute to the dynamic atributes char array
5. return pointer to char array with stored attribute/s

Parameters

<i>*attrs</i>	projection attributes delimited by ";" (ATTR_DELIMITER)
<i>*tblName</i>	name of the table

Returns

filtered list of projection attributes as the AK_list

5.51.2.8 AK_rel_eq_projection_test()

```
TestResult AK_rel_eq_projection_test ( )
```

Function for testing rel_eq_selection.

Author

Dino Laktašić.

Returns

No return value

5.51.2.9 AK_rel_eq_remove_duplicates()

```
char* AK_rel_eq_remove_duplicates (
    char * attribs )
```

Function which removes duplicate attributes from attributes expresion.

Author

Dino Laktašić.

Parameters

<i>*attribs</i>	attributes from which to remove duplicates
-----------------	--------------------------------------------

Returns

pointer to char array without duplicate attributes

5.52 opti/rel_eq_selection.c File Reference

```
#include "rel_eq_selection.h"
#include "../auxi/auxiliary.h"
Include dependency graph for rel_eq_selection.c:
```

Functions

- int [AK_rel_eq_is_attr_subset](#) (char *set, char *subset)
Function that checks if some set of attributes is subset of larger set.
- char * [AK_rel_eq_get_attributes_char](#) (char *tblName)
Function that fetches attributes for a given table and store them to the char array.
- char * [AK_rel_eq_cond_attributes](#) (char *cond)
Function for filtering and returning attributes from condition.
- int [AK_rel_eq_share_attributes](#) (char *set, char *subset)
Function that checks if two sets share one or more of it's attributes.
- struct [list_node](#) * [AK_rel_eq_split_condition](#) (char *cond)
Function that checks if selection can commute with theta-join or product (if working with conditions in infix format use this function instead - also remember to change code at the other places)

- struct [list_node](#) * [AK_rel_eq_selection](#) (struct [list_node](#) *list_rel_eq)
Main function for generating RA expresion according to selection equivalence rules.
- void [AK_print_rel_eq_selection](#) (struct [list_node](#) *list_rel_eq)
Function for printing struct [list_node](#) to the screen.
- [TestResult AK_rel_eq_selection_test](#) ()
Function for testing rel_eq_selection.

5.52.1 Detailed Description

Provides functions for for relational equivalences in selection

5.52.2 Function Documentation

5.52.2.1 [AK_print_rel_eq_selection\(\)](#)

```
void AK_print_rel_eq_selection (
    struct list\_node * list_rel_eq )
```

Function for printing struct [list_node](#) to the screen.

Author

Dino Laktašić.

Parameters

*list_rel_eq	RA expresion as the struct list_node
------------------------------	------------------------------------------------------

Returns

void

5.52.2.2 [AK_rel_eq_cond_attributes\(\)](#)

```
char* AK_rel_eq_cond_attributes (
    char * cond )
```

Function for filtering and returning attributes from condition.

Author

Dino Laktašić.

Parameters

<i>*cond</i>	condition array that contains condition data
--------------	----------------------------------------------

Returns

pointer to array that contains attributes for a given condition

5.52.2.3 AK_rel_eq_get_attributes_char()

```
char* AK_rel_eq_get_attributes_char (
    char * tblName )
```

Function that fetches attributes for a given table and store them to the char array.

Author

Dino Laktašić.

1. Get the number of attributes in a given table
2. If there is no attributes return NULL
3. Get the table header for a given table
4. Initialize struct [list_node](#)
5. For each attribute in table header, insert attribute in the array
6. Delimit each new attribute with ";" (ATTR_DELIMITER)
7. return pointer to char array

Parameters

<i>*tblName</i>	name of the table
-----------------	-------------------

Returns

pointer to char array

5.52.2.4 AK_rel_eq_is_attr_subset()

```
int AK_rel_eq_is_attr_subset (
    char * set,
    char * subset )
```

Function that checks if some set of attributes is subset of larger set.

Author

Dino Laktašić.

1. Tokenize set and subset of projection attributes and store each of them to it's own array
2. Check if the size of subset array is larger than the size of set array
3. if the subset array is larger return 0
4. else sort both arrays ascending
5. Compare the subset and set items at the same positions, starting from 0
6. if there is an item in the subset array that doesn't match attribute at the same position in the set array return 0
7. else continue comparing until final item in the subset array is reached
8. on loop exit return EXIT_SUCCESS

Parameters

<i>*set</i>	set array
<i>*subset</i>	subset array

Returns

EXIT_SUCCESS if some set of attributes is subset of larger set, else returns EXIT_FAILURE

5.52.2.5 AK_rel_eq_selection()

```
struct list_node* AK_rel_eq_selection (
    struct list_node * list_rel_eq )
```

Main function for generating RA expression according to selection equivalence rules.

Author

Dino Laktašić.

Parameters

<i>*list_rel_eq</i>	RA expression as the struct list_node
---------------------	-------------------------------------------------------

Returns

optimised RA expression as the struct [list_node](#)

5.52.2.6 AK_rel_eq_selection_test()

```
TestResult AK_rel_eq_selection_test ( )
```

Function for testing `rel_eq_selection`.

Author

Dino Laktašić.

Returns

No return value

5.52.2.7 AK_rel_eq_share_attributes()

```
int AK_rel_eq_share_attributes (
    char * set,
    char * subset )
```

Function that checks if two sets share one or more of it's attributes.

Author

Dino Laktašić.

1. If is empty set or subset returns EXIT_FAILURE
2. For each attribute in one set check if there is same attribute in the second set
3. If there is the same attribute return EXIT_SUCCESS
4. else remove unused pointers and return EXIT_FAILURE

Parameters

<i>*set</i>	first set of attributes delimited by ";" (ATTR_DELIMITER)
<i>*subset</i>	second set of attributes delimited by ";" (ATTR_DELIMITER)

Returns

EXIT_SUCCESS if set and subset share at least one attribute, else returns EXIT_FAILURE

5.52.2.8 AK_rel_eq_split_condition()

```
struct list_node* AK_rel_eq_split_condition (
    char * cond )
```

Function that checks if selection can commute with theta-join or product (if working with conditions in infix format use this function instead - also remember to change code at the other places)

Break conjunctive conditions to individual conditions.

Author

Dino Laktašić.

1. For each token (delimited by " ") in selection condition first check if token represents attribute/s and is subset in the given table
2. If token is a subset set variable id to 1
3. else check if token differs from "OR", and if so, set id to 0, else make no changes to variable id
4. if token equals to "AND" and id equals to 1 append collected conds to result condition
5. else if token equals to "AND" and id equals to 0 discharge collected conds
6. else append token to collected data
7. When exits from loop if id greater then 0, append the last collected data to result
8. return pointer to char array that contains new condition for a given table

Parameters

<i>*cond</i>	condition array that contains condition data
<i>*tblName</i>	name of the table

Returns

pointer to char array that contains new condition for a given table

Author

Dino Laktašić.

Break conjunctive conditions to individual conditions (currently not used - commented in main AK_rel_eq_selection function), it can be usefull in some optimization cases

1. For each delimited item (' AND ') insert item to the struct [list_node](#)
2. Remove unused pointers and return the conditions list

Parameters

<i>*cond</i>	condition expression
--------------	----------------------

Returns

conditions list

5.53 opti/rel_eq_selection.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../auxi/mempro.h"
```

Include dependency graph for rel_eq_selection.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_rel_eq_is_attr_subset](#) (char *set, char *subset)
Function that checks if some set of attributes is subset of larger set.
- char * [AK_rel_eq_get_attributes_char](#) (char *tblName)
Function that fetches attributes for a given table and store them to the char array.
- char * [AK_rel_eq_cond_attributes](#) (char *cond)
Function for filtering and returning attributes from condition.
- int [AK_rel_eq_share_attributes](#) (char *set, char *subset)
Function that checks if two sets share one or more of it's attributes.
- struct [list_node](#) * [AK_rel_eq_split_condition](#) (char *cond)
Break conjunctive conditions to individual conditions.
- struct [list_node](#) * [AK_rel_eq_selection](#) (struct [list_node](#) *list_rel_eq)
Main function for generating RA expresion according to selection equivalence rules.
- void [AK_print_rel_eq_selection](#) (struct [list_node](#) *list_rel_eq)
Function for printing struct [list_node](#) to the screen.
- [TestResult](#) [AK_rel_eq_selection_test](#) ()
Function for testing rel_eq_selection.

5.53.1 Detailed Description

Header file that provides data structures, functions and defines for relational equivalences in selection

5.53.2 Function Documentation

5.53.2.1 [AK_print_rel_eq_selection\(\)](#)

```
void AK_print_rel_eq_selection (
    struct list\_node * list_rel_eq )
```

Function for printing struct [list_node](#) to the screen.

Author

Dino Laktašić.

Parameters

<i>*list_rel_eq</i>	RA expresion as the struct list_node
---------------------	------------------------------------------------------

Returns

void

5.53.2.2 AK_rel_eq_cond_attributes()

```
char* AK_rel_eq_cond_attributes (
    char * cond )
```

Function for filtering and returning attributes from condition.

Author

Dino Laktašić.

Parameters

<i>*cond</i>	condition array that contains condition data
--------------	----------------------------------------------

Returns

pointer to array that contains attributes for a given condition

5.53.2.3 AK_rel_eq_get_attributes_char()

```
char* AK_rel_eq_get_attributes_char (
    char * tblName )
```

Function that fetches attributes for a given table and store them to the char array.

Author

Dino Laktašić.

Parameters

<i>*tblName</i>	name of the table
-----------------	-------------------

Returns

pointer to char array

Author

Dino Laktašić.

1. Get the number of attributes in a given table
2. If there is no attributes return NULL
3. Get the table header for a given table
4. Initialize struct [list_node](#)
5. For each attribute in table header, insert attribute in the array

6. Delimit each new attribute with ";" (ATTR_DELIMITER)
7. return pointer to char array

Parameters

<i>*tblName</i>	name of the table
-----------------	-------------------

Returns

pointer to char array

5.53.2.4 AK_rel_eq_is_attr_subset()

```
int AK_rel_eq_is_attr_subset (
    char * set,
    char * subset )
```

Function that checks if some set of attributes is subset of larger set.

Author

Dino Laktašić.

Parameters

<i>*set</i>	set array
<i>*subset</i>	subset array

Returns

EXIT_SUCCESS if some set of attributes is subset of larger set, else returns EXIT_FAILURE

Author

Dino Laktašić.

1. Tokenize set and subset of projection attributes and store each of them to it's own array
2. Check if the size of subset array is larger than the size of set array
3. if the subset array is larger return 0
4. else sort both arrays ascending
5. Compare the subset and set items at the same positions, starting from 0
6. if there is an item in the subset array that doesn't match attribute at the same position in the set array return 0
7. else continue comparing until final item in the subset array is reached
8. on loop exit return EXIT_SUCCESS

Parameters

<i>*set</i>	set array
<i>*subset</i>	subset array

Returns

EXIT_SUCCESS if some set of attributes is subset of larger set, else returns EXIT_FAILURE

5.53.2.5 AK_rel_eq_selection()

```
struct list_node* AK_rel_eq_selection (
    struct list_node * list_rel_eq )
```

Main function for generating RA expresion according to selection equivalence rules.

Author

Dino Laktašić.

Parameters

<i>*list_rel_eq</i>	RA expresion as the struct list_node
---------------------	------------------------------------------------------

Returns

optimised RA expresion as the struct [list_node](#)

5.53.2.6 AK_rel_eq_selection_test()

```
TestResult AK_rel_eq_selection_test ( )
```

Function for testing rel_eq_selection.

Author

Dino Laktašić.

Returns

No return value

5.53.2.7 AK_rel_eq_share_attributes()

```
int AK_rel_eq_share_attributes (
    char * set,
    char * subset )
```

Function that checks if two sets share one or more of it's attributes.

Author

Dino Laktašić.

Parameters

<i>*set</i>	first set of attributes delimited by ";" (ATTR_DELIMITER)
<i>*subset</i>	second set of attributes delimited by ";" (ATTR_DELIMITER)

Returns

EXIT_SUCCESS if set and subset share at least one attribute, else returns EXIT_FAILURE

Author

Dino Laktašić.

1. If is empty set or subset returns EXIT_FAILURE
2. For each attribute in one set check if there is same attribute in the second set
3. If there is the same attribute return EXIT_SUCCESS
4. else remove unused pointers and return EXIT_FAILURE

Parameters

<i>*set</i>	first set of attributes delimited by ";" (ATTR_DELIMITER)
<i>*subset</i>	second set of attributes delimited by ";" (ATTR_DELIMITER)

Returns

EXIT_SUCCESS if set and subset share at least one attribute, else returns EXIT_FAILURE

5.53.2.8 AK_rel_eq_split_condition()

```
struct list_node* AK_rel_eq_split_condition (
    char * cond )
```

Break conjunctive conditions to individual conditions.

Author

Dino Laktašić.

Parameters

<i>*cond</i>	condition expression
--------------	----------------------

Returns

conditions list

Break conjunctive conditions to individual conditions.

Author

Dino Laktašić.

1. For each token (delimited by " ") in selection condition first check if token represents attribute/s and is subset in the given table
2. If token is a subset set variable id to 1
3. else check if token differs from "OR", and if so, set id to 0, else make no changes to variable id
4. if token equals to "AND" and id equals to 1 append collected conds to result condition
5. else if token equals to "AND" and id equals to 0 discharge collected conds
6. else append token to collected data
7. When exits from loop if id greater then 0, append the last collected data to result
8. return pointer to char array that contains new condition for a given table

Parameters

<i>*cond</i>	condition array that contains condition data
<i>*tblName</i>	name of the table

Returns

pointer to char array that contains new condition for a given table

Author

Dino Laktašić.

Break conjunctive conditions to individual conditions (currently not used - commented in main AK_rel_eq_selection function), it can be usefull in some optimization cases

1. For each delimited item (' AND ') insert item to the struct [list_node](#)
2. Remove unused pointers and return the conditions list

Parameters

<i>*cond</i>	condition expression
--------------	----------------------

Returns

conditions list

5.54 rec/archive_log.h File Reference

```
#include "../file/table.h"
#include "sys/time.h"
```

```
#include <sys/types.h>
#include <sys/stat.h>
#include <fcntl.h>
#include "../auxi/mempro.h"
```

Include dependency graph for archive_log.h: This graph shows which files directly or indirectly include this file:

Functions

- void [AK_archive_log](#) (int sig)
Function for making archive log.
- char * [AK_get_timestamp](#) ()
Function that returns the current timestamp.

5.54.1 Detailed Description

Header file that provides functions and defines for archive logging

5.54.2 Function Documentation

5.54.2.1 AK_archive_log()

```
void AK_archive_log (
    int sig )
```

Function for making archive log.

Author

Dražen Bandić, update by Tomislav Turek

Returns

No return value

Function that creates a binary file that stores all commands that failed to execute with a number that shows the size of how many commands failed.

Todo this function takes static filename to store the failed commands, create certain logic that would make the function to use dynamic filename (this is partly implemented inside [AK_get_timestamp](#), but there is no logic that uses the last file when recovering - [recovery.c](#))
{link} [recovery.c](#) function test

Author

Dražen Bandić, update by Tomislav Turek

Returns

No return value

5.54.2.2 AK_get_timestamp()

```
char* AK_get_timestamp ( )
```

Function that returns the current timestamp.

Author

Dražen Bandić main logic, replaced by Tomislav Turek

Returns

char array in format day.month.year-hour:min:sec.usecu.bin

This function returns the current timestamp that could be concatenated to a log file in future usages.

Author

Dražen Bandić main logic, replaced by Tomislav Turek

Todo Think about this in the future when creating multiple binary recovery files. Implementation gives the timestamp, but is not used anywhere for now.

Returns

char array in format day.month.year-hour:min:sec.usecu.bin

5.55 rec/recovery.c File Reference

```
#include "recovery.h"
Include dependency graph for recovery.c:
```

Functions

- void [AK_recover_archive_log](#) (char *fileName)
Function that reads the binary file in which last commands were saved, and executes them.
- void [AK_recovery_insert_row](#) (char *table, int commandNumber)
Function that inserts a new row in the table with attributes.
- int [recovery_insert_row](#) (char *table, char **attr_name, char **attributes, int n, int *type)
Function that inserts row in table.
- char ** [AK_recovery_tokenize](#) (char *input, char *delimiter, int valuesOrNot)
Function that tokenizes the input with the given delimiter and puts them in an double pointer structure (so we can execute an insert)
- void [AK_recover_operation](#) (int sig)
Function that recovers and executes failed commands.
- [TestResult AK_recovery_test](#) ()
Function for recovery testing.
- void [AK_load_chosen_log](#) ()
Executes the recovery operation for the chosen bin file.
- void [AK_load_latest_log](#) ()
Executes the recovery operation for the latest bin file.

Variables

- short `grandfailure` = 0

5.55.1 Detailed Description

Provides recovery functions.

5.55.2 Function Documentation

5.55.2.1 `AK_load_chosen_log()`

```
void AK_load_chosen_log ( )
```

Executes the recovery operation for the chosen bin file.

Function lists the contents of the `archive_log` directory. The user then types in the name of the desired bin file to open and perform the necessary actions.

Author

Matija Večenaj

Parameters

<i>none</i>	
-------------	--

Returns

no value

5.55.2.2 `AK_load_latest_log()`

```
void AK_load_latest_log ( )
```

Executes the recovery operation for the latest bin file.

Function reads the `latest.txt` file which contains the name of the latest bin file that's been created. Then it loads it and does the necessary recovery operations.

Author

Matija Večenaj

Parameters

<i>none</i>	
-------------	--

Returns

no value

5.55.2.3 AK_recover_archive_log()

```
void AK_recover_archive_log (  
    char * fileName )
```

Function that reads the binary file in which last commands were saved, and executes them.

Function opens the recovery binary file and executes all commands that were saved inside the redo_log structure

Author

Dražen Bandić, update by Tomislav Turek

Parameters

<i>fileName</i>	- name of the archive log
-----------------	---------------------------

Returns

no value

5.55.2.4 AK_recover_operation()

```
void AK_recover_operation (  
    int sig )
```

Function that recovers and executes failed commands.

Function is called when SIGINT signal is sent to the system. All commands that are written to rec.bin file are recovered to the designated structure and then executed.

Author

Tomislav Turek

Parameters

<i>sig</i>	required integer parameter for SIGINT handler functions
------------	---------------------------------------------------------

5.55.2.5 AK_recovery_insert_row()

```
void AK_recovery_insert_row (
    char * table,
    int commandNumber )
```

Function that inserts a new row in the table with attributes.

Function is given the table name with desired data that should be inserted inside. By using the table name, function retrieves table attributes names and their types which uses afterwards for insert_data_test function to insert data to designated table.

Author

Dražen Bandić, updated by Tomislav Turek

Parameters

<i>table</i>	- table name to insert to
<i>commandNumber</i>	- number of current command

Returns

no value

5.55.2.6 AK_recovery_test()

```
TestResult AK_recovery_test ( )
```

Function for recovery testing.

Function does nothing while waiting a SIGINT signal (signal represents // doxygen @ for full description ??? system failure). Upon retrieving the signal it calls function AK_recover_operation which starts the recovery by building commands. To comply with the designated structure [AK_command_recovery_struct](#) // {link} to struct ??? it writes dummy commands to the file log.log

Author

Tomislav Turek

5.55.2.7 AK_recovery_tokenize()

```
char** AK_recovery_tokenize (
    char * input,
    char * delimiter,
    int valuesOrNot )
```

Function that tokenizes the input with the given delimiter and puts them in an double pointer structure (so we can execute an insert)

Author

Dražen Bandić

Parameters

<i>input</i>	- input to tokenize
<i>delimiter</i>	- delimiter
<i>valuesOrNot</i>	- 1 if the input are values, 0 otherwise

Returns

new double pointer structure with tokens

5.55.2.8 recovery_insert_row()

```
int recovery_insert_row (
    char * table,
    char ** attr_name,
    char ** attributes,
    int n,
    int * type )
```

Function that inserts row in table.

Author

Danko Bukovac

Returns

EXIT_SUCCESS if insert is successful, else EXIT_FAILURE

5.55.3 Variable Documentation

5.55.3.1 grandfailure

```
short grandfailure = 0
```

this variable flags if system failed

5.56 rec/redo_log.c File Reference

```
#include "redo_log.h"
Include dependency graph for redo_log.c:
```

Functions

- int [AK_add_to_redolog](#) (int [command](#), struct [list_node](#) *[row_root](#))
Function that adds a new element to redolog.
- void [AK_redolog_commit](#) ()
- int [AK_add_to_redolog_select](#) (int [command](#), struct [list_node](#) *[condition](#), char *[srcTable](#))
Function that adds a new select to redolog, commented code with the new select from [select.c](#), current code works with [selection.c](#).
- int [AK_check_redo_log_select](#) (int [command](#), struct [list_node](#) *[condition](#), char *[srcTable](#))
Function that checks redolog for select, works only with [selection.c](#), not [select.c](#).
- void [AK_printout_redolog](#) ()
Function that prints out the content of redolog memory.
- char * [AK_check_attributes](#) (char *[attributes](#))
Function that checks if the attribute contains '|', and if it does it replaces it with "||".

5.56.1 Detailed Description

Provides redolog functions.

5.56.2 Function Documentation

5.56.2.1 AK_add_to_redolog()

```
int AK_add_to_redolog (
    int command,
    struct list\_node * row\_root )
```

Function that adds a new element to redolog.

Author

Krunoslav Bilić updated by Dražen Bandić, second update by Tomislav Turek

Returns

EXIT_FAILURE if not allocated memory for ispis, otherwise EXIT_SUCCESS

5.56.2.2 AK_add_to_redolog_select()

```
int AK_add_to_redolog_select (
    int command,
    struct list_node * condition,
    char * srcTable )
```

Function that adds a new select to redolog, commented code with the new select from [select.c](#), current code works with [selection.c](#).

Author

Danko Bukovac

Returns

EXIT_FAILURE if not allocated memory for ispis, otherwise EXIT_SUCCESS

5.56.2.3 AK_check_attributes()

```
char* AK_check_attributes (
    char * attributes )
```

Function that checks if the attribute contains '|', and if it does it replaces it with "\\|".

Author

Dražen Bandić

Returns

new attribute

5.56.2.4 AK_check_redo_log_select()

```
int AK_check_redo_log_select (
    int command,
    struct list_node * condition,
    char * srcTable )
```

Function that checks redolog for select, works only with [selection.c](#), not [select.c](#).

Author

Danko Bukovac

Returns

0 if select was not found, otherwise 1

5.56.2.5 AK_printout_redolog()

```
void AK_printout_redolog ( )
```

Function that prints out the content of redolog memory.

Author

Krunoslav Bilić updated by Dražen Bandić, second update by Tomislav Turek

Returns

No return value.

5.57 rel/aggregation.c File Reference

```
#include "aggregation.h"
```

Include dependency graph for aggregation.c:

Functions

- [search_result AK_search_unsorted](#) (char *szRelation, [search_params](#) *aspParams, int iNum_search_↔
params)
Function that searches through unsorted values of multiple attributes in a segment. Only tuples that are equal on all given attribute values are returned (A == 1 AND B == 7 AND ...). SEARCH_RANGE is inclusive. Only one value (or range) per attribute allowed - use [search_params.pData_lower](#) for SEARCH_PARTICULAR. Supported types for SEARCH_RANGE: TYPE_INT, TYPE_FLOAT, TYPE_NUMBER, TYPE_DATE, TYPE_DATETIME, TYPE_TIME. Do not provide the wrong data types in the array of search parameters. There is no way to test for that and it could cause a memory access violation.
- int [AK_header_size](#) (AK_header *header)
Function that calculates how many attributes there are in the header with a while loop.
- void [AK_agg_input_init](#) (AK_agg_input *input)
Function that initializes the input object for aggregation with init values.
- int [AK_agg_input_add](#) (AK_header header, int agg_task, [AK_agg_input](#) *input)
Function that adds a header with a task in input object for aggregation.
- int [AK_agg_input_add_to_beginning](#) (AK_header header, int agg_task, [AK_agg_input](#) *input)
Function that adds a header with a task on the beginning of the input object for aggregation. With the use of for loop existing attributes and tasks are moved from one place forward in input object.
- void [AK_agg_input_fix](#) (AK_agg_input *input)
function that handles AVG (average) aggregation. It goes through array of tasks in input object until it comes to task with a value of -1. While loop examines whether the task in array is equal to AGG_TASK_AVG. If so, AGG_TASK_↔_AVG_COUNT is put on the beginning of input object. After that, AGG_TASK_AVG_SUM is put on the beginning of input object.
- int [AK_aggregation](#) (AK_agg_input *input, char *source_table, char *agg_table)
Function that aggregates a given table by given attributes. Firstly, AGG_TASK_AVG_COUNT and AGG_TASK_↔_AVG_SUM are put on the beginning of the input object. Then for loop iterates through input tasks and assigns the type of aggregation operation according to aggregation operation. New table has to be created. For loop goes through given table. GROUP operation is executed separately from other operations. Addresses of records are put in needed_values array and results are put in new table.
- [TestResult AK_aggregation_test](#) ()

5.57.1 Detailed Description

Provides functions for aggregation and grouping

5.57.2 Function Documentation

5.57.2.1 AK_agg_input_add()

```
int AK_agg_input_add (
    AK_header header,
    int agg_task,
    AK_agg_input * input )
```

Function that adds a header with a task in input object for aggregation.

Author

Dejan Frankovic

Parameters

<i>header</i>	a header that is being aggregated
<i>agg_task</i>	the task which is to be done on the header
<i>input</i>	the input object

Returns

On success, returns EXIT_SUCCESS, otherwise EXIT_FAILURE

5.57.2.2 AK_agg_input_add_to_beginning()

```
int AK_agg_input_add_to_beginning (
    AK_header header,
    int agg_task,
    AK_agg_input * input )
```

Function that adds a header with a task on the beginning of the input object for aggregation. With the use of for loop existing attributes and tasks are moved from one place forward in input object.

Author

Dejan Frankovic

Parameters

<i>header</i>	a header that is being aggregated
<i>agg_task</i>	the task which is to be done on the header
<i>input</i>	the input object

Returns

On success, returns EXIT_SUCCESS, otherwise EXIT_FAILURE

5.57.2.3 AK_agg_input_fix()

```
void AK_agg_input_fix (
    AK_agg_input * input )
```

function that handles AVG (average) aggregation. It goes through array of tasks in input object until it comes to task with a value of -1. While loop examines whether the task in array is equal to AGG_TASK_AVG. If so, AGG_TASK_AVG_COUNT is put on the beginning of input object. After that, AGG_TASK_AVG_SUM is put on the beginning of input object.

Author

Dejan Frankovic

Parameters

<i>input</i>	the input object
--------------	------------------

Returns

No return value

5.57.2.4 AK_agg_input_init()

```
void AK_agg_input_init (
    AK_agg_input * input )
```

Function that initializes the input object for aggregation with init values.

Author

Dejan Frankovic

Parameters

<i>input</i>	the input object
--------------	------------------

Returns

No return value

5.57.2.5 AK_aggregation()

```
int AK_aggregation (
    AK_agg_input * input,
    char * source_table,
    char * agg_table )
```

Function that aggregates a given table by given attributes. Firstly, AGG_TASK_AVG_COUNT and AGG_TASK_AVG_SUM are put on the beginning of the input object. Then for loop iterates through input tasks and assigns the type of aggregation operation according to aggregation operation. New table has to be created. For loop goes through given table. GROUP operation is executed separately from other operations. Addresses of records are put in needed_values array and results are put in new table.

Author

Dejan Frankovic

Parameters

<i>input</i>	input object with list of attributes by which we aggregate and types of aggregations
<i>source_table</i>	- table name for the source table
<i>agg_table</i>	table name for aggregated table

Returns

EXIT_SUCCESS if continues successfully, when not EXIT_ERROR

THIS SINGLE LINE BELOW (memcpy) is the purpose of ALL evil in the world! This line is the reason why test function prints one extra empty row with "nulls" at the end! Trust me! Comment it, and you will see - test function will not print extra row with nulls (but counts and averages in table will be all messed up!) After two days of hard research, I still have not found what is the reason behind printing extra row at the end! Fellow programmer, if you really really want to solve this issue, arm yourself with at least 2 liters of hot coffee!

What this line does? What is the purpose of this line in the universe? Well, fellow programmer, this line sets the initial count to 1. That means if name "Ivan" is found, it will have count of 1 because, well, that's the first Ivan that is found! If function finds another Ivan (which, actually, will happen), this part of code will not handle it (other part of code will).

That actually means that this little piece of code (this line below) only (and ONLY) sets count to 1! And besides that causes every other evil in the world. :O

P.S. The reason for that may be in linked list, or in [AK_insert_row\(\)](#) You'll have to check every piece of AKDB code to find cause! I have found out that additional line is added when `k == 25`. There may be problem in linked lists or in `AK_insert_row` function or somewhere else. Who knows.

If I didn't handle that last row (which has one attribute of size 0), test would not pass!

Good luck, fellow programmer!

5.57.2.6 AK_aggregation_test()

```
TestResult AK_aggregation_test ( )
```

checking results

This variable was added to handle bug described in this file.

5.57.2.7 AK_header_size()

```
int AK_header_size (
    AK_header * header )
```

Function that calculates how many attributes there are in the header with a while loop.

Author

Dejan Frankovic

Parameters

<i>header</i>	A header array
---------------	----------------

Returns

Number of attributes defined in header array

5.57.2.8 AK_search_unsorted()

```
search_result AK_search_unsorted (
    char * szRelation,
    search_params * aspParams,
    int iNum_search_params )
```

Function that searches through unsorted values of multiple attributes in a segment. Only tuples that are equal on all given attribute values are returned (`A == 1 AND B == 7 AND ...`). `SEARCH_RANGE` is inclusive. Only one value (or range) per attribute allowed - use [search_params.pData_lower](#) for `SEARCH_PARTICULAR`. Supported types for `SEARCH_RANGE`: `TYPE_INT`, `TYPE_FLOAT`, `TYPE_NUMBER`, `TYPE_DATE`, `TYPE_DATETIME`, `TYPE_TIME`. Do not provide the wrong data types in the array of search parameters. There is no way to test for that and it could cause a memory access violation.

Author

Miroslav Policki

Parameters

<i>szRelation</i>	relation name
<i>aspParams</i>	array of search parameters
<i>iNum_search_params</i>	number of search parameters

Returns

[search_result](#) structure defined in [filesearch.h](#). Use `AK_deallocate_search_result` to deallocate.

iterate through all the blocks

count number of attributes in segment/relation

determine index of attributes on which search will be performed

if any of the provided attributes are not found in the relation, return empty result

in every tuple, for all required attributes, compare attribute value with searched-for value and store matched tuple addresses

5.58 rel/aggregation.h File Reference

```
#include "../auxi/test.h"
#include "selection.h"
#include "projection.h"
#include "../file/filesearch.h"
#include "../auxi/mempro.h"
#include "../sql/drop.h"
```

Include dependency graph for aggregation.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [AK_agg_value](#)
Structure that contains attribute name, date and aggregation task associated.
- struct [AK_agg_input](#)
Structure that contains attributes from table header, tasks for this table and counter value.

Macros

- `#define AGG_TASK_GROUP 1`
- `#define AGG_TASK_COUNT 2`
- `#define AGG_TASK_SUM 3`
- `#define AGG_TASK_MAX 4`
- `#define AGG_TASK_MIN 5`
- `#define AGG_TASK_AVG 6`
- `#define AGG_TASK_AVG_COUNT 10`
- `#define AGG_TASK_AVG_SUM 11`

Functions

- `int AK_header_size (AK_header *)`
Function that calculates how many attributes there are in the header with a while loop.
- `void AK_agg_input_init (AK_agg_input *input)`
Function that initializes the input object for aggregation with init values.
- `int AK_agg_input_add (AK_header header, int agg_task, AK_agg_input *input)`
Function that adds a header with a task in input object for aggregation.
- `int AK_agg_input_add_to_beginning (AK_header header, int agg_task, AK_agg_input *input)`
Function that adds a header with a task on the beginning of the input object for aggregation. With the use of for loop existing attributes and tasks are moved from one place forward in input object.
- `void AK_agg_input_fix (AK_agg_input *input)`
function that handles AVG (average) aggregation. It goes through array of tasks in input object until it comes to task with a value of -1. While loop examines whether the task in array is equal to AGG_TASK_AVG. If so, AGG_TASK_AVG_COUNT is put on the beginning of input object. After that, AGG_TASK_AVG_SUM is put on the beginning of input object.
- `int AK_aggregation (AK_agg_input *input, char *source_table, char *agg_table)`
Function that aggregates a given table by given attributes. Firstly, AGG_TASK_AVG_COUNT and AGG_TASK_AVG_SUM are put on the beginning of the input object. Then for loop iterates through input tasks and assigns the type of aggregation operation according to aggregation operation. New table has to be created. For loop goes through given table. GROUP operation is executed separately from other operations. Addresses of records are put in needed_values array and results are put in new table.
- `TestResult AK_aggregation_test ()`

5.58.1 Detailed Description

Header file that provides data structures, functions and defines for aggregation and grouping

5.58.2 Function Documentation

5.58.2.1 AK_agg_input_add()

```
int AK_agg_input_add (
    AK_header header,
    int agg_task,
    AK_agg_input * input )
```

Function that adds a header with a task in input object for aggregation.

Author

Dejan Frankovic

Parameters

<i>header</i>	a header that is being aggregated
<i>agg_task</i>	the task which is to be done on the header
<i>input</i>	the input object

Returns

On success, returns EXIT_SUCCESS, otherwise EXIT_FAILURE

5.58.2.2 AK_agg_input_add_to_beginning()

```
int AK_agg_input_add_to_beginning (
    AK_header header,
    int agg_task,
    AK_agg_input * input )
```

Function that adds a header with a task on the beginning of the input object for aggregation. With the use of for loop existing attributes and tasks are moved from one place forward in input object.

Author

Dejan Frankovic

Parameters

<i>header</i>	a header that is being aggregated
<i>agg_task</i>	the task which is to be done on the header
<i>input</i>	the input object

Returns

On success, returns EXIT_SUCCESS, otherwise EXIT_FAILURE

5.58.2.3 AK_agg_input_fix()

```
void AK_agg_input_fix (
    AK_agg_input * input )
```

function that handles AVG (average) aggregation. It goes through array of tasks in input object until it comes to task with a value of -1. While loop examines whether the task in array is equal to AGG_TASK_AVG. If so, AGG_TASK_AVG_COUNT is put on the beginning of input object. After that, AGG_TASK_AVG_SUM is put on the beginning of input object.

Author

Dejan Frankovic

Parameters

<i>input</i>	the input object
--------------	------------------

Returns

No return value

5.58.2.4 AK_agg_input_init()

```
void AK_agg_input_init (
    AK_agg_input * input )
```

Function that initializes the input object for aggregation with init values.

Author

Dejan Frankovic

Parameters

<i>input</i>	the input object
--------------	------------------

Returns

No return value

5.58.2.5 AK_aggregation()

```
int AK_aggregation (
    AK_agg_input * input,
    char * source_table,
    char * agg_table )
```

Function that aggregates a given table by given attributes. Firstly, AGG_TASK_AVG_COUNT and AGG_TASK_AVG_SUM are put on the beginning of the input object. Then for loop iterates through input tasks and assigns the type of aggregation operation according to aggregation operation. New table has to be created. For loop goes through given table. GROUP operation is executed separately from other operations. Addresses of records are put in needed_values array and results are put in new table.

Author

Dejan Frankovic

Parameters

<i>input</i>	input object with list of attributes by which we aggregate and types of aggregations
<i>source_table</i>	- table name for the source table
<i>agg_table</i>	table name for aggregated table

Returns

EXIT_SUCCESS if continues succesfully, when not EXIT_ERROR

THIS SINGLE LINE BELOW (memcpy) is the purpose of ALL evil in the world! This line is the reason why test function prints one extra empty row with "nulls" at the end! Trust me! Comment it, and you will see - test function will not print extra row with nulls (but counts and averages in table will be all messed up!) After two days of hard research, I still have not found what is the reason behind printing extra row at the end! Fellow programmer, if you really really want to solve this issue, arm yourself with at least 2 liters of hot coffee!

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That actually means that this little piece of code (this line below) only (and ONLY) sets count to 1! And besides that causes every other evil in the world. :O

P.S. The reason for that may be in linked list, or in [AK_insert_row\(\)](#) You'll have to check every piece of AKDB code to find cause! I have found out that additional line is added when `k == 25`. There may be problem in linked lists or in `AK_insert_row` function or somewhere else. Who knows.

If I didn't handle that last row (which has one attribute of size 0), test would not pass!

Good luck, fellow programmer!

5.58.2.6 AK_aggregation_test()

```
TestResult AK_aggregation_test ( )
```

checking results

This variable was added to handle bug described in this file.

5.58.2.7 AK_header_size()

```
int AK_header_size (
    AK_header * header )
```

Function that calculates how many attributes there are in the header with a while loop.

Author

Dejan Frankovic

Parameters

<i>header</i>	A header array
---------------	----------------

Returns

Number of attributes defined in header array

5.59 rel/difference.c File Reference

```
#include "difference.h"
```

Include dependency graph for difference.c:

Functions

- int [AK_difference](#) (char *srcTable1, char *srcTable2, char *dstTable)

Function that produces a difference of the two tables. Table addresses are get through names of tables. Specially start addresses are taken from them. They are used to allocate blocks for them. It is checked whether the tables have same table schemas. If not, it returns EXIT_ERROR. New segment for result of difference operation is initialized. Function compares every block in extent of the first table with every block in extent of second table. If there is a difference between their rows, they are put in dstTable.

- [TestResult AK_op_difference_test](#) ()

Function for difference operator testing.

5.59.1 Detailed Description

Provides functions for relational difference operation

5.59.2 Function Documentation**5.59.2.1 AK_difference()**

```
int AK_difference (
    char * srcTable1,
    char * srcTable2,
    char * dstTable )
```

Function that produces a difference of the two tables. Table addresses are get through names of tables. Specially start addresses are taken from them. They are used to allocate blocks for them. It is checked whether the tables have same table schemas. If not, it returns EXIT_ERROR. New segment for result of difference operation is initialized. Function compares every block in extent of the first table with every block in extent of second table. If there is a difference between their rows, they are put in dstTable.

Author

Dino Laktašić

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>dstTable</i>	name of the new table

Returns

if success returns EXIT_SUCCESS, else returns EXIT_ERROR

5.59.2.2 AK_op_difference_test()

```
TestResult AK_op_difference_test ( )
```

Function for difference operator testing.

Author

Dino Laktašić

5.60 rel/difference.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../auxi/mempro.h"
#include "../sql/drop.h"
```

Include dependency graph for difference.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_difference](#) (char *srcTable1, char *srcTable2, char *dstTable)

Function that produces a difference of the two tables. Table addresses are get through names of tables. Specially start addresses are taken from them. They are used to allocate blocks for them. It is checked whether the tables have same table schemas. If not, it returns EXIT_ERROR. New segment for result of difference operation is initialized. Function compares every block in extent of the first table with every block in extent of second table. If there is a difference between their rows, they are put in dstTable.

- [TestResult AK_op_difference_test](#) ()

Function for difference operator testing.

5.60.1 Detailed Description

Header file that provides functions and defines for relational difference operation

5.60.2 Function Documentation

5.60.2.1 AK_difference()

```
int AK_difference (
    char * srcTable1,
    char * srcTable2,
    char * dstTable )
```

Function that produces a difference of the two tables. Table addresses are get through names of tables. Specially start addresses are taken from them. They are used to allocate blocks for them. It is checked whether the tables have same table schemas. If not, it returns EXIT_ERROR. New segment for result of difference operation is initialized. Function compares every block in extent of the first table with every block in extent of second table. If there is a difference between their rows, they are put in dstTable.

Author

Dino Laktašić

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>dstTable</i>	name of the new table

Returns

if success returns EXIT_SUCCESS, else returns EXIT_ERROR

5.60.2.2 AK_op_difference_test()

```
TestResult AK_op_difference_test ( )
```

Function for difference operator testing.

Author

Dino Laktašić

5.61 rel/expression_check.c File Reference

```
#include "expression_check.h"
Include dependency graph for expression_check.c:
```

Functions

- int [AK_check_arithmetic_statement](#) (struct [list_node](#) *el, const char *op, const char *a, const char *b)
Function that compares values according to their data type, checks arithmetic statement which is part of expression given in the function below. For every type of arithmetic operator, there is switch-case statement which examines type of el and casts void operands to this type.
- char * [AK_replace_wild_card](#) (const char *s, char ch, const char *repl)
Function that replaces character wildcard (%_) ch in string s with repl characters.
- int [AK_check_regex_expression](#) (const char *value, const char *expression, int sensitive, int checkWildCard)
Function that evaluates regex expression on a given string input.
- int [AK_check_regex_operator_expression](#) (const char *value, const char *expression)
Function that evaluates regex expression on a given string input.
- int [AK_check_if_row_satisfies_expression](#) (struct [list_node](#) *row_root, struct [list_node](#) *expr)
Function that evaluates whether one record (row) satisfies logical expression. It goes through given row. If it comes to logical operator, it evaluates by itself. For arithmetic operators function [AK_check_arithmetic_statement\(\)](#) is called.
- [TestResult](#) [AK_expression_check_test](#) ()

5.61.1 Detailed Description

Provides functions for constraint checking used in selection and theta-join

5.61.2 Function Documentation

5.61.2.1 AK_check_arithmetic_statement()

```
int AK_check_arithmetic_statement (
    struct list\_node * el,
    const char * op,
    const char * a,
    const char * b )
```

Function that compares values according to their data type, checks arithmetic statement which is part of expression given in the function below. For every type of arithmetic operator, there is switch-case statement which examines type of el and casts void operands to this type.

Function that compares values according to their data type, checks arithmetic statement which is part of expression given in the function below.

Author

Dino Laktašić, abstracted by Tomislav Mikulček, updated by Nikola Miljancic

Parameters

<i>el</i>	list element, last element put in list temp which holds elements of row ordered according to expression and results of their evaluation
<i>*op</i>	comparison operator
<i>*a</i>	left operand
<i>*b</i>	right operand

Returns

0 if arithmetic statement is false, 1 if arithmetic statement is true

5.61.2.2 AK_check_if_row_satisfies_expression()

```
int AK_check_if_row_satisfies_expression (
    struct list_node * row_root,
    struct list_node * expr )
```

Function that evaluates whether one record (row) satisfies logical expression. It goes through given row. If it comes to logical operator, it evaluates by itself. For arithmetic operators function [AK_check_arithmetic_statement\(\)](#) is called.

Function that replaces character wildcard (%,_) ch in string s with repl characters.

Author

Matija Šestak, updated by Dino Laktašić, Nikola Miljancic, abstracted by Tomislav Mikulček

Parameters

<i>row_root</i>	beginning of the row that is to be evaluated
<i>*expr</i>	list with the logical expression in postfix notation

Returns

0 if row does not satisfy, 1 if row satisfies expression

5.61.2.3 AK_check_regex_expression()

```
int AK_check_regex_expression (
    const char * value,
    const char * expression,
    int sensitive,
    int checkWildCard )
```

Function that evaluates regex expression on a given string input.

@Author Leon Palaić

Parameters

<i>value</i>	string value that must match regex expression
<i>expression</i>	POSIX regex expression
<i>checkWildCard</i>	replaces SQL wildcard to corresponding POSIX regex character
<i>sensitive</i>	case insensitive indicator 1-case sensitive,0- case insensitive

Returns

0 if regex didnt match or sytnax of regex is incorRECT 1 if string matches coresponding regex expression

5.61.2.4 AK_check_regex_operator_expression()

```
int AK_check_regex_operator_expression (
    const char * value,
    const char * expression )
```

Function that evaluates regex expression on a given string input.

@Author Leon Palaić

Parameters

<i>value</i>	string value that must match regex expression
<i>expression</i>	POSIX regex expression

Returns

0 if regex didnt match or sytnax of regex is incorRECT 1 if string matches coresponding regex expression

5.61.2.5 AK_replace_wild_card()

```
char* AK_replace_wild_card (
    const char * s,
    char ch,
    const char * repl )
```

Function that replaces charachter wildcard (%_) ch in string s with repl characters.

@Author Leon Palaić

Parameters

<i>s</i>	input string
<i>ch</i>	charachter to be replaced

Returns

new sequence of charachters

5.62 rel/expression_check.h File Reference

```
#include "../auxi/test.h"
```

```
#include "../file/table.h"
#include "../file/fileio.h"
#include "../auxi/mempro.h"
#include <regex.h>
```

Include dependency graph for expression_check.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_check_arithmetic_statement](#) (struct [list_node](#) *el, const char *op, const char *a, const char *b)
Function that compares values according to their data type, checks arithmetic statement which is part of expression given in the function below.
- int [AK_check_if_row_satisfies_expression](#) (struct [list_node](#) *row_root, struct [list_node](#) *expr)
Function that replaces character wildcard (%,_) ch in string s with repl characters.
- int [AK_check_regex_expression](#) (const char *value, const char *expression, int sensitive, int checkWildCard)
Function that evaluates regex expression on a given string input.
- int [AK_check_regex_operator_expression](#) (const char *value, const char *expression)
Function that evaluates regex expression on a given string input.
- [TestResult](#) [AK_expression_check_test](#) ()

5.62.1 Detailed Description

Header file that functions and defines for expression ckecking

5.62.2 Function Documentation

5.62.2.1 AK_check_arithmetic_statement()

```
int AK_check_arithmetic_statement (
    struct list\_node * el,
    const char * op,
    const char * a,
    const char * b )
```

Function that compares values according to their data type, checks arithmetic statement which is part of expression given in the function below.

Author

Dino Laktašić, abstracted by Tomislav Mikulček, updated by Nikola Miljancic

Parameters

<i>el</i>	list element, last element put in list temp which holds elements of row ordered according to expression and results of their evaluation
<i>*op</i>	comparison operator
<i>*a</i>	left operand
<i>*b</i>	right operand

Returns

0 if arithmetic statement is false, 1 if arithmetic statement is true

Function that compares values according to their data type, checks arithmetic statement which is part of expression given in the function below.

Author

Dino Laktašić, abstracted by Tomislav Mikulček, updated by Nikola Miljancic

Parameters

<i>el</i>	list element, last element put in list temp which holds elements of row ordered according to expression and results of their evaluation
<i>*op</i>	comparison operator
<i>*a</i>	left operand
<i>*b</i>	right operand

Returns

0 if arithmetic statement is false, 1 if arithmetic statement is true

5.62.2.2 AK_check_if_row_satisfies_expression()

```
int AK_check_if_row_satisfies_expression (
    struct list_node * row_root,
    struct list_node * expr )
```

Function that replaces character wildcard (%,_) ch in string s with repl characters.

@Author Leon Palaić

Parameters

<i>s</i>	input string
<i>ch</i>	character to be replaced

Returns

new sequence of characters

Function that replaces character wildcard (%,_) ch in string s with repl characters.

Author

Matija Šestak, updated by Dino Laktašić, Nikola Miljancic, abstracted by Tomislav Mikulček

Parameters

<i>row_root</i>	beginning of the row that is to be evaluated
<i>*expr</i>	list with the logical expression in postfix notation

Returns

0 if row does not satisfy, 1 if row satisfies expression

5.62.2.3 AK_check_regex_expression()

```
int AK_check_regex_expression (
    const char * value,
    const char * expression,
    int sensitive,
    int checkWildCard )
```

Function that evaluates regex expression on a given string input.

@Author Leon Palaić

Parameters

<i>value</i>	string value that must match regex expression
<i>expression</i>	POSIX regex expression
<i>checkWildCard</i>	replaces SQL wildcard to corresponding POSIX regex character
<i>sensitive</i>	case insensitive indicator 1-case sensitive,0- case insensitive

Returns

0 if regex didnt match or syntax of regex is incorrect 1 if string matches corresponding regex expression

5.62.2.4 AK_check_regex_operator_expression()

```
int AK_check_regex_operator_expression (
    const char * value,
    const char * expression )
```

Function that evaluates regex expression on a given string input.

@Author Leon Palaić

Parameters

<i>value</i>	string value that must match regex expression
<i>expression</i>	POSIX regex expression

Returns

0 if regex didnt match or syntax of regex is incorrect 1 if string matches coresponding regex expression

5.63 rel/intersect.c File Reference

```
#include "intersect.h"
Include dependency graph for intersect.c:
```

Functions

- int [AK_intersect](#) (char *srcTable1, char *srcTable2, char *dstTable)
Function that makes a intersect of the two tables. Intersect is implemented for working with multiple sets of data, i.e. duplicate tuples can be written in same table (intersect)
- [TestResult AK_op_intersect_test](#) ()
Function for intersect operator testing.

5.63.1 Detailed Description

Provides functions for relational intersect operation

5.63.2 Function Documentation

5.63.2.1 AK_intersect()

```
int AK_intersect (
    char * srcTable1,
    char * srcTable2,
    char * dstTable )
```

Function that makes a intersect of the two tables. Intersect is implemented for working with multiple sets of data, i.e. duplicate tuples can be written in same table (intersect)

Author

Dino Laktašić

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>dstTable</i>	name of the new table

Returns

if success returns EXIT_SUCCESS, else returns EXIT_ERROR

5.63.2.2 AK_op_intersect_test()

```
TestResult AK_op_intersect_test ( )
```

Function for intersect operator testing.

Author

Dino Laktašić

Returns

No return value

5.64 rel/intersect.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../rec/archive_log.h"
#include "../auxi/mempro.h"
#include "../sql/drop.h"
```

Include dependency graph for intersect.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [intersect_attr](#)
Structure defines intersect attribute.

Functions

- int [AK_intersect](#) (char *srcTable1, char *srcTable2, char *dstTable)
Function that makes a intersect of the two tables. Intersect is implemented for working with multiple sets of data, i.e. duplicate tuples can be written in same table (intersect)
- [TestResult AK_op_intersect_test](#) ()
Function for intersect operator testing.

5.64.1 Detailed Description

Provides data structures, functions and defines for relational intersect operation

5.64.2 Function Documentation

5.64.2.1 AK_intersect()

```
int AK_intersect (
    char * srcTable1,
    char * srcTable2,
    char * dstTable )
```

Function that makes a intersect of the two tables. Intersect is implemented for working with multiple sets of data, i.e. duplicate tuples can be written in same table (intersect)

Author

Dino Laktašić

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>dstTable</i>	name of the new table

Returns

if success returns EXIT_SUCCESS, else returns EXIT_ERROR

5.64.2.2 AK_op_intersect_test()

```
TestResult AK_op_intersect_test ( )
```

Function for intersect operator testing.

Author

Dino Laktašić

Returns

No return value

5.65 rel/nat_join.c File Reference

```
#include "nat_join.h"
Include dependency graph for nat_join.c:
```

Functions

- void [AK_create_join_block_header](#) (int table_address1, int table_address2, char *new_table, struct [list_node](#) *att)
Function that makes a header for the new table and call the function to create the segment.
- void [AK_merge_block_join](#) (struct [list_node](#) *row_root, struct [list_node](#) *row_root_insert, [AK_block](#) *temp_block, char *new_table)
Function that searches the second block and when found matches with the first one makes a join and writes a row to join the tables.
- void [AK_copy_blocks_join](#) ([AK_block](#) *tbl1_temp_block, [AK_block](#) *tbl2_temp_block, struct [list_node](#) *att, char *new_table)
Function that iterates through block of the first table and copies data that needs for join, then it calls a merge function to merge with the second table.
- int [AK_join](#) (char *srcTable1, char *srcTable2, char *dstTable, struct [list_node](#) *att)
Function that makes a nat_join between two tables on some attributes.
- [TestResult AK_op_join_test](#) ()
Function for natural join testing.

5.65.1 Detailed Description

Provides functions for relational natural join operation

5.65.2 Function Documentation

5.65.2.1 AK_copy_blocks_join()

```
void AK_copy_blocks_join (
    AK\_block * tbl1_temp_block,
    AK\_block * tbl2_temp_block,
    struct list\_node * att,
    char * new_table )
```

Function that iterates through block of the first table and copies data that needs for join, then it calls a merge function to merge with the second table.

Author

Matija Novak, optimized, and updated to work with AK_list by Dino Laktašić

Parameters

<i>tbl1_temp_block</i>	block of the first table
<i>tbl2_temp_block</i>	block of the second join table
<i>att</i>	attributes on which we make nat_join
<i>new_table</i>	name of the nat_join table

Returns

No return value

5.65.2.2 AK_create_join_block_header()

```
void AK_create_join_block_header (
    int table_address1,
    int table_address2,
    char * new_table,
    struct list_node * att )
```

Function that makes a header for the new table and call the function to create the segment.

Author

Matija Novak, optimized, and updated to work with AK_list by Dino Laktašić

Parameters

<i>table_address1</i>	address of the block of the first table
<i>table_address2</i>	address of the block of the second table
<i>new_table</i>	name of the join table
<i>att_root</i>	tributes on which we make nat_join

Returns

No return value

5.65.2.3 AK_join()

```
int AK_join (
    char * srcTable1,
    char * srcTable2,
    char * dstTable,
    struct list_node * att )
```

Function that makes a nat_join between two tables on some attributes.

Author

Matija Novak, updated to work with AK_list and support cacheing by Dino Laktašić

Parameters

<i>srcTable1</i>	name of the first table to join
<i>srcTable2</i>	name of the second table to join
<i>att</i>	tributes on which we make nat_join
<i>dstTable</i>	name of the nat_join table

Returns

if success returns EXIT_SUCCESS

5.65.2.4 AK_merge_block_join()

```
void AK_merge_block_join (
    struct list_node * row_root,
    struct list_node * row_root_insert,
    AK_block * temp_block,
    char * new_table )
```

Function that searches the second block and when found matches with the first one makes a join and writes a row to join the tables.

Author

Matija Novak, updated by Dino Laktašić

Parameters

<i>row_root</i>	- list of values from the first table to be marged with table2
<i>row_root_insert</i>	- list of values from the first table to be inserted into nat_join table
<i>temp_block</i>	- block from the second table to be merged
<i>new_table</i>	- name of the nat_join table

Returns

No return value

5.65.2.5 AK_op_join_test()

```
TestResult AK_op_join_test ( )
```

Function for natural join testing.

Author

Matija Novak

Returns

No return value

5.66 rel/nat_join.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../rel/projection.h"
#include "../auxi/mempro.h"
#include "../sql/drop.h"
```

Include dependency graph for nat_join.h: This graph shows which files directly or indirectly include this file:

Functions

- void [AK_create_join_block_header](#) (int table_address1, int table_address2, char *new_table, struct [list_node](#) *att)
Function that makes a header for the new table and call the function to create the segment.
- void [AK_merge_block_join](#) (struct [list_node](#) *row_root, struct [list_node](#) *row_root_insert, [AK_block](#) *temp_block, char *new_table)
Function that searches the second block and when found matches with the first one makes a join and writes a row to join the tables.
- void [AK_copy_blocks_join](#) ([AK_block](#) *tbl1_temp_block, [AK_block](#) *tbl2_temp_block, struct [list_node](#) *att, char *new_table)
Function that iterates through block of the first table and copies data that needs for join, then it calls a merge function to merge with the second table.
- int [AK_join](#) (char *srcTable1, char *srcTable2, char *dstTable, struct [list_node](#) *att)
Function that makes a nat_join between two tables on some attributes.
- [TestResult AK_op_join_test](#) ()
Function for natural join testing.

5.66.1 Detailed Description

Header file that provides functions and defines for relational natural join operation

5.66.2 Function Documentation

5.66.2.1 AK_copy_blocks_join()

```
void AK_copy_blocks_join (
    AK\_block * tbl1_temp_block,
    AK\_block * tbl2_temp_block,
    struct list\_node * att,
    char * new_table )
```

Function that iterates through block of the first table and copies data that needs for join, then it calls a merge function to merge with the second table.

Author

Matija Novak, optimized, and updated to work with AK_list by Dino Laktašić

Parameters

<i>tbl1_temp_block</i>	block of the first table
<i>tbl2_temp_block</i>	block of the second join table
<i>att</i>	attributes on which we make nat_join
<i>new_table</i>	name of the nat_join table

Returns

No return value

5.66.2.2 AK_create_join_block_header()

```
void AK_create_join_block_header (
    int table_address1,
    int table_address2,
    char * new_table,
    struct list_node * att )
```

Function that makes a header for the new table and call the function to create the segment.

Author

Matija Novak, optimized, and updated to work with AK_list by Dino Laktašić

Parameters

<i>table_address1</i>	address of the block of the first table
<i>table_address2</i>	address of the block of the second table
<i>new_table</i>	name of the join table
<i>att_root</i>	tributes on which we make nat_join

Returns

No return value

5.66.2.3 AK_join()

```
int AK_join (
    char * srcTable1,
    char * srcTable2,
    char * dstTable,
    struct list_node * att )
```

Function that makes a nat_join between two tables on some attributes.

Author

Matija Novak, updated to work with AK_list and support cacheing by Dino Laktašić

Parameters

<i>srcTable1</i>	name of the first table to join
<i>srcTable2</i>	name of the second table to join
<i>att</i>	attributes on which we make nat_join
<i>dstTable</i>	name of the nat_join table

Returns

if success returns EXIT_SUCCESS

5.66.2.4 AK_merge_block_join()

```
void AK_merge_block_join (
    struct list_node * row_root,
    struct list_node * row_root_insert,
    AK_block * temp_block,
    char * new_table )
```

Function that searches the second block and when found matches with the first one makes a join and writes a row to join the tables.

Author

Matija Novak, updated by Dino Laktašić

Parameters

<i>row_root</i>	- list of values from the first table to be merged with table2
<i>row_root_insert</i>	- list of values from the first table to be inserted into nat_join table
<i>temp_block</i>	- block from the second table to be merged
<i>new_table</i>	- name of the nat_join table

Returns

No return value

5.66.2.5 AK_op_join_test()

```
TestResult AK_op_join_test ( )
```

Function for natural join testing.

Author

Matija Novak

Returns

No return value

5.67 rel/product.c File Reference

```
#include "product.h"
```

Include dependency graph for product.c:

Functions

- `int AK_product (char *srcTable1, char *srcTable2, char *dstTable)`
Function that makes the structure of an empty destination table for product operation.
- `void AK_product_procedure (char *srcTable1, char *srcTable2, char *dstTable, AK_header header[MAX_ATTRIBUTES])`
Functions that iterates trough both tables and concates rows. The result is in destination table.
- `TestResult AK_op_product_test ()`
Function for product operator testing.

5.67.1 Detailed Description

Provides functions for relational product operation

5.67.2 Function Documentation

5.67.2.1 AK_op_product_test()

```
TestResult AK_op_product_test ( )
```

Function for product operator testing.

Author

Dino Laktašić, Fabijan Josip Kraljić

5.67.2.2 AK_product()

```
int AK_product (
    char * srcTable1,
    char * srcTable2,
    char * dstTable )
```

Function that makes the structure of an empty destination table for product operation.

Author

Dino Laktašić

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>dstTable</i>	name of the product table

Returns

if success returns EXIT_SUCCESS, else returns EXIT_ERROR

5.67.2.3 AK_product_procedure()

```
void AK_product_procedure (
    char * srcTable1,
    char * srcTable2,
    char * dstTable,
    AK_header header[MAX_ATTRIBUTES] )
```

Functions that iterates trough both tables and concates rows. The result is in destination table.

Author

Dino Laktašić, Fabijan Josip Kraljić

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>dstTable</i>	name of the product table
<i>header</i>	header of product table

Product procedure Going through one table, and for each row in it, going through another table, and joining rows that way!

5.68 rel/product.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../file/files.h"
#include "../auxi/mempro.h"
#include "../sql/drop.h"
```

Include dependency graph for product.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_product](#) (char *srcTable1, char *srcTable2, char *dstTable)

Function that makes the structure of an empty destination table for product operation.

- void [AK_product_procedure](#) (char *srcTable1, char *srcTable2, char *dstTable, [AK_header](#) header[[MAX_ATTRIBUTES](#)])

Functions that iterates trough both tables and concates rows. The result is in destination table.

- [TestResult AK_op_product_test](#) ()

Function for product operator testing.

5.68.1 Detailed Description

Header file that provides functions and defines for relational product operation

5.68.2 Function Documentation

5.68.2.1 AK_op_product_test()

```
TestResult AK_op_product_test ( )
```

Function for product operator testing.

Author

Dino Laktašić, Fabijan Josip Kraljić

5.68.2.2 AK_product()

```
int AK_product (
    char * srcTable1,
    char * srcTable2,
    char * dstTable )
```

Function that makes the structure of an empty destination table for product operation.

Author

Dino Laktašić

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>dstTable</i>	name of the product table

Returns

if success returns EXIT_SUCCESS, else returns EXIT_ERROR

5.68.2.3 AK_product_procedure()

```
void AK_product_procedure (
    char * srcTable1,
    char * srcTable2,
    char * dstTable,
    AK_header header[MAX_ATTRIBUTES] )
```

Functions that iterates trough both tables and concates rows. The result is in destination table.

Author

Dino Laktašić, Fabijan Josip Kraljić

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>dstTable</i>	name of the product table
<i>header</i>	header of product table

Product procedure Going through one table, and for each row in it, going through another table, and joining rows that way!

5.69 rel/projection.c File Reference

```
#include "projection.h"
```

Include dependency graph for projection.c:

Functions

- void [AK_create_block_header](#) (int old_block, char *dstTable, struct [list_node](#) *att)
Function that creates a new header for the projection table.
- char * [AK_get_operator](#) (char *exp)
Function that fetches arithmetic operator from given expression string, determinates given operator so it can be used for arithmetic operations.
- void [AK_remove_substring](#) (char *s, const char *substring)
Function that iterates through given string and removes specified part of that string.
- int [AK_determine_header_type](#) (int firstOperand, int secondOperand)
Function that determines the new header type.
- char * [AK_create_header_name](#) (char *first, char *second, char *operator)
Function that creates new header name from passed operand names and operator.

- void [AK_copy_block_projection](#) ([AK_block](#) *old_block, struct [list_node](#) *att, char *dstTable, struct [list_node](#) *expr)
Function that copies the data from old table block to the new projection table.
- char * [AK_perform_operation](#) (char *op, struct [AK_operand](#) *firstOperand, struct [AK_operand](#) *secondOperand, int type)
Function that performs arithmetics operation depended on given operator.
- int [AK_projection](#) (char *srcTable, char *dstTable, struct [list_node](#) *att, struct [list_node](#) *expr)
Function that makes a projection of some table on given attributes.
- [TestResult AK_op_projection_test](#) ()
Function for projection operation testing, tests usual projection functionality, projection when it is given arithmetic operation or expression.

5.69.1 Detailed Description

Provides functions for relational projection operation

5.69.2 Function Documentation

5.69.2.1 AK_copy_block_projection()

```
void AK_copy_block_projection (
    AK\_block * old_block,
    struct list\_node * att,
    char * dstTable,
    struct list\_node * expr )
```

Function that copies the data from old table block to the new projection table.

Author

Matija Novak, rewritten and optimized by Dino Laktašić to support AK_list

Parameters

<i>old_block</i>	block from which we copy data
<i>dstTable</i>	name of the new table
<i>att</i>	list of the attributes which should the projection table contain
<i>expr</i>	given expression to check

Returns

New projection table that contains all blocks from old table

No return value

5.69.2.2 AK_create_block_header()

```
void AK_create_block_header (
    int old_block,
    char * dstTable,
    struct list_node * att )
```

Function that creates a new header for the projection table.

Author

Matija Novak, rewritten and optimized by Dino Laktašić to support AK_list

Parameters

<i>old_block_add</i>	address of the block from which we copy headers we need
<i>dstTable</i>	name of the new table - destination table
<i>att</i>	list of the attributes which should the projection table contain

Returns

Newly created header

No return value

5.69.2.3 AK_create_header_name()

```
char* AK_create_header_name (
    char * first,
    char * second,
    char * operator )
```

Function that creates new header name from passed operand names and operator.

Author

Leon Palaić

Parameters

<i>first</i>	operand name
<i>second</i>	operand name
<i>operator</i>	given operator

Returns

Function returns set of characters that represent new header name

Character - new name

5.69.2.4 AK_determine_header_type()

```
int AK_determine_header_type (
    int firstOperand,
    int secondOperand )
```

Function that determines the new header type.

Author

Leon Palać

Parameters

<i>firstOperand</i>	operand type
<i>secondOperand</i>	operand type

Returns

Function returns determinated header type

Integer - type

5.69.2.5 AK_get_operator()

```
char* AK_get_operator (
    char * exp )
```

Function that fetches arithmetic operator from given expression string, determinates given operator so it can be used for arithmetic operations.

Author

Leon Palać

Parameters

<i>exp</i>	input expression string
------------	-------------------------

Returns

character - arithmetic operator

character

5.69.2.6 AK_op_projection_test()

```
TestResult AK_op_projection_test ( )
```

Function for projection operation testing, tests usual projection functionality, projection when it is given arithmetic operation or expression.

Author

Dino Laktašić, rewritten and optimized by Irena Ilišević to support ILIKE operator and perform usual projection

Returns

Projection tables and number of passed tests

Test result - number of successful and unsuccessful tests

5.69.2.7 AK_perform_operation()

```
char* AK_perform_operation (
    char * op,
    struct AK_operand * firstOperand,
    struct AK_operand * secondOperand,
    int type )
```

Function that performs arithmetics operation depended on given operator.

Author

Leon Palać

Parameters

<i>firstOperand</i>	first operand
<i>secondOperand</i>	second operand
<i>op</i>	arithmetic operator
<i>type</i>	type of operand

Returns

result of arithmetic operation

character

5.69.2.8 AK_projection()

```
int AK_projection (
    char * srcTable,
```

```

char * dstTable,
struct list_node * att,
struct list_node * expr )

```

Function that makes a projection of some table on given attributes.

Author

Matija Novak, rewritten and optimized by Dino Laktašić, now support cacheing

Parameters

<i>srcTable</i>	source table - table on which projection is made
<i>expr</i>	given expression to check while doing projection
<i>att</i>	list of attributes on which we make projection
<i>dstTable</i>	table name for projection table - new table - destination table

Returns

Projection table on given attributes

EXIT_SUCCESS if continues successfully, when not EXIT_ERROR

5.69.2.9 AK_remove_substring()

```

void AK_remove_substring (
    char * s,
    const char * substring )

```

Function that iterates through given string and removes specified part of that string.

Author

Leon Palačić

Parameters

<i>s</i>	input string
<i>substring</i>	string that needs to be removed

Returns

Cleaned new string

No return value

5.70 rel/projection.h File Reference

```
#include "../auxi/test.h"
```

```
#include "expression_check.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../aux/mempro.h"
```

Include dependency graph for projection.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [AK_operand](#)

Functions

- void [AK_create_block_header](#) (int old_block, char *dstTable, struct [list_node](#) *att)
Function that creates a new header for the projection table.
- char * [AK_get_operator](#) (char *exp)
Function that fetches arithmetic operator from given expression string, determinates given operator so it can be used for arithmetic operations.
- void [AK_remove_substring](#) (char *s, const char *substring)
Function that iterates through given string and removes specified part of that string.
- int [AK_determine_header_type](#) (int firstOperand, int secondOperand)
Function that determines the new header type.
- char * [AK_create_header_name](#) (char *first, char *operator, char *second)
Function that creates new header name from passed operand names and operator.
- void [AK_copy_block_projection](#) ([AK_block](#) *old_block, struct [list_node](#) *att, char *dstTable, struct [list_node](#) *expr)
Function that copies the data from old table block to the new projection table.
- char * [AK_perform_operation](#) (char *op, struct [AK_operand](#) *firstOperand, struct [AK_operand](#) *secondOperand, int type)
Function that performs arithmetics operation depended on given operator.
- int [AK_projection](#) (char *srcTable, char *dstTable, struct [list_node](#) *att, struct [list_node](#) *expr)
Function that makes a projection of some table on given attributes.
- [TestResult](#) [AK_op_projection_test](#) ()
Function for projection operation testing, tests usual projection functionality, projection when it is given arithmetic operation or expression.

5.70.1 Detailed Description

Header file that provides data structures, functions and defines for relational projection operation

5.70.2 Function Documentation

5.70.2.1 AK_copy_block_projection()

```
void AK_copy_block_projection (
    AK_block * old_block,
    struct list_node * att,
    char * dstTable,
    struct list_node * expr )
```

Function that copies the data from old table block to the new projection table.

Author

Matija Novak, rewritten and optimized by Dino Laktašić to support AK_list

Parameters

<i>old_block</i>	block from which we copy data
<i>dstTable</i>	name of the new table
<i>att</i>	list of the attributes which should the projection table contain
<i>expr</i>	given expression to check

Returns

New projection table that contains all blocks from old table

No return value

5.70.2.2 AK_create_block_header()

```
void AK_create_block_header (
    int old_block,
    char * dstTable,
    struct list_node * att )
```

Function that creates a new header for the projection table.

Author

Matija Novak, rewritten and optimized by Dino Laktašić to support AK_list

Parameters

<i>old_block_add</i>	address of the block from which we copy headers we need
<i>dstTable</i>	name of the new table - destination table
<i>att</i>	list of the attributes which should the projection table contain

Returns

Newly created header

No return value

5.70.2.3 AK_create_header_name()

```
char* AK_create_header_name (
    char * first,
    char * second,
    char * operator )
```

Function that creates new header name from passed operand names and operator.

Author

Leon Palaić

Parameters

<i>first</i>	operand name
<i>second</i>	operand name
<i>operator</i>	given operator

Returns

Function returns set of characters that represent new header name

Character - new name

5.70.2.4 AK_determine_header_type()

```
int AK_determine_header_type (
    int firstOperand,
    int secondOperand )
```

Function that determines the new header type.

Author

Leon Palaić

Parameters

<i>firstOperand</i>	operand type
<i>secondOperand</i>	operand type

Returns

Function returns determined header type
Integer - type

5.70.2.5 AK_get_operator()

```
char* AK_get_operator (
    char * exp )
```

Function that fetches arithmetic operator from given expression string, determinates given operator so it can be used for arithmetic operations.

Author

Leon Palaić

Parameters

<i>exp</i>	input expression string
------------	-------------------------

Returns

character - arithmetic operator
character

Author

Leon Palaić

Parameters

<i>exp</i>	input expression string
------------	-------------------------

Returns

character - arithmetic operator
character

5.70.2.6 AK_op_projection_test()

```
TestResult AK_op_projection_test ( )
```

Function for projection operation testing, tests usual projection functionality, projection when it is given arithmetic operation or expression.

Author

Dino Laktašić, rewritten and optimized by Irena Ilišević to support ILIKE operator and perform usual projection

Returns

Projection tables and number of passed tests

Test result - number of successful and unsuccessful tests

5.70.2.7 AK_perform_operation()

```
char* AK_perform_operation (
    char * op,
    struct AK_operand * firstOperand,
    struct AK_operand * secondOperand,
    int type )
```

Function that performs arithmetics operation depended on given operator.

Author

Leon Palaić

Parameters

<i>firstOperand</i>	first operand
<i>secondOperand</i>	second operand
<i>op</i>	aritmetic operator
<i>type</i>	type of operand

Returns

result of arithmetic operation

character

5.70.2.8 AK_projection()

```
int AK_projection (
    char * srcTable,
    char * dstTable,
    struct list_node * att,
    struct list_node * expr )
```

Function that makes a projection of some table on given attributes.

Author

Matija Novak, rewritten and optimized by Dino Laktašić, now support cacheing

Parameters

<i>srcTable</i>	source table - table on which projection is made
<i>expr</i>	given expression to check while doing projection
<i>att</i>	list of attributes on which we make projection
<i>dstTable</i>	table name for projection table - new table - destination table

Returns

Projection table on given attributes

EXIT_SUCCESS if continues successfully, when not EXIT_ERROR

5.70.2.9 AK_remove_substring()

```
void AK_remove_substring (
    char * s,
    const char * substring )
```

Function that iterates through given string and removes specified part of that string.

Author

Leon Palać

Parameters

<i>s</i>	input string
<i>substring</i>	string that needs to be removed

Returns

Cleaned new string

No return value

5.71 rel/selection.c File Reference

```
#include "selection.h"
```

Include dependency graph for selection.c:

Functions

- int [AK_selection](#) (char *srcTable, char *dstTable, struct [list_node](#) *expr)
Function that which implements selection.
- [TestResult AK_op_selection_test](#) ()

Function for selection operator testing using WHERE clause and operators BETWEEN, AND.

- [TestResult AK_op_selection_test_pattern](#) ()

Function for selection operator testing using operators LIKE, ILIKE, SIMILAR TO.

- [int AK_selection_op_rename](#) (char *srcTable, char *dstTable, struct [list_node](#) *expr)

Function that which implements selection rename operation test.

5.71.1 Detailed Description

Provides functions for relational selection operation

5.71.2 Function Documentation

5.71.2.1 AK_op_selection_test()

```
TestResult AK_op_selection_test ( )
```

Function for selection operator testing using WHERE clause and operators BETWEEN, AND.

Author

Matija Šestak, updated by Dino Laktašić, Nikola Miljancic

5.71.2.2 AK_op_selection_test_pattern()

```
TestResult AK_op_selection_test_pattern ( )
```

Function for selection operator testing using operators LIKE, ILIKE, SIMILAR TO.

Author

Krunoslav Bilić updated by Filip Belinić

5.71.2.3 AK_selection()

```
int AK_selection (
    char * srcTable,
    char * dstTable,
    struct list_node * expr )
```

Function that which implements selection.

Author

Matija Šestak.

Parameters

<i>*srcTable</i>	source table name
<i>*dstTable</i>	destination table name
<i>*expr</i>	list with postfix notation of the logical expression

Returns

EXIT_SUCCESS

5.71.2.4 AK_selection_op_rename()

```
int AK_selection_op_rename (
    char * srcTable,
    char * dstTable,
    struct list_node * expr )
```

Function that which implements selection rename operation test.

Author

unknown

Parameters

<i>*srcTable</i>	source table name
<i>*dstTable</i>	destination table name
<i>*expr</i>	list with postfix notation of the logical expression

Returns

EXIT_SUCCESS

5.72 rel/selection.h File Reference

```
#include "../auxi/test.h"
#include "expression_check.h"
#include "../rec/redo_log.h"
#include "../auxi/constants.h"
#include "../auxi/configuration.h"
#include "../file/files.h"
#include "../auxi/mempro.h"
```

Include dependency graph for selection.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_selection](#) (char *srcTable, char *dstTable, struct [list_node](#) *expr)
Function that which implements selection.
- [TestResult AK_op_selection_test](#) ()
Function for selection operator testing using WHERE clause and operators BETWEEN, AND.
- [TestResult AK_op_selection_test_pattern](#) ()
Function for selection operator testing using operators LIKE, ILIKE, SIMILAR TO.

5.72.1 Detailed Description

Header file that provides functions and defines for relational selection operation

5.72.2 Function Documentation

5.72.2.1 AK_op_selection_test()

```
TestResult AK_op_selection_test ( )
```

Function for selection operator testing using WHERE clause and operators BETWEEN, AND.

Author

Matija Šestak, updated by Dino Laktašić, Nikola Miljancic

5.72.2.2 AK_op_selection_test_pattern()

```
TestResult AK_op_selection_test_pattern ( )
```

Function for selection operator testing using operators LIKE, ILIKE, SIMILAR TO.

Author

Krunoslav Bilić updated by Filip Belinić

5.72.2.3 AK_selection()

```
int AK_selection (
    char * srcTable,
    char * dstTable,
    struct list\_node * expr )
```

Function that which implements selection.

Author

Matija Šestak.

Parameters

<i>*srcTable</i>	source table name
<i>*dstTable</i>	destination table name
<i>*expr</i>	list with postfix notation of the logical expression

Returns

EXIT_SUCCESS

5.73 rel/theta_join.c File Reference

```
#include "theta_join.h"
```

Include dependency graph for theta_join.c:

Functions

- int [AK_create_theta_join_header](#) (char *srcTable1, char *srcTable2, char *new_table)
Function that creates a header of the new table for theta join.
- void [AK_check_constraints](#) ([AK_block](#) *tbl1_temp_block, [AK_block](#) *tbl2_temp_block, int tbl1_num_att, int tbl2_num_att, struct [list_node](#) *constraints, char *new_table)
Function that iterates through blocks of the two tables and copies the rows which pass the constraint check into the new table.
- int [AK_theta_join](#) (char *srcTable1, char *srcTable2, char *dstTable, struct [list_node](#) *constraints)
Function that creates a theta join between two tables on specified conditions. Names of the attributes in the constraints parameter must be prefixed with the table name followed by a dot if and only if they exist in both tables. This is left for the preprocessing. Also, for now the constraints must come from the two source tables and not from a third.
- [TestResult AK_op_theta_join_test](#) ()
Function for testing the theta join.

5.73.1 Detailed Description

Provides functions for relational theta join operation

5.73.2 Function Documentation

5.73.2.1 AK_check_constraints()

```
void AK_check_constraints (
    AK\_block * tbl1_temp_block,
    AK\_block * tbl2_temp_block,
    int tbl1_num_att,
    int tbl2_num_att,
    struct list\_node * constraints,
    char * new_table )
```

Function that iterates through blocks of the two tables and copies the rows which pass the constraint check into the new table.

Author

Tomislav Mikulček

Parameters

<i>tbl1_temp_block</i>	block of the first table
<i>tbl2_temp_block</i>	block of the second join table
<i>tbl1_num_att</i>	number of attributes in the first table
<i>tbl2_num_att</i>	number of attributes in the second table
<i>constraints</i>	list of attributes, (in)equality and logical operators which are the conditions for the join in postfix notation
<i>new_table</i>	name of the theta_join table

Returns

No return value

5.73.2.2 AK_create_theta_join_header()

```
int AK_create_theta_join_header (
    char * srcTable1,
    char * srcTable2,
    char * new_table )
```

Function that creates a header of the new table for theta join.

Author

Tomislav Mikulček

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>new_table</i>	name of the destination table

Returns

EXIT_SUCCESS if the header was successfully created and EXIT_ERROR if the renamed headers are too long

5.73.2.3 AK_op_theta_join_test()

```
TestResult AK_op_theta_join_test ( )
```

Function for testing the theta join.

Author

Tomislav Mikulček

Returns

No return value

5.73.2.4 AK_theta_join()

```
int AK_theta_join (
    char * srcTable1,
    char * srcTable2,
    char * dstTable,
    struct list_node * constraints )
```

Function that creates a theta join between two tables on specified conditions. Names of the attributes in the constraints parameter must be prefixed with the table name followed by a dot if and only if they exist in both tables. This is left for the preprocessing. Also, for now the constraints must come from the two source tables and not from a third.

Function that creates a theta join between two tables on specified conditions.

Author

Tomislav Mikulček, updated by Nikola Miljancic

Parameters

<i>srcTable1</i>	name of the first table to join
<i>srcTable2</i>	name of the second table to join
<i>constraints</i>	list of attributes, (in)equality and logical operators which are the conditions for the join in postfix notation
<i>dstTable</i>	name of the theta join table

Returns

if successful returns EXIT_SUCCESS and EXIT_ERROR otherwise

5.74 rel/theta_join.h File Reference

```
#include "../auxi/test.h"
#include "expression_check.h"
#include "../file/fileio.h"
#include "../auxi/mempro.h"
```

Include dependency graph for theta_join.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_theta_join](#) (char *srcTable1, char *srcTable2, char *dstTable, struct [list_node](#) *constraints)
Function that creates a theta join between two tables on specified conditions.
- int [AK_create_theta_join_header](#) (char *srcTable1, char *srcTable2, char *new_table)
Function that creates a header of the new table for theta join.
- void [AK_check_constraints](#) ([AK_block](#) *tbl1_temp_block, [AK_block](#) *tbl2_temp_block, int tbl1_num_att, int tbl2_num_att, struct [list_node](#) *constraints, char *new_table)
Function that iterates through blocks of the two tables and copies the rows which pass the constraint check into the new table.
- [TestResult AK_op_theta_join_test](#) ()
Function for testing the theta join.

5.74.1 Detailed Description

Header file that provides functions and defines for theta-join

5.74.2 Function Documentation

5.74.2.1 AK_check_constraints()

```
void AK_check_constraints (
    AK\_block * tbl1_temp_block,
    AK\_block * tbl2_temp_block,
    int tbl1_num_att,
    int tbl2_num_att,
    struct list\_node * constraints,
    char * new_table )
```

Function that iterates through blocks of the two tables and copies the rows which pass the constraint check into the new table.

Author

Tomislav Mikulček

Parameters

<i>tbl1_temp_block</i>	block of the first table
<i>tbl2_temp_block</i>	block of the second join table
<i>tbl1_num_att</i>	number of attributes in the first table
<i>tbl2_num_att</i>	number of attributes in the second table
<i>constraints</i>	list of attributes, (in)equality and logical operators which are the conditions for the join in postfix notation
<i>new_table</i>	name of the theta_join table

Returns

No return value

5.74.2.2 AK_create_theta_join_header()

```
int AK_create_theta_join_header (
    char * srcTable1,
    char * srcTable2,
    char * new_table )
```

Function that creates a header of the new table for theta join.

Author

Tomislav Mikulček

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>new_table</i>	name of the destination table

Returns

EXIT_SUCCESS if the header was successfully created and EXIT_ERROR if the renamed headers are too long

5.74.2.3 AK_op_theta_join_test()

```
TestResult AK_op_theta_join_test ( )
```

Function for testing the theta join.

Author

Tomislav Mikulček

Returns

No return value

5.74.2.4 AK_theta_join()

```
int AK_theta_join (
    char * srcTable1,
    char * srcTable2,
    char * dstTable,
    struct list_node * constraints )
```

Function that creates a theta join between two tables on specified conditions.

Author

Tomislav Mikulček, updated by Nikola Miljancic

Parameters

<i>srcTable1</i>	name of the first table to join
<i>srcTable2</i>	name of the second table to join
<i>constraints</i>	list of attributes, (in)equality and logical operators which are the conditions for the join in postfix notation
<i>dstTable</i>	name of the theta join table

Returns

if successful returns EXIT_SUCCESS and EXIT_ERROR otherwise

Function that creates a theta join between two tables on specified conditions.

Author

Tomislav Mikulček, updated by Nikola Miljancic

Parameters

<i>srcTable1</i>	name of the first table to join
<i>srcTable2</i>	name of the second table to join
<i>constraints</i>	list of attributes, (in)equality and logical operators which are the conditions for the join in postfix notation
<i>dstTable</i>	name of the theta join table

Returns

if successful returns EXIT_SUCCESS and EXIT_ERROR otherwise

5.75 rel/union.c File Reference

```
#include "union.h"
Include dependency graph for union.c:
```

Functions

- `int AK_union (char *srcTable1, char *srcTable2, char *dstTable)`
Function that makes a union of two tables. Union is implemented for working with multiple sets of data, i.e. duplicate tuples can be written in same table (union)
- `TestResult AK_op_union_test ()`
Function for union operator testing.

5.75.1 Detailed Description

Provides functions for relational union operation

5.75.2 Function Documentation

5.75.2.1 AK_op_union_test()

```
TestResult AK_op_union_test ( )
```

Function for union operator testing.

Author

Dino Laktašić

Returns

No return value

5.75.2.2 AK_union()

```
int AK_union (
    char * srcTable1,
    char * srcTable2,
    char * dstTable )
```

Function that makes a union of two tables. Union is implemented for working with multiple sets of data, i.e. duplicate tuples can be written in same table (union)

Function that makes a union of two tables.

Author

Dino Laktašić

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>dstTable</i>	name of the new table

Returns

if success returns EXIT_SUCCESS, else returns EXIT_ERROR

5.76 rel/union.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../auxi/mempro.h"
```

Include dependency graph for union.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_union](#) (char *srcTable1, char *srcTable2, char *dstTable)
Function that makes a union of two tables.
- [TestResult AK_op_union_test](#) ()
Function for union operator testing.

5.76.1 Detailed Description

Header file that provides functions and defines for relational union operation

5.76.2 Function Documentation

5.76.2.1 AK_op_union_test()

```
TestResult AK_op_union_test ( )
```

Function for union operator testing.

Author

Dino Laktašić

Returns

No return value

5.76.2.2 AK_union()

```
int AK_union (
    char * srcTable1,
    char * srcTable2,
    char * dstTable )
```

Function that makes a union of two tables.

Author

Dino Laktašić

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>dstTable</i>	name of the new table

Returns

if success returns EXIT_SUCCESS, else returns EXIT_ERROR

Function that makes a union of two tables.

Author

Dino Laktašić

Parameters

<i>srcTable1</i>	name of the first table
<i>srcTable2</i>	name of the second table
<i>dstTable</i>	name of the new table

Returns

if success returns EXIT_SUCCESS, else returns EXIT_ERROR

5.77 sql/command.c File Reference

```
#include "command.h"
```

Include dependency graph for command.c:

Functions

- int [AK_command](#) ([command](#) *commands, int commandNum)
Function for executing given commands (SELECT, UPDATE, DELETE AND INSERT)
- [TestResult AK_test_command](#) ()
Function for testing commands.

5.77.1 Detailed Description

TODO: Description

5.77.2 Function Documentation

5.77.2.1 AK_command()

```
int AK_command (
    command * commands,
    int commandNum )
```

Function for executing given commands (SELECT, UPDATE, DELETE AND INSERT)

Author

Mario Kolmacic updated by Ivan Pusic and Tomislav Ilisevic

Parameters

<i>commands</i>	Commands array to execute
<i>commandNum</i>	Number of commands in array

Returns

ERROR_EXIT only if command can't be executed returns EXIT_ERROR

5.77.2.2 AK_test_command()

```
TestResult AK_test_command ( )
```

Function for testing commands.

Author

Unknown, updated by Tomislav Ilisevic

5.78 sql/command.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../rel/selection.h"
#include "../auxi/mempro.h"
```

Include dependency graph for command.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [AK_command_struct](#)

Typedefs

- typedef struct [AK_command_struct](#) **command**

Functions

- int [AK_command](#) ([command](#) *komande, int brojkomandi)
Function for executing given commands (SELECT, UPDATE, DELETE AND INSERT)
- [TestResult AK_test_command](#) ()
Function for testing commands.

5.78.1 Detailed Description

Header file that provides data structures, functions and defines for [command.c](#)

5.78.2 Function Documentation

5.78.2.1 AK_command()

```
int AK_command (
    command * commands,
    int commandNum )
```

Function for executing given commands (SELECT, UPDATE, DELETE AND INSERT)

Author

Mario Kolmacic updated by Ivan Pusic and Tomislav Ilisevic

Parameters

<i>commands</i>	Commands array to execute
<i>commandNum</i>	Number of commands in array

Returns

ERROR_EXIT only if command can't be executed returns EXIT_ERROR

5.78.2.2 AK_test_command()

```
TestResult AK_test_command ( )
```

Function for testing commands.

Author

Unknown, updated by Tomislav Ilisevic

5.79 sql/cs/between.c File Reference

```
#include "between.h"  
Include dependency graph for between.c:
```

Functions

- int [AK_find_table_address](#) (char *_systemTableName)
Function that returns system tables addresses by name.
- void [AK_set_constraint_between](#) (char *tableName, char *constraintName, char *attName, char *startValue, char *endValue)
Function that sets between constraints on particular attribute, string constraint should be written in lowercase. It searches for AK_free space. Then it inserts id, name of table, name of constraint, name of attribute, start and end value in temporary block.
- int [AK_read_constraint_between](#) (char *tableName, char *newValue, char *attNamePar)
Function that checks if the given value is between lower and upper bounds of the "between" constraint.
- void [AK_print_constraints](#) (char *tableName)
Function for printing tables.
- int [AK_delete_constraint_between](#) (char *tableName, char *constraintNamePar, char *attNamePar)
Function for deleting specific between constraint.
- [TestResult AK_constraint_between_test](#) ()
Function that tests the functionality of implemented between constraint.

5.79.1 Detailed Description

Provides functions for between constraint

5.79.2 Function Documentation

5.79.2.1 AK_constraint_between_test()

```
TestResult AK_constraint_between_test ( )
```

Function that tests the functionality of implemented between constraint.

Author

Saša Vukšić, updated by Mislav Jurinić

Returns

No return value

5.79.2.2 AK_delete_constraint_between()

```
int AK_delete_constraint_between (
    char * tableName,
    char * constraintNamePar,
    char * attNamePar )
```

Function for deleting specific between constraint.

Author

Maja Vračan

Parameters

<i>tableName</i>	name of table on which constraint refers
<i>attName</i>	name of attribute on which constraint is declared
<i>constraintName</i>	name of constraint

Returns

EXIT_SUCCESS when constraint is deleted, else EXIT_ERROR

5.79.2.3 AK_find_table_address()

```
int AK_find_table_address (
    char * _systemTableName )
```

Function that returns system tables addresses by name.

Author

Mislav Jurinić

Parameters

<i>_systemTableName</i>	table name
-------------------------	------------

Returns

int

5.79.2.4 AK_print_constraints()

```
void AK_print_constraints (
    char * tableName )
```

Function for printing tables.

Author

Maja Vračan

Parameters

<i>tableName</i>	name of table
------------------	---------------

5.79.2.5 AK_read_constraint_between()

```
int AK_read_constraint_between (
    char * tableName,
    char * newValue,
    char * attNamePar )
```

Function that checks if the given value is between lower and upper bounds of the "between" constraint.

Author

Saša Vukšić, updated by Mislav Jurinić

Parameters

<i>tableName</i>	table name
<i>newValue</i>	value we want to insert
<i>attNamePar</i>	attribute name

Returns

EXIT_SUCCESS or EXIT_ERROR

5.79.2.6 AK_set_constraint_between()

```
void AK_set_constraint_between (
    char * tableName,
    char * constraintName,
    char * attName,
    char * startValue,
    char * endValue )
```

Function that sets between constraints on particular attribute, string constraint should be written in lowercase. It searches for AK_free space. Then it inserts id, name of table, name of constraint, name of attribute, start and end value in temporary block.

Function that sets between constraints on particular attribute, string constraint should be written in lowercase.

Author

Saša Vukšić, updated by Mislav Jurinić

Parameters

<i>tableName</i>	table name
<i>constraintName</i>	name of constraint
<i>attName</i>	name of attribute
<i>startValue</i>	initial constraint
<i>endValue</i>	final constraint

Returns

No return value

5.80 sql/cs/between.h File Reference

```
#include "../auxi/test.h"
#include "../mm/memoman.h"
#include "../file/id.h"
#include "../auxi/mempro.h"
```

Include dependency graph for between.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_find_table_address](#) (char *_systemTableName)

Function that returns system tables addresses by name.

- void [AK_set_constraint_between](#) (char *tableName, char *constraintName, char *attName, char *startValue, char *endValue)

Function that sets between constraints on particular attribute, string constraint should be written in lowercase.

- int [AK_read_constraint_between](#) (char *tableName, char *newValue, char *attNamePar)

Function that checks if the given value is between lower and upper bounds of the "between" constraint.

- int [AK_delete_constraint_between](#) (char *tableName, char attName[], char constraintName[])

Function for deleting specific between constraint.

- [TestResult AK_constraint_between_test](#) ()

Function that tests the functionality of implemented between constraint.

5.80.1 Detailed Description

Header file that provides functions and defines for between constraint

5.80.2 Function Documentation

5.80.2.1 AK_constraint_between_test()

```
TestResult AK_constraint_between_test ( )
```

Function that tests the functionality of implemented between constraint.

Author

Saša Vukšić, updated by Mislav Jurinić

Returns

No return value

5.80.2.2 AK_delete_constraint_between()

```
int AK_delete_constraint_between (
    char * tableName,
    char attName[],
    char constraintName[] )
```

Function for deleting specific between constraint.

Author

Maja Vračan

Parameters

<i>tableName</i>	name of table on which constraint refers
<i>attName</i>	name of attribute on which constraint is declared
<i>constraintName</i>	name of constraint

Returns

EXIT_SUCCESS when constraint is deleted, else EXIT_ERROR

5.80.2.3 AK_find_table_address()

```
int AK_find_table_address (
    char * _systemTableName )
```

Function that returns system tables addresses by name.

Author

Mislav Jurinić

Parameters

<i>_systemTableName</i>	table name
-------------------------	------------

Returns

int

5.80.2.4 AK_read_constraint_between()

```
int AK_read_constraint_between (
    char * tableName,
    char * newValue,
    char * attNamePar )
```

Function that checks if the given value is between lower and upper bounds of the "between" constraint.

Author

Saša Vukšić, updated by Mislav Jurinić

Parameters

<i>tableName</i>	table name
<i>newValue</i>	value we want to insert
<i>attNamePar</i>	attribute name

Returns

EXIT_SUCCESS or EXIT_ERROR

5.80.2.5 AK_set_constraint_between()

```
void AK_set_constraint_between (
    char * tableName,
    char * constraintName,
    char * attName,
    char * startValue,
    char * endValue )
```

Function that sets between constraints on particular attribute, string constraint should be written in lowercase.

Author

Saša Vukšić, updated by Mislav Jurinić

Parameters

<i>tableName</i>	table name
<i>constraintName</i>	name of constraint
<i>attName</i>	name of attribute
<i>startValue</i>	initial constraint
<i>endValue</i>	final constraint

Returns

No return value

Function that sets between constraints on particular attribute, string constraint should be written in lowercase.

Author

Saša Vukšić, updated by Mislav Jurinić

Parameters

<i>tableName</i>	table name
<i>constraintName</i>	name of constraint
<i>attName</i>	name of attribute
<i>startValue</i>	initial constraint
<i>endValue</i>	final constraint

Returns

No return value

5.81 sql/cs/check_constraint.c File Reference

```
#include "check_constraint.h"
#include "../drop.h"
Include dependency graph for check_constraint.c:
```

Functions

- int [condition_passed](#) (char *condition, int type, void *value, void *row_data)
Function that for a given value, checks if it satisfies the "check" constraint.
- int [AK_set_check_constraint](#) (char *table_name, char *constraint_name, char *attribute_name, char *condition, int type, void *value)
Function that adds a new "check" constraint into the system table.
- int [AK_check_constraint](#) (char *table, char *attribute, void *value)
Function that verifies if the value we want to insert satisfies the "check" constraint.
- [TestResult AK_check_constraint_test](#) ()
Test function for "check" constraint.

5.81.1 Detailed Description

Check constraint implementation file.

5.81.2 Function Documentation

5.81.2.1 AK_check_constraint()

```
int AK_check_constraint (
    char * table,
    char * attribute,
    void * value )
```

Function that verifies if the value we want to insert satisfies the "check" constraint.

Author

Mislav Jurinić

Parameters

<i>table</i>	target table name
<i>attribute</i>	target attribute name
<i>value</i>	data we want to insert

Returns

1 - result, 0 - failure

5.81.2.2 AK_check_constraint_test()

```
TestResult AK_check_constraint_test ( )
```

Test function for "check" constraint.

Author

Mislav Jurinić

Returns

void

5.81.2.3 AK_set_check_constraint()

```
int AK_set_check_constraint (
    char * table_name,
    char * constraint_name,
    char * attribute_name,
    char * condition,
    int type,
    void * value )
```

Function that adds a new "check" constraint into the system table.

Author

Mislav Jurinić

Parameters

<i>table_name</i>	target table for "check" constraint evaluation
<i>constraint_name</i>	new "check" constraint name that will be visible in the system table
<i>attribute_name</i>	target attribute for "check" constraint evaluation
<i>condition</i>	logical operator ['<', '>', '!=', ...]
<i>type</i>	data type [int, float, varchar, datetime, ...]
<i>value</i>	condition to be set

Returns

1 - result, 0 - failure

5.81.2.4 condition_passed()

```
int condition_passed (
    char * condition,
    int type,
    void * value,
    void * row_data )
```

Function that for a given value, checks if it satisfies the "check" constraint.

Author

Mislav Jurinić

Parameters

<i>condition</i>	logical operator ['<', '>', '!=', ...]
<i>type</i>	data type [int, float, varchar, datetime, ...]
<i>value</i>	condition to be set
<i>row_data</i>	data in table

Returns

1 - result, 0 - failure

5.82 sql/cs/check_constraint.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../rel/expression_check.h"
#include "../auxi/mempro.h"
```

Include dependency graph for check_constraint.h: This graph shows which files directly or indirectly include this file:

Functions

- int [condition_passed](#) (char *condition, int type, void *value, void *row_data)
Function that for a given value, checks if it satisfies the "check" constraint.
- int [AK_set_check_constraint](#) (char *table_name, char *constraint_name, char *attribute_name, char *condition, int type, void *value)
Function that adds a new "check" constraint into the system table.
- int [AK_check_constraint](#) (char *table, char *attribute, void *value)
Function that verifies if the value we want to insert satisfies the "check" constraint.
- [TestResult AK_check_constraint_test](#) ()
Test function for "check" constraint.

5.82.1 Detailed Description

Header file that provides functions and defines for check constraint

5.82.2 Function Documentation

5.82.2.1 AK_check_constraint()

```
int AK_check_constraint (
    char * table,
    char * attribute,
    void * value )
```

Function that verifies if the value we want to insert satisfies the "check" constraint.

Author

Mislav Jurinić

Parameters

<i>table</i>	target table name
<i>attribute</i>	target attribute name
<i>value</i>	data we want to insert

Returns

1 - result, 0 - failure

5.82.2.2 AK_check_constraint_test()

```
TestResult AK_check_constraint_test ( )
```

Test function for "check" constraint.

Author

Mislav Jurinić

Returns

void

5.82.2.3 AK_set_check_constraint()

```
int AK_set_check_constraint (
    char * table_name,
    char * constraint_name,
    char * attribute_name,
    char * condition,
    int type,
    void * value )
```

Function that adds a new "check" constraint into the system table.

Author

Mislav Jurinić

Parameters

<i>table_name</i>	target table for "check" constraint evaluation
<i>constraint_name</i>	new "check" constraint name that will be visible in the system table
<i>attribute_name</i>	target attribute for "check" constraint evaluation
<i>condition</i>	logical operator ['<', '>', '!=', ...]
<i>type</i>	data type [int, float, varchar, datetime, ...]
<i>value</i>	condition to be set

Returns

1 - result, 0 - failure

5.82.2.4 condition_passed()

```
int condition_passed (
    char * condition,
    int type,
    void * value,
    void * row_data )
```

Function that for a given value, checks if it satisfies the "check" constraint.

Author

Mislav Jurinić

Parameters

<i>condition</i>	logical operator ['<', '>', '!=', ...]
<i>type</i>	data type [int, float, varchar, datetime, ...]
<i>value</i>	condition to be set
<i>row_data</i>	data in table

Returns

1 - result, 0 - failure

5.83 sql/cs/constraint_names.c File Reference

```
#include "constraint_names.h"
Include dependency graph for constraint_names.c:
```

Functions

- int [AK_check_constraint_name](#) (char *constraintName)
Function that checks if constraint name would be unique in database.
- [TestResult AK_constraint_names_test](#) ()
Function that tests if constraint name would be unique in database.

5.83.1 Detailed Description

Provides functions for checking if constraint name is unique in database

5.83.2 Function Documentation

5.83.2.1 AK_check_constraint_name()

```
int AK_check_constraint_name (
    char * constraintName )
```

Function that checks if constraint name would be unique in database.

Author

Nenad Makar, updated by Matej Lipovača

Parameters

<i>char</i>	constraintName name which you want to give to constraint which you are trying to create
-------------	-----------------------------------------------------------------------------------------

Returns

EXIT_ERROR or EXIT_SUCCESS

Updated by Matej Lipovača Added other constraint names from catalog, aswell in "constants.h"

5.83.2.2 AK_constraint_names_test()

```
TestResult AK_constraint_names_test ( )
```

Function that tests if constraint name would be unique in database.

Author

Nenad Makar

Returns

No return value

5.84 sql/cs/constraint_names.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../auxi/mempro.h"
```

Include dependency graph for constraint_names.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_check_constraint_name](#) (char *constraintName)
Function that checks if constraint name would be unique in database.
- [TestResult AK_constraint_names_test](#) ()
Function that tests if constraint name would be unique in database.

5.84.1 Detailed Description

Header file that provides functions and defines for checking if constraint name is unique in database

5.84.2 Function Documentation

5.84.2.1 AK_check_constraint_name()

```
int AK_check_constraint_name (
    char * constraintName )
```

Function that checks if constraint name would be unique in database.

Author

Nenad Makar, updated by Mislav Jurinić

Parameters

<i>char</i>	constraintName name which you want to give to constraint which you are trying to create
-------------	-----------------------------------------------------------------------------------------

Returns

EXIT_ERROR or EXIT_SUCCESS

Author

Nenad Makar, updated by Matej Lipovača

Parameters

<i>char</i>	constraintName name which you want to give to constraint which you are trying to create
-------------	-----------------------------------------------------------------------------------------

Returns

EXIT_ERROR or EXIT_SUCCESS

Updated by Matej Lipovača Added other constraint names from catalog, aswell in "constants.h"

5.84.2.2 AK_constraint_names_test()

```
TestResult AK_constraint_names_test ( )
```

Function that tests if constraint name would be unique in database.

Author

Nenad Makar

Returns

No return value

5.85 sql/cs/nnull.c File Reference

```
#include "nnull.h"  
Include dependency graph for nnull.c:
```

Functions

- int [AK_set_constraint_not_null](#) (char *tableName, char *attName, char *constraintName)
Function that sets NOT NULL constraint on an attribute.
- int [AK_check_constraint_not_null](#) (char *tableName, char *attName, char *constraintName)
Function that checks if constraint name is unique and in violation of NOT NULL constraint.
- int [AK_read_constraint_not_null](#) (char *tableName, char *attName, char *newValue)
Function checks if NOT NULL constraint is already set.
- int [AK_delete_constraint_not_null](#) (char *tableName, char attName[], char constraintName[])
Function for deleting specific not null constraint.
- [TestResult AK_nnull_constraint_test](#) ()
Function for testing NOT NULL constraint.

5.85.1 Detailed Description

Provides functions for not null constraint

5.85.2 Function Documentation

5.85.2.1 [AK_check_constraint_not_null\(\)](#)

```
int AK_check_constraint_not_null (
    char * tableName,
    char * attName,
    char * constraintName )
```

Function that checks if constraint name is unique and in violation of NOT NULL constraint.

Author

Saša Vukšić, updated by Nenad Makar

Parameters

<i>char*</i>	tableName name of table
<i>char*</i>	attName name of attribute
<i>char*</i>	constraintName name of constraint

Returns

EXIT_ERROR or EXIT_SUCCESS

5.85.2.2 AK_delete_constraint_not_null()

```
int AK_delete_constraint_not_null (
    char * tableName,
    char attName[],
    char constraintName[] )
```

Function for deleting specific not null constraint.

Author

Maja Vračan

Parameters

<i>tableName</i>	name of table on which constraint refers
<i>attName</i>	name of attribute on which constraint is declared
<i>constraintName</i>	name of constraint

Returns

EXIT_SUCCESS when constraint is deleted, else EXIT_ERROR

5.85.2.3 AK_nnull_constraint_test()

```
TestResult AK_nnull_constraint_test ( )
```

Function for testing NOT NULL constraint.

Author

Saša Vukšić, updated by Nenad Makar

Returns

No return value

5.85.2.4 AK_read_constraint_not_null()

```
int AK_read_constraint_not_null (
    char * tableName,
    char * attName,
    char * newValue )
```

Function checks if NOT NULL constraint is already set.

Author

Saša Vukšić, updated by Nenad Makar

Parameters

<i>char*</i>	tableName name of table
<i>char*</i>	attName name of attribute
<i>char*</i>	newValue new value

Returns

EXIT_ERROR or EXIT_SUCCESS

5.85.2.5 AK_set_constraint_not_null()

```
int AK_set_constraint_not_null (
    char * tableName,
    char * attName,
    char * constraintName )
```

Function that sets NOT NULL constraint on an attribute.

Author

Saša Vukšić, updated by Nenad Makar

Parameters

<i>char*</i>	tableName name of table
<i>char*</i>	attName name of attribute
<i>char*</i>	constraintName name of constraint

Returns

EXIT_ERROR or EXIT_SUCCESS

5.86 sql/cs/nnull.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../auxi/mempro.h"
#include "constraint_names.h"
```

Include dependency graph for nnull.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_set_constraint_not_null](#) (char *tableName, char *attName, char *constraintName)

Function that sets NOT NULL constraint on an attribute.

- int [AK_read_constraint_not_null](#) (char *tableName, char *attName, char *newValue)

Function checks if NOT NULL constraint is already set.

- int [AK_check_constraint_not_null](#) (char *tableName, char *attName, char *newValue)

Function that checks if constraint name is unique and in violation of NOT NULL constraint.

- int [AK_delete_constraint_not_null](#) (char *tableName, char attName[], char constraintName[])

Function for deleting specific not null constraint.

- [TestResult AK_nnull_constraint_test](#) ()

Function for testing NOT NULL constraint.

5.86.1 Detailed Description

Header file that provides functions and defines for not null constraint

5.86.2 Function Documentation

5.86.2.1 AK_check_constraint_not_null()

```
int AK_check_constraint_not_null (  
    char * tableName,  
    char * attName,  
    char * constraintName )
```

Function that checks if constraint name is unique and in violation of NOT NULL constraint.

Author

Saša Vukšić, updated by Nenad Makar

Parameters

<i>char*</i>	tableName name of table
<i>char*</i>	attName name of attribute
<i>char*</i>	constraintName name of constraint

Returns

EXIT_ERROR or EXIT_SUCCESS

5.86.2.2 AK_delete_constraint_not_null()

```
int AK_delete_constraint_not_null (  
    char * tableName,
```

```
char attName[],  
char constraintName[] )
```

Function for deleting specific not null constraint.

Author

Maja Vračan

Parameters

<i>tableName</i>	name of table on which constraint refers
<i>attName</i>	name of attribute on which constraint is declared
<i>constraintName</i>	name of constraint

Returns

EXIT_SUCCESS when constraint is deleted, else EXIT_ERROR

5.86.2.3 AK_nnull_constraint_test()

```
TestResult AK_nnull_constraint_test ( )
```

Function for testing NOT NULL constraint.

Author

Saša Vukšić, updated by Nenad Makar

Returns

No return value

5.86.2.4 AK_read_constraint_not_null()

```
int AK_read_constraint_not_null (   
    char * tableName,  
    char * attName,  
    char * newValue )
```

Function checks if NOT NULL constraint is already set.

Author

Saša Vukšić, updated by Nenad Makar

Parameters

<i>char*</i>	tableName name of table
<i>char*</i>	attName name of attribute
<i>char*</i>	newValue new value

Returns

EXIT_ERROR or EXIT_SUCCESS

5.86.2.5 AK_set_constraint_not_null()

```
int AK_set_constraint_not_null (
    char * tableName,
    char * attName,
    char * constraintName )
```

Function that sets NOT NULL constraint on an attribute.

Author

Saša Vukšić, updated by Nenad Makar

Parameters

<i>char*</i>	tableName name of table
<i>char*</i>	attName name of attribute
<i>char*</i>	constraintName name of constraint

Returns

EXIT_ERROR or EXIT_SUCCESS

5.87 sql/cs/reference.c File Reference

```
#include "reference.h"
```

Include dependency graph for reference.c:

Functions

- int [AK_add_reference](#) (char *childTable, char *childAttNames[], char *parentTable, char *parentAttNames[], int attNum, char *constraintName, int type)
Function that adds a reference for a group of attributes over a given table to a group of attributes over another table with a given constraint name.
- [AK_ref_item](#) [AK_get_reference](#) (char *tableName, char *constraintName)

Function that reads a reference entry from system table.

- int [AK_reference_check_attribute](#) (char *tableName, char *attribute, char *value)

Function that checks referential integrity for one attribute.

- int [AK_reference_check_if_update_needed](#) (struct [list_node](#) *lista, int action)

Function that quickly checks if there are any referential constraints that should be applied on a given list of changes.

- int [AK_reference_check_restricion](#) (struct [list_node](#) *lista, int action)

Function that checks for a REF_TYPE_RESTRICT references applicable to the operation of updating or deleting a row in a table.

- int [AK_reference_update](#) (struct [list_node](#) *lista, int action)

Function that updates child table entries according to ongoing update of parent table entries.

- int [AK_reference_check_entry](#) (struct [list_node](#) *lista)

Function that checks a new entry for referential integrity.

- [TestResult AK_reference_test](#) ()

Function for testing referential integrity.

5.87.1 Detailed Description

Provides functions for referential integrity

5.87.2 Function Documentation

5.87.2.1 AK_add_reference()

```
int AK_add_reference (
    char * childTable,
    char * childAttNames[],
    char * parentTable,
    char * parentAttNames[],
    int attNum,
    char * constraintName,
    int type )
```

Function that adds a reference for a group of attributes over a given table to a group of attributes over another table with a given constraint name.

Author

Dejan Frankovic

Parameters

<i>name</i>	of the child table
<i>array</i>	of child table attribute names (foreign key attributes)
<i>name</i>	of the parent table
<i>array</i>	of parent table attribute names (primary key attributes)
<i>number</i>	of attributes in foreign key
<i>name</i>	of the constraint
<i>type</i>	of the constraint, constants defined in ' reference.h '

Returns

EXIT_SUCCESS

5.87.2.2 AK_get_reference()

```
AK_ref_item AK_get_reference (
    char * tableName,
    char * constraintName )
```

Function that reads a reference entry from system table.

Author

Dejan Frankovic

Parameters

<i>name</i>	of the table with reference (with foreign key)
<i>name</i>	of the reference constraint

Returns

[AK_ref_item](#) object with all necessary information about the reference

5.87.2.3 AK_reference_check_attribute()

```
int AK_reference_check_attribute (
    char * tableName,
    char * attribute,
    char * value )
```

Function that checks referential integrity for one attribute.

Author

Dejan Frankovic

Parameters

<i>child</i>	table name
<i>attribute</i>	name (foreign key attribute)
<i>value</i>	of the attribute we're checking

Returns

EXIT_ERROR if check failed, EXIT_SUCCESS if referential integrity is ok

5.87.2.4 AK_reference_check_entry()

```
int AK_reference_check_entry (
    struct list_node * lista )
```

Function that checks a new entry for referential integrity.

Author

Dejan Franković

Parameters

<i>list</i>	of elements for insert row
-------------	----------------------------

Returns

EXIT_SUCCESS if referential integrity is ok, EXIT_ERROR if it is compromised

5.87.2.5 AK_reference_check_if_update_needed()

```
int AK_reference_check_if_update_needed (
    struct list_node * lista,
    int action )
```

Funcction that quickly checks if there are any referential constraints that should be applied on a given list of changes.

Author

Dejan Frankovic

Parameters

<i>list</i>	of elements for update
<i>is</i>	action UPDATE or DELETE ?

Returns

EXIT_SUCCESS if update is needed, EXIT_ERROR if not

5.87.2.6 AK_reference_check_restricion()

```
int AK_reference_check_restricion (
    struct list_node * lista,
    int action )
```

Function that checks for a REF_TYPE_RESTRICIT references appliable to the operation of updating or deleting a row in a table.

Author

Dejan Franković

Parameters

<i>list</i>	of elements for update
<i>is</i>	action UPDATE or DELETE?

Returns

EXIT_SUCCESS if there is no restriction on this action, EXIT_ERROR if there is

5.87.2.7 AK_reference_test()

```
TestResult AK_reference_test ( )
```

Function for testing referential integrity.

Author

Dejan Franković

Returns

No return value

5.87.2.8 AK_reference_update()

```
int AK_reference_update (
    struct list_node * lista,
    int action )
```

Function that updates child table entries according to ongoing update of parent table entries.

Author

Dejan Franković

Parameters

<i>list</i>	of elements for update
<i>is</i>	action UPDATE or DELETE ?

Returns

EXIT_SUCCESS

5.88 sql/cs/reference.h File Reference

```
#include "../auxi/test.h"
#include "../dm/dbman.h"
#include "../file/table.h"
#include "../auxi/mempro.h"
```

Include dependency graph for reference.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [AK_ref_item](#)

Structure that represents reference item. It contains of table, attributes, parent table and it's attributes, number of attributes, constraint and type of reference.

Macros

- #define [REF_TYPE_NONE](#) -1
Constant declaring none reference type.
- #define [REF_TYPE_SET_NULL](#) 1
Constant declaring set null reference type.
- #define [REF_TYPE_NO_ACTION](#) 2
Constant declaring no action reference type.
- #define [REF_TYPE_CASCADE](#) 3
- #define [REF_TYPE_RESTRICT](#) 4
Constant declaring restrict reference type.
- #define [REF_TYPE_SET_DEFAULT](#) 5
Constant declaring set default reference type.
- #define [MAX_REFERENCE_ATTRIBUTES](#) 10
Constant declaring maximum number of reference attributes.
- #define [MAX_CHILD_CONSTRAINTS](#) 20
Constant declaring maximum number of child constraints.

Functions

- int [AK_add_reference](#) (char *childTable, char *childAttNames[], char *parentTable, char *parentAttNames[], int attNum, char *constraintName, int type)
Function that adds a reference for a group of attributes over a given table to a group of attributes over another table with a given constraint name.
- [AK_ref_item AK_get_reference](#) (char *tableName, char *constraintName)
Function that reads a reference entry from system table.
- int [AK_reference_check_attribute](#) (char *tableName, char *attribute, char *value)
Function that checks referential integrity for one attribute.
- int [AK_reference_check_if_update_needed](#) (struct [list_node](#) *lista, int action)
Funcction that quickly checks if there are any referential constraints that should be applied on a given list of changes.
- int [AK_reference_check_restricion](#) (struct [list_node](#) *lista, int action)
Function that checks for a REF_TYPE_RESTRICT references applicable to the operation of updating or deleting a row in a table.
- int [AK_reference_update](#) (struct [list_node](#) *lista, int action)
Function that updates child table entries according to ongoing update of parent table entries.
- int [AK_reference_check_entry](#) (struct [list_node](#) *lista)
Function that checks a new entry for referential integrity.
- [TestResult AK_reference_test](#) ()
Function for testing referential integrity.
- void [AK_Insert_New_Element](#) (int newtype, void *data, char *table, char *attribute_name, struct [list_node](#) *ElementBefore)
Used to add a new element after some element, to insert on first place give list as before element. It calls function AK_Insert_New_Element_For_Update.
- void [AK_Update_Existing_Element](#) (int newtype, void *data, char *table, char *attribute_name, struct [list_node](#) *ElementBefore)
Used to add a constraint attribute which will define what element gets updated when the operation is executed.
- int [AK_insert_row](#) (struct [list_node](#) *row_root)
Function inserts a one row into table. Firstly it is checked whether inserted row would violite reference integrity. Then it is checked in which table should row be inserted. If there is no AK_free space for new table, new extent is allocated. New block is allocated on given address. Row is inserted in this block and dirty flag is set to BLOCK_DIRTY.
- int [AK_selection](#) (char *srcTable, char *dstTable, struct [list_node](#) *expr)
Function that which implements selection.
- void [AK_Insert_New_Element_For_Update](#) (int newtype, void *data, char *table, char *attribute_name, struct [list_node](#) *ElementBefore, int newconstraint)
!! YOU PROBABLY DON'T WANT TO USE THIS FUNCTION !! - Use AK_Update_Existing_Element or AK_Insert↵_New_Element instead. Function inserts new element after some element, to insert on first place give list as before element. New element is allocated. Type, data, attribute name and constraint of new elemets are set according to function arguments. Pointers are changed so that before element points to new element.
- int [AK_delete_row](#) (struct [list_node](#) *row_root)
Function deletes rows.
- int [AK_update_row](#) (struct [list_node](#) *row_root)
Function updates rows of some table.
- int [AK_initialize_new_segment](#) (char *name, int type, [AK_header](#) *header)
Function that initializes a new segment and writes its start and finish address in system catalog table. For creting new table, index, temporary table, etc. call this function.

5.88.1 Detailed Description

d Provides data structures, functions and defines for referential integrity

5.88.2 Macro Definition Documentation

5.88.2.1 REF_TYPE_NO_ACTION

```
#define REF_TYPE_NO_ACTION 2
```

Constant declaring no action reference type.

Constant declaring cascade reference type.

5.88.3 Function Documentation

5.88.3.1 AK_add_reference()

```
int AK_add_reference (
    char * childTable,
    char * childAttNames[],
    char * parentTable,
    char * parentAttNames[],
    int attNum,
    char * constraintName,
    int type )
```

Function that adds a reference for a group of attributes over a given table to a group of attributes over another table with a given constraint name.

Author

Dejan Frankovic

Parameters

<i>name</i>	of the child table
<i>array</i>	of child table attribute names (foreign key attributes)
<i>name</i>	of the parent table
<i>array</i>	of parent table attribute names (primary key attributes)
<i>number</i>	of attributes in foreign key
<i>name</i>	of the constraint
<i>type</i>	of the constraint, constants defined in ' reference.h '

Returns

EXIT_SUCCESS

5.88.3.2 AK_delete_row()

```
int AK_delete_row (
    struct list\_node * row_root )
```

Function deletes rows.

Author

Matija Novak, Dejan Frankovic (added referential integrity)

Parameters

<i>row_root</i>	elements of one row @returs EXIT_SUCCESS if success
-----------------	-----------------------------------------------------

5.88.3.3 AK_get_reference()

```
AK\_ref\_item AK_get_reference (
    char * tableName,
    char * constraintName )
```

Function that reads a reference entry from system table.

Author

Dejan Frankovic

Parameters

<i>name</i>	of the table with reference (with foreign key)
<i>name</i>	of the reference constraint

Returns

[AK_ref_item](#) object with all neccessary information about the reference

5.88.3.4 AK_initialize_new_segment()

```
int AK_initialize_new_segment (
    char * name,
    int type,
    AK\_header * header )
```

Function that initializes a new segment and writes its start and finish address in system catalog table. For creting new table, index, temporary table, etc. call this function.

Author

Tomislav Fotak, updated by Matija Šestak (function now uses caching)

Parameters

<i>name</i>	segment name
<i>type</i>	segment type
<i>header</i>	pointer to header that should be written to the new extent (all blocks)

Returns

start address of new segment

5.88.3.5 AK_Insert_New_Element()

```
void AK_Insert_New_Element (
    int newtype,
    void * data,
    char * table,
    char * attribute_name,
    struct list_node * ElementBefore )
```

Used to add a new element after some element, to insert on first place give list as before element. It calls function AK_Insert_New_Element_For_Update.

Author

Matija Novak, changed by Dino Laktašić

Parameters

<i>newtype</i>	type of the data
<i>data</i>	the data
<i>table</i>	table name
<i>attribute_name</i>	attribute name
<i>element</i>	element after we which insert the new element
<i>constraint</i>	is NEW_VALUE

Returns

No return value

5.88.3.6 AK_Insert_New_Element_For_Update()

```
void AK_Insert_New_Element_For_Update (
    int newtype,
```



```

void * data,
char * table,
char * attribute_name,
struct list_node * ElementBefore,
int newconstraint )

```

!! YOU PROBABLY DON'T WANT TO USE THIS FUNCTION !! - Use AK_Update_Existing_Element or AK_Insert↵_New_Element instead. Function inserts new element after some element, to insert on first place give list as before element. New element is allocated. Type, data, attribute name and constraint of new elemets are set according to function arguments. Pointers are changed so that before element points to new element.

Author

Matija Novak

Parameters

<i>newtype</i>	type of the data
<i>data</i>	the data
<i>table</i>	table name
<i>attribute_name</i>	attribute name
<i>element</i>	element after we which insert the new element
<i>constraint</i>	NEW_VALUE if data is new value, SEARCH_CONSTRAINT if data is constraint to search for

Returns

No return value

5.88.3.7 AK_insert_row()

```

int AK_insert_row (
    struct list_node * row_root )

```

Function inserts a one row into table. Firstly it is checked whether inserted row would violite reference integrity. Then it is checked in which table should row be inserted. If there is no AK_free space for new table, new extent is allocated. New block is allocated on given address. Row is inserted in this block and dirty flag is set to BLOCK_↵DIRTY.

Author

Matija Novak, updated by Matija Šestak (function now uses caching), updated by Dejan Frankovic (added reference check), updated by Dino Laktašić (removed variable AK_free, variable table initialized using memset)

Parameters

<i>row_root</i>	list of elements which contain data of one row
-----------------	------------------------------------------------

Returns

EXIT_SUCCESS if success else EXIT_ERROR

5.88.3.8 AK_reference_check_attribute()

```
int AK_reference_check_attribute (
    char * tableName,
    char * attribute,
    char * value )
```

Function that checks referential integrity for one attribute.

Author

Dejan Frankovic

Parameters

<i>child</i>	table name
<i>attribute</i>	name (foreign key attribute)
<i>value</i>	of the attribute we're checking

Returns

EXIT_ERROR if check failed, EXIT_SUCCESS if referential integrity is ok

5.88.3.9 AK_reference_check_entry()

```
int AK_reference_check_entry (
    struct list_node * lista )
```

Function that checks a new entry for referential integrity.

Author

Dejan Franković

Parameters

<i>list</i>	of elements for insert row
-------------	----------------------------

Returns

EXIT_SUCCESS if referential integrity is ok, EXIT_ERROR if it is compromised

5.88.3.10 AK_reference_check_if_update_needed()

```
int AK_reference_check_if_update_needed (
    struct list_node * lista,
    int action )
```

Function that quickly checks if there are any referential constraints that should be applied on a given list of changes.

Author

Dejan Frankovic

Parameters

<i>list</i>	of elements for update
<i>is</i>	action UPDATE or DELETE ?

Returns

EXIT_SUCCESS if update is needed, EXIT_ERROR if not

5.88.3.11 AK_reference_check_restricion()

```
int AK_reference_check_restricion (
    struct list_node * lista,
    int action )
```

Function that checks for a REF_TYPE_RESTRICT references applicable to the operation of updating or deleting a row in a table.

Author

Dejan Franković

Parameters

<i>list</i>	of elements for update
<i>is</i>	action UPDATE or DELETE?

Returns

EXIT_SUCCESS if there is no restriction on this action, EXIT_ERROR if there is

5.88.3.12 AK_reference_test()

```
TestResult AK_reference_test ( )
```

Function for testing referential integrity.

Author

Dejan Franković

Returns

No return value

5.88.3.13 AK_reference_update()

```
int AK_reference_update (
    struct list_node * lista,
    int action )
```

Function that updates child table entries according to ongoing update of parent table entries.

Author

Dejan Franković

Parameters

<i>list</i>	of elements for update
<i>is</i>	action UPDATE or DELETE ?

Returns

EXIT_SUCCESS

5.88.3.14 AK_selection()

```
int AK_selection (
    char * srcTable,
```

```
char * dstTable,  
struct list_node * expr )
```

Function that which implements selection.

Author

Matija Šestak.

Parameters

<i>*srcTable</i>	source table name
<i>*dstTable</i>	destination table name
<i>*expr</i>	list with posfix notation of the logical expression

Returns

EXIT_SUCCESS

5.88.3.15 AK_Update_Existing_Element()

```
void AK_Update_Existing_Element (   
    int newtype,  
    void * data,  
    char * table,  
    char * attribute_name,  
    struct list_node * ElementBefore )
```

Used to add a constraint attribute which will define what element gets updated when the operation is executed.

Author

Igor Rinkovec

Parameters

<i>newtype</i>	type of the data
<i>data</i>	the data
<i>table</i>	table name
<i>attribute_name</i>	attribute name
<i>element</i>	element after we which insert the new element
<i>constraint</i>	is NEW_VALUE

Returns

No return value

5.88.3.16 AK_update_row()

```
int AK_update_row (
    struct list_node * row_root )
```

Function updates rows of some table.

Author

Matija Novak, Dejan Frankovic (added referential integrity)

Parameters

<i>row_root</i>	elements of one row
-----------------	---------------------

Returns

EXIT_SUCCESS if success

5.89 sql/cs/unique.c File Reference

```
#include "unique.h"
Include dependency graph for unique.c:
```

Functions

- int [AK_set_constraint_unique](#) (char *tableName, char attName[], char constraintName[])
Function that sets unique constraint on attribute(s)
- int [AK_read_constraint_unique](#) (char *tableName, char attName[], char newValue[])
Function that checks if the insertion of some value(s) would violate the UNIQUE constraint.
- int [AK_delete_constraint_unique](#) (char *tableName, char attName[], char constraintName[])
Function for deleting specific unique constraint.
- [TestResult AK_unique_test](#) ()
Function for testing UNIQUE constraint.

5.89.1 Detailed Description

Provides functions for unique constraint

5.89.2 Function Documentation

5.89.2.1 AK_delete_constraint_unique()

```
int AK_delete_constraint_unique (
    char * tableName,
    char attName[],
    char constraintName[] )
```

Function for deleting specific unique constraint.

Author

Maja Vračan

Parameters

<i>tableName</i>	name of table on which constraint refers
<i>attName</i>	name of attribute on which constraint is declared
<i>constraintName</i>	name of constraint

Returns

EXIT_SUCCESS when constraint is deleted, else EXIT_ERROR

5.89.2.2 AK_read_constraint_unique()

```
int AK_read_constraint_unique (
    char * tableName,
    char attName[],
    char newValue[] )
```

Function that checks if the insertion of some value(s) would violate the UNIQUE constraint.

Author

Domagoj Tuličić, updated by Nenad Makar

Parameters

<i>char*</i>	tableName name of table
<i>char</i>	attName[] name(s) of attribute(s), if you want to check combination of values of more attributes separate names of attributes with constant SEPARATOR (see test)
<i>char</i>	newValue[] new value(s), if you want to check combination of values of more attributes separate their values with constant SEPARATOR (see test), if some value(s) which you want to check isn't stored as char (string) convert it to char (string) using AK_tuple_to_string(struct list_node *tuple) or with <code>sprintf</code> in a similar way it's used in that function (if value isn't part of a *tuple), to concatenate more values in newValue[] use <code>strcat(destination, source)</code> and put constant SEPARATOR between them (see test) if newValue[] should contain NULL sign pass it as " " (space)

Returns

EXIT_ERROR or EXIT_SUCCESS

5.89.2.3 AK_set_constraint_unique()

```
int AK_set_constraint_unique (
    char * tableName,
    char attName[],
    char constraintName[] )
```

Function that sets unique constraint on attribute(s)

Author

Domagoj Tuličić, updated by Nenad Makar

Parameters

<i>char*</i>	tableName name of table
<i>char</i>	attName[] name(s) of attribute(s), if you want to set UNIQUE constraint on combination of attributes separate their names with constant SEPARATOR (see test)
<i>char</i>	constraintName[] name of constraint

Returns

EXIT_ERROR or EXIT_SUCCESS

5.89.2.4 AK_unique_test()

```
TestResult AK_unique_test ( )
```

Function for testing UNIQUE constraint.

Author

Domagoj Tuličić, updated by Nenad Makar

Returns

No return value

5.90 sql/cs/unique.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../auxi/mempro.h"
#include "../auxi/dictionary.h"
#include "constraint_names.h"
```

Include dependency graph for unique.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_set_constraint_unique](#) (char *tableName, char attName[], char constraintName[])
Function that sets unique constraint on attribute(s)
- int [AK_read_constraint_unique](#) (char *tableName, char attName[], char newValue[])
Function that checks if the insertion of some value(s) would violate the UNIQUE constraint.
- int [AK_delete_constraint_unique](#) (char *tableName, char attName[], char constraintName[])
Function for deleting specific unique constraint.
- [TestResult AK_unique_test](#) ()
Function for testing UNIQUE constraint.

5.90.1 Detailed Description

Header file that provides functions and defines for unique constraint

5.90.2 Function Documentation

5.90.2.1 AK_delete_constraint_unique()

```
int AK_delete_constraint_unique (
    char * tableName,
    char attName[],
    char constraintName[] )
```

Function for deleting specific unique constraint.

Author

Maja Vračan

Parameters

<i>tableName</i>	name of table on which constraint refers
<i>attName</i>	name of attribute on which constraint is declared
<i>constraintName</i>	name of constraint

Returns

EXIT_SUCCESS when constraint is deleted, else EXIT_ERROR

5.90.2.2 AK_read_constraint_unique()

```
int AK_read_constraint_unique (
    char * tableName,
    char attName[],
    char newValue[] )
```

Function that checks if the insertion of some value(s) would violate the UNIQUE constraint.

Author

Domagoj Tuličić, updated by Nenad Makar

Parameters

<i>char*</i>	tableName name of table
<i>char</i>	attName[] name(s) of attribute(s), if you want to check combination of values of more attributes separate names of attributes with constant SEPARATOR (see test)
<i>char</i>	newValue[] new value(s)

Returns

EXIT_ERROR or EXIT_SUCCESS

Author

Domagoj Tuličić, updated by Nenad Makar

Parameters

<i>char*</i>	tableName name of table
<i>char</i>	attName[] name(s) of attribute(s), if you want to check combination of values of more attributes separate names of attributes with constant SEPARATOR (see test)
<i>char</i>	newValue[] new value(s), if you want to check combination of values of more attributes separate their values with constant SEPARATOR (see test), if some value(s) which you want to check isn't stored as char (string) convert it to char (string) using AK_tuple_to_string(struct list_node *tuple) or with <code>sprintf</code> in a similar way it's used in that function (if value isn't part of a *tuple), to concatenate more values in newValue[] use <code>strcat(destination, source)</code> and put constant SEPARATOR between them (see test) if newValue[] should contain NULL sign pass it as " " (space)

Returns

EXIT_ERROR or EXIT_SUCCESS

5.90.2.3 AK_set_constraint_unique()

```
int AK_set_constraint_unique (
    char * tableName,
    char attName[],
    char constraintName[] )
```

Function that sets unique constraint on attribute(s)

Author

Domagoj Tuličić, updated by Nenad Makar

Parameters

<i>char*</i>	tableName name of table
<i>char</i>	attName[] name(s) of attribute(s), if you want to set UNIQUE constraint on combination of attributes separate their names with constant SEPARATOR (see test)
<i>char</i>	constraintName[] name of constraint

Returns

EXIT_ERROR or EXIT_SUCCESS

5.90.2.4 AK_unique_test()

```
TestResult AK_unique_test ( )
```

Function for testing UNIQUE constraint.

Author

Domagoj Tuličić, updated by Nenad Makar

Returns

No return value

5.91 sql/drop.c File Reference

```
#include "drop.h"
Include dependency graph for drop.c:
```

Functions

- int [AK_drop](#) (int type, [AK_drop_arguments](#) *drop_arguments)
Function for DROP table, index, view, sequence, trigger, function, user, group and constraint.
- void [AK_drop_help_function](#) (char *tblName, char *sys_table)
Help function for the drop command. Delete memory blocks and addresses of table and removes table or index from system table.
- int [AK_if_exist](#) (char *tblName, char *sys_table)
Help function for checking if the element(view, function, sequence, user ...) exist in system catalog table.
- [TestResult AK_drop_test](#) ()
Function for testing all DROP functions.

Variables

- char * **system_catalog** [[NUM_SYS_TABLES](#)]

5.91.1 Detailed Description

Author

Unknown, Jurica Hlevnjak - drop table bugs fixed, reorganized code structure, system catalog tables drop disabled, drop index added, drop view added, drop sequence added, drop trigger added, drop_function added, drop user added, drop group added, AK_drop_test updated

Provides DROP functions

5.91.2 Function Documentation

5.91.2.1 AK_drop()

```
int AK_drop (
    int type,
    AK\_drop\_arguments * drop_arguments )
```

Function for DROP table, index, view, sequence, trigger, function, user, group and constraint.

Author

Unknown, Jurica Hlevnjak, updated by Tomislav Ilisevic, Maja Vračan

Parameters

<i>type</i>	drop type
drop_arguments	arguments of DROP command

5.91.2.2 AK_drop_help_function()

```
void AK_drop_help_function (
    char * tblName,
    char * sys_table )
```

Help function for the drop command. Delete memory blocks and addresses of table and removes table or index from system table.

Author

unknown, Jurica Hlevnjak - fix bugs and reorganize code in this function

Parameters

<i>tblName</i>	name of table or index
<i>sys_table</i>	name of system catalog table

5.91.2.3 AK_drop_test()

```
TestResult AK_drop_test ( )
```

Function for testing all DROP functions.

Author

unknown, Jurica Hlevnjak - added all tests except drop table test, updated by Tomislav Ilisevic, Maja Vračan

5.91.2.4 AK_if_exist()

```
int AK_if_exist (
    char * tblName,
    char * sys_table )
```

Help function for checking if the element(view, function, sequence, user ...) exist in system catalog table.

Author

Jurica Hlevnjak, updated by Tomislav Ilisevic

Parameters

<i>tblName</i>	name of table, index view, function, trigger, sequence, user, group or constraint
<i>sys_table</i>	name of system catalog table

Returns

if element exist in system catalog returns 1, if not returns 0

5.91.3 Variable Documentation**5.91.3.1 system_catalog**

```
char* system_catalog[NUM\_SYS\_TABLES]
```

Initial value:

```
= {
    "AK_relation",
    "AK_attribute",
    "AK_index",
    "AK_view",
    "AK_sequence",
    "AK_function",
    "AK_function_arguments",
    "AK_trigger",
    "AK_trigger_conditions",
    "AK_db",
    "AK_db_obj",
    "AK_user",
    "AK_group",
    "AK_user_group",
    "AK_user_right",
    "AK_group_right",
    "AK_constraints_between",
    "AK_constraints_not_null",
    AK\_CONSTRAINTS\_CHECK\_CONSTRAINT,
    "AK_constraints_unique",
    "AK_reference"
}
```

5.92 sql/drop.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../file/sequence.h"
#include "view.h"
#include "trigger.h"
#include "function.h"
#include "privileges.h"
#include "../auxi/mempro.h"
#include "../auxi/constants.h"
```

Include dependency graph for drop.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [drop_arguments](#)

Typedefs

- typedef struct [drop_arguments](#) **AK_drop_arguments**

Functions

- int [AK_drop](#) (int type, [AK_drop_arguments](#) *[drop_arguments](#))
Function for DROP table, index, view, sequence, trigger, function, user, group and constraint.
- [TestResult](#) [AK_drop_test](#) ()
Function for testing all DROP functions.
- int [AK_if_exist](#) (char *tblName, char *sys_table)
Help function for checking if the element(view, function, sequence, user ...) exist in system catalog table.

5.92.1 Detailed Description

Header file that provides data structures, functions and defines for unique constraint

5.92.2 Function Documentation

5.92.2.1 [AK_drop\(\)](#)

```
int AK_drop (
    int type,
    AK\_drop\_arguments * drop_arguments )
```

Function for DROP table, index, view, sequence, trigger, function, user, group and constraint.

Author

Unknown, Jurica Hlevnjak, updated by Tomislav Ilisevic, Maja Vračan

Parameters

<i>type</i>	drop type
drop_arguments	arguments of DROP command

5.92.2.2 AK_drop_test()

```
TestResult AK_drop_test ( )
```

Function for testing all DROP functions.

Author

unknown, Jurica Hlevnjak - added all tests except drop table test, updated by Tomislav Ilisevic, Maja Vračan

5.92.2.3 AK_if_exist()

```
int AK_if_exist (
    char * tblName,
    char * sys_table )
```

Help function for checking if the element(view, function, sequence, user ...) exist in system catalog table.

Author

Jurica Hlevnjak, updated by Tomislav Ilisevic

Parameters

<i>tblName</i>	name of table, index view, function, trigger, sequence, user, group or constraint
<i>sys_table</i>	name of system catalog table

Returns

if element exist in system catalog returns 1, if not returns 0

5.93 sql/function.c File Reference

```
#include "function.h"
```

Include dependency graph for function.c:

Functions

- int [AK_get_function_obj_id](#) (char *function, struct [list_node](#) *arguments_list)
Function that gets obj_id of a function by name and arguments list (transferred from [trigger.c/drop.c](#)).
- int [AK_check_function_arguments](#) (int function_id, struct [list_node](#) *arguments_list)
Function that checks whether arguments belongs to a function.
- int [AK_check_function_arguments_type](#) (int function_id, struct [list_node](#) *args)
Function that checks whether arguments belongs to a function but only checks argument type (not name). Used for drop function.

- int [AK_function_add](#) (char *name, int return_type, struct [list_node](#) *arguments_list)
Function that adds a function to system table.
- int [AK_function_arguments_add](#) (int function_id, int arg_number, int arg_type, char *argname)
Function that adds a function argument to system table.
- int [AK_function_remove_by_obj_id](#) (int obj_id)
Function that removes a function by its obj_id.
- int [AK_function_arguments_remove_by_obj_id](#) (int *obj_id)
Function that removes function arguments by function id.
- int [AK_function_remove_by_name](#) (char *name, struct [list_node](#) *arguments_list)
Function that removes a function from system table by name and arguments.
- int [AK_function_rename](#) (char *name, struct [list_node](#) *arguments_list, char *new_name)
Function that changes the function name.
- int [AK_function_change_return_type](#) (char *name, struct [list_node](#) *arguments_list, int new_return_type)
Function that changes the return type.
- [TestResult AK_function_test](#) ()
Function for functions testing.

5.93.1 Detailed Description

Provides functions for functions

5.93.2 Function Documentation

5.93.2.1 AK_check_function_arguments()

```
int AK_check_function_arguments (  
    int function_id,  
    struct list\_node * arguments_list )
```

Function that checks whether arguments belongs to a function.

Author

Boris Kišić

Parameters

<i>*function_id</i>	id of the function
<i>*arguments_list</i>	list of arguments

Returns

EXIT_SUCCESS of the function or EXIT_ERROR

5.93.2.2 AK_check_function_arguments_type()

```
int AK_check_function_arguments_type (
    int function_id,
    struct list_node * args )
```

Function that checks whether arguments belongs to a function but only checks argument type (not name). Used for drop function.

Author

Jurica Hlevnjak updated by Aleksandra Polak

Parameters

<i>function_id</i>	id of the function
<i>args</i>	function arguments

Returns

EXIT_SUCCESS or EXIT_ERROR

5.93.2.3 AK_function_add()

```
int AK_function_add (
    char * name,
    int return_type,
    struct list_node * arguments_list )
```

Function that adds a function to system table.

Author

Boris Kišić, updated by Tomislav Ilisevic

Parameters

<i>*name</i>	name of the function
<i>*return_type</i>	data type returned from a function - values from 0 to 13 - defined in constants.h
<i>*arguments_list</i>	list of function arguments

Returns

function id or EXIT_ERROR

5.93.2.4 AK_function_arguments_add()

```
int AK_function_arguments_add (
    int function_id,
    int arg_number,
    int arg_type,
    char * argname )
```

Function that adds a function argument to system table.

Author

Boris Kišić

Parameters

<i>*function_id</i>	id of the function to which the argument belongs
<i>*arg_number</i>	number of the argument
<i>*arg_type</i>	data type of the argument
<i>*argname</i>	name of the argument

Returns

function argument id or EXIT_ERROR

5.93.2.5 AK_function_arguments_remove_by_obj_id()

```
int AK_function_arguments_remove_by_obj_id (
    int * obj_id )
```

Function that removes function arguments by function id.

Author

Boris Kišić

Parameters

<i>obj_id</i>	obj_id of the function
---------------	------------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.93.2.6 AK_function_change_return_type()

```
int AK_function_change_return_type (
    char * name,
    struct list_node * arguments_list,
    int new_return_type )
```

Function that changes the return type.

Author

Boris Kišić

Parameters

<i>*name</i>	name of the function to be modified
<i>*arguments_list</i>	list of function arguments
<i>*new_return_type</i>	new return type

Returns

EXIT_SUCCESS or EXIT_ERROR

5.93.2.7 AK_function_remove_by_name()

```
int AK_function_remove_by_name (
    char * name,
    struct list_node * arguments_list )
```

Function that removes a function from system table by name and arguments.

Author

Boris Kišić

Parameters

<i>*name</i>	name of the function
<i>*arguments_list</i>	list of arguments

Returns

EXIT_SUCCESS or EXIT_ERROR

5.93.2.8 AK_function_remove_by_obj_id()

```
int AK_function_remove_by_obj_id (
    int obj_id )
```

Function that removes a function by its obj_id.

Author

Boris Kišić

Parameters

<i>obj_id</i>	obj_id of the function
---------------	------------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.93.2.9 AK_function_rename()

```
int AK_function_rename (
    char * name,
    struct list_node * arguments_list,
    char * new_name )
```

Function that changes the function name.

Author

Boris Kišić

Parameters

<i>*name</i>	name of the function to be modified
<i>*arguments_list</i>	list of arguments to be modified
<i>*new_name</i>	new name of the function

Returns

EXIT_SUCCESS or EXIT_ERROR

5.93.2.10 AK_function_test()

```
TestResult AK_function_test ( )
```

Function for functions testing.

Author

Boris Kišić, updated by Tomislav Ilisevic

Returns

No return value

5.93.2.11 AK_get_function_obj_id()

```
int AK_get_function_obj_id (
    char * function,
    struct list_node * arguments_list )
```

Function that gets obj_id of a function by name and arguments list (transferred from [trigger.c/drop.c](#)).

Author

Unknown, updated by Jurica Hlevnjak - check function arguments included for drop purpose, updated by Tomislav Ilisevic

Parameters

<i>*function</i>	name of the function
<i>*arguments_list</i>	list of arguments

Returns

obj_id of the function or EXIT_ERROR

5.94 sql/function.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../auxi/mempro.h"
#include "../auxi/auxiliary.h"
```

Include dependency graph for function.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_get_function_obj_id](#) (char *function, struct [list_node](#) *arguments_list)
Function that gets obj_id of a function by name and arguments list (transferred from [trigger.c/drop.c](#)).
- int [AK_check_function_arguments](#) (int function_id, struct [list_node](#) *arguments_list)
Function that checks whether arguments belongs to a function.
- int [AK_check_function_arguments_type](#) (int function_id, struct [list_node](#) *args)
Function that checks whether arguments belongs to a function but only checks argument type (not name). Used for drop function.
- int [AK_function_add](#) (char *name, int return_type, struct [list_node](#) *arguments_list)
Function that adds a function to system table.
- int [AK_function_arguments_add](#) (int function_id, int arg_number, int arg_type, char *argname)
Function that adds a function argument to system table.
- int [AK_function_remove_by_obj_id](#) (int obj_id)
Function that removes a function by its obj_id.
- int [AK_function_arguments_remove_by_obj_id](#) (int *obj_id)
Function that removes function arguments by function id.
- int [AK_function_remove_by_name](#) (char *name, struct [list_node](#) *arguments_list)
Function that removes a function from system table by name and arguments.
- int [AK_function_rename](#) (char *name, struct [list_node](#) *arguments_list, char *new_name)
Function that changes the function name.
- int [AK_function_change_return_type](#) (char *name, struct [list_node](#) *arguments_list, int new_return_type)
Function that changes the return type.
- [TestResult AK_function_test](#) ()
Function for functions testing.

5.94.1 Detailed Description

Header file that provides functions and defines for functions

Header file that provides functions and defines for [view.c](#)

5.94.2 Function Documentation

5.94.2.1 [AK_check_function_arguments\(\)](#)

```
int AK_check_function_arguments (
    int function_id,
    struct list\_node * arguments_list )
```

Function that checks whether arguments belongs to a function.

Author

Boris Kišić

Parameters

<i>*function_id</i>	id of the function
<i>*arguments_list</i>	list of arguments

Returns

EXIT_SUCCESS of the function or EXIT_ERROR

5.94.2.2 AK_check_function_arguments_type()

```
int AK_check_function_arguments_type (
    int function_id,
    struct list_node * args )
```

Function that checks whether arguments belongs to a function but only checks argument type (not name). Used for drop function.

Author

Jurica Hlevnjak updated by Aleksandra Polak

Parameters

<i>function↔ _id</i>	id of the function
<i>args</i>	function arguments

Returns

EXIT_SUCCESS or EXIT_ERROR

5.94.2.3 AK_function_add()

```
int AK_function_add (
    char * name,
    int return_type,
    struct list_node * arguments_list )
```

Function that adds a function to system table.

Author

Boris Kišić, updated by Tomislav Ilisevic

Parameters

<i>*name</i>	name of the function
<i>*return_type</i>	data type returned from a function - values from 0 to 13 - defined in constants.h
<i>*arguments_list</i>	list of function arguments

Returns

function id or EXIT_ERROR

5.94.2.4 AK_function_arguments_add()

```
int AK_function_arguments_add (
    int function_id,
    int arg_number,
    int arg_type,
    char * argname )
```

Function that adds a function argument to system table.

Author

Boris Kišić

Parameters

<i>*function_id</i>	id of the function to which the argument belongs
<i>*arg_number</i>	number of the argument
<i>*arg_type</i>	data type of the argument
<i>*argname</i>	name of the argument

Returns

function argument id or EXIT_ERROR

5.94.2.5 AK_function_arguments_remove_by_obj_id()

```
int AK_function_arguments_remove_by_obj_id (
    int * obj_id )
```

Function that removes function arguments by function id.

Author

Boris Kišić

Parameters

<i>obj_id</i>	obj_id of the function
---------------	------------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.94.2.6 AK_function_change_return_type()

```
int AK_function_change_return_type (
    char * name,
    struct list_node * arguments_list,
    int new_return_type )
```

Function that changes the return type.

Author

Boris Kišić

Parameters

<i>*name</i>	name of the function to be modified
<i>*arguments_list</i>	list of function arguments
<i>*new_return_type</i>	new return type

Returns

EXIT_SUCCESS or EXIT_ERROR

5.94.2.7 AK_function_remove_by_name()

```
int AK_function_remove_by_name (
    char * name,
    struct list_node * arguments_list )
```

Function that removes a function from system table by name and arguments.

Author

Boris Kišić

Parameters

<i>*name</i>	name of the function
<i>*arguments_list</i>	list of arguments

Returns

EXIT_SUCCESS or EXIT_ERROR

5.94.2.8 AK_function_remove_by_obj_id()

```
int AK_function_remove_by_obj_id (  
    int obj_id )
```

Function that removes a function by its obj_id.

Author

Boris Kišić

Parameters

<i>obj_id</i>	obj_id of the function
---------------	------------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.94.2.9 AK_function_rename()

```
int AK_function_rename (  
    char * name,  
    struct list_node * arguments_list,  
    char * new_name )
```

Function that changes the function name.

Author

Boris Kišić

Parameters

<i>*name</i>	name of the function to be modified
<i>*arguments_list</i>	list of arguments to be modified
<i>*new_name</i>	new name of the function

Returns

EXIT_SUCCESS or EXIT_ERROR

5.94.2.10 AK_function_test()

```
TestResult AK_function_test ( )
```

Function for functions testing.

Author

Boris Kišić, updated by Tomislav Ilisevic

Returns

No return value

5.94.2.11 AK_get_function_obj_id()

```
int AK_get_function_obj_id (
    char * function,
    struct list_node * arguments_list )
```

Function that gets obj_id of a function by name and arguments list (transferred from [trigger.c/drop.c](#)).

Author

Unknown, updated by Jurica Hlevnjak - check function arguments included for drop purpose, updated by Tomislav Ilisevic

Parameters

<i>*function</i>	name of the function
<i>*arguments_list</i>	list of arguments

Returns

obj_id of the function or EXIT_ERROR

5.95 sql/insert.h File Reference

```
#include "../auxi/mempro.h"
#include "../auxi/test.h"
```

```
#include "../file/fileio.h"
#include "../aux/constants.h"
#include "../file/table.h"
#include "drop.h"
Include dependency graph for insert.h:
```

Functions

- [AK_header](#) * [AK_get_insert_header](#) (int *size, char *tblName, struct [list_node](#) *columns)
Function creates headers based on entered columns in SQL command. If no columns are entered it will use table header.
- int [AK_insert](#) (char *tableName, struct [list_node](#) *columns, struct [list_node](#) *values)
Function that implements SQL insert command.
- [TestResult](#) [AK_insert_test](#) ()

5.95.1 Detailed Description

Implementation of SQL insert command.

Header file SQL insert command.

5.95.2 Function Documentation

5.95.2.1 AK_get_insert_header()

```
AK_header* AK_get_insert_header (
    int * size,
    char * tblName,
    struct list_node * columns )
```

Function creates headers based on entered columns in SQL command. If no columns are entered it will use table header.

Author

Filip Žmuk

Parameters

<i>size</i>	pointer to integer in which size of header will be saved
<i>tblName</i>	table in which rows will be inserted
<i>columns</i>	list of columns in SQL command

Returns

header for values to be inserted or EXIT_ERROR

5.95.2.2 AK_insert()

```
int AK_insert (
    char * tblName,
    struct list_node * columns,
    struct list_node * values )
```

Function that implements SQL insert command.

Author

Filip Žmuk

Parameters

<i>tableName</i>	table in which rows will be inserted
<i>columns</i>	list of columns
<i>values</i>	values to be inserted

Returns

EXIT_SUCCESS or EXIT_ERROR

5.96 sql/privileges.c File Reference

```
#include "privileges.h"
```

Include dependency graph for privileges.c:

Functions

- int [AK_user_add](#) (char *username, int *password, int set_id)
Inserts a new user in the AK_user table.
- int [AK_user_get_id](#) (char *username)
Function that returns an ID of the given user.
- int [AK_user_check_pass](#) (char *username, int *password)
Function that checks if there is user with given password.
- int [AK_user_remove_by_name](#) (char *name)
Function that removes the given user.
- int [AK_user_rename](#) (char *old_name, char *new_name, int *password)
Function that renames a given user.
- int [AK_group_add](#) (char *name, int set_id)
Function that adds a new group.

- int [AK_group_get_id](#) (char *name)
Function that returns the ID from the given group name.
- int [AK_group_remove_by_name](#) (char *name)
Function that removes the given group.
- int [AK_group_rename](#) (char *old_name, char *new_name)
Function that renames the given group.
- int [AK_grant_privilege_user](#) (char *username, char *table, char *right)
Function that grants a specific privilege to the desired user on a given table.
- int [AK_revoke_privilege_user](#) (char *username, char *table, char *right)
Function that revokes users privilege on the given table.
- int [AK_revoke_all_privileges_user](#) (char *username)
Function that revokes ALL user's privileges on ALL tables (for DROP user)
- int [AK_grant_privilege_group](#) (char *groupname, char *table, char *right)
Function that grants a privilege to a given group on a given table.
- int [AK_revoke_privilege_group](#) (char *groupname, char *table, char *right)
Function that revokes a groups privilege on the given table.
- int [AK_revoke_all_privileges_group](#) (char *groupname)
Function that revokes ALL privileges from the desired group on ALL tables (needed for DROP group)
- int [AK_add_user_to_group](#) (char *user, char *group)
Function that puts the desired user in the given group.
- int [AK_remove_user_from_all_groups](#) (char *user)
Function that removes user from all groups. Used for DROP user.
- int [AK_remove_all_users_from_group](#) (char *group)
Function that removes all users from a group. Used for DROP group.
- int [AK_check_privilege](#) (char *username, char *table, char *privilege)
Function that checks whether the given user has a right for the given operation on the given table.
- int [AK_check_user_privilege](#) (char *user)
Function that checks if the user has any privileges or belongs to any group. Used in drop user for restriction.
- int [AK_check_group_privilege](#) (char *group)
Function that checks if the group has any privileges. Used in drop group for restriction.
- [TestResult AK_privileges_test](#) ()
Function that tests all the previous functions.

5.96.1 Detailed Description

Provides functions for privileges

5.96.2 Function Documentation

5.96.2.1 [AK_add_user_to_group\(\)](#)

```
int AK_add_user_to_group (
    char * user,
    char * group )
```

Function that puts the desired user in the given group.

Author

Kristina Takač, updated by Mario Peroković, added verifying the existence of user in the group, updated by Maja Vračan

Parameters

<i>*user</i>	username of user which will be put in group
<i>*group</i>	name of group in which user will be put

Returns

EXIT_SUCCESS or EXIT_ERROR if the user is already in the group

5.96.2.2 AK_check_group_privilege()

```
int AK_check_group_privilege (
    char * group )
```

Function that checks if the group has any privileges. Used in drop group for restriction.

Author

Jurica Hlevnjak, updated by Lidija Lastavec, updated by Marko Flajšek

Parameters

<i>group</i>	name of group
--------------	---------------

Returns

EXIT_ERROR or EXIT_SUCCESS

5.96.2.3 AK_check_privilege()

```
int AK_check_privilege (
    char * username,
    char * table,
    char * privilege )
```

Function that checks whether the given user has a right for the given operation on the given table.

Author

Kristina Takač, updated by Marko Flajšek

Parameters

<i>*user</i>	username for which we want check privileges
<i>*table</i>	name of table for which we want to check whether user has right on
<i>*privilege</i>	privilege for which we want to check whether user has right for

Returns

EXIT_SUCCESS if user has right, EXIT_ERROR if user has no right

5.96.2.4 AK_check_user_privilege()

```
int AK_check_user_privilege (
    char * user )
```

Function that checks if the user has any privileges or belongs to any group. Used in drop user for restriction.

Author

Jurica Hlevnjak, updated by Lidija Lastavec

Parameters

<i>user</i>	name of user
-------------	--------------

Returns

EXIT_ERROR or EXIT_SUCCESS

5.96.2.5 AK_grant_privilege_group()

```
int AK_grant_privilege_group (
    char * groupname,
    char * table,
    char * right )
```

Function that grants a privilege to a given group on a given table.

Author

Kristina Takač.

Parameters

<i>*groupname</i>	name of group to which we want to grant privilege
<i>*table</i>	name of table on which privilege will be granted to user
<i>*right</i>	type of privilege which will be granted to user on given table

Returns

privilege_id or EXIT_ERROR if table or user aren't correct

5.96.2.6 AK_grant_privilege_user()

```
int AK_grant_privilege_user (
    char * username,
    char * table,
    char * right )
```

Function that grants a specific privilege to the desired user on a given table.

Author

Kristina Takač, updated by Mario Peroković, inserting user id instead of username in AK_user_right, updated by Marko Flajšek

Parameters

<i>*username</i>	username of user to whom we want to grant privilege
<i>*table</i>	name of table on which privilege will be granted to user
<i>*right</i>	type of privilege which will be granted to user on given table

Returns

privilege_id or EXIT_ERROR if table or user aren't correct

5.96.2.7 AK_group_add()

```
int AK_group_add (
    char * name,
    int set_id )
```

Function that adds a new group.

Author

Kristina Takač, edited by Ljubo Barać

Parameters

<i>*name</i>	name of group to be added
<i>set_id</i>	non default id to be passed

Returns

id of group

5.96.2.8 AK_group_get_id()

```
int AK_group_get_id (
    char * name )
```

Function that returns the ID from the given group name.

Author

Kristina Takač.

Parameters

<i>*name</i>	name of group whose id we are looking for
--------------	-------------------------------------------

Returns

id of group, otherwise EXIT_ERROR

5.96.2.9 AK_group_remove_by_name()

```
int AK_group_remove_by_name (
    char * name )
```

Function that removes the given group.

Author

Ljubo Barać

Parameters

<i>name</i>	Name of the group to be removed
-------------	---------------------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.96.2.10 AK_group_rename()

```
int AK_group_rename (
    char * old_name,
    char * new_name )
```

Function that renames the given group.

Author

Ljubo Barać, update by Lidija Lastavec

Parameters

<i>old_name</i>	Name of the group to be renamed
<i>new_name</i>	New name of the group

Returns

EXIT_SUCCESS or EXIT_ERROR

5.96.2.11 AK_privileges_test()

```
TestResult AK_privileges_test ( )
```

Function that tests all the previous functions.

Author

Kristina Takač, updated by Tomislav Ilisevic, updated by Lidija Lastavec, updated by Marko Flajšek

Returns

no return value

5.96.2.12 AK_remove_all_users_from_group()

```
int AK_remove_all_users_from_group (
    char * group )
```

Function that removes all users from a group. Used for DROP group.

Author

Jurica Hlevnjak, update by Lidija Lastavec

Parameters

<i>group</i>	name of group
--------------	---------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.96.2.13 AK_remove_user_from_all_groups()

```
int AK_remove_user_from_all_groups (
    char * user )
```

Function that removes user from all groups. Used for DROP user.

Author

Jurica Hlevnjak, update by Lidija Lastavec

Parameters

<i>user</i>	name of user
-------------	--------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.96.2.14 AK_revoke_all_privileges_group()

```
int AK_revoke_all_privileges_group (
    char * groupname )
```

Function that revokes ALL privileges from the desired group on ALL tables (needed for DROP group)

Author

Jurica Hlevnjak

Parameters

<i>groupname</i>	name of group from which we want to revoke all privileges
------------------	-----------------------------------------------------------

Returns

EXIT_SUCCESS if privilege is revoked, EXIT_ERROR if it isn't

5.96.2.15 AK_revoke_all_privileges_user()

```
int AK_revoke_all_privileges_user (
    char * username )
```

Function that revokes ALL user's privileges on ALL tables (for DROP user)

Author

Jurica Hlevnjak, updated by Marko Flajšek

Parameters

<i>username</i>	name of user from whom we want to revoke all privileges
-----------------	---------------------------------------------------------

Returns

EXIT_SUCCESS if privilege is revoked, EXIT_ERROR if it isn't

5.96.2.16 AK_revoke_privilege_group()

```
int AK_revoke_privilege_group (
    char * groupname,
    char * table,
    char * right )
```

Function that revokes a groups privilege on the given table.

NOTICE: Test 9 isn't currently revoking a privilege since the obj_id in the AK_group_right table is passing the value of 127. Once the issue #87 on GitHub concerning the data type is solved, the test should be working as expected.

Author

Kristina Takač, updated by Mario Peroković - added comparing by table id

Parameters

<i>*grounamep</i>	name of group which user belongs to
<i>*table</i>	name of table on which privilege will be granted to group
<i>*right</i>	type of privilege which will be granted to group on a given table

Returns

EXIT_SUCCESS if privilege is revoked, EXIT_ERROR if it isn't

5.96.2.17 AK_revoke_privilege_user()

```
int AK_revoke_privilege_user (
    char * username,
    char * table,
    char * right )
```

Function that revokes users privilege on the given table.

NOTICE: Test 12 isn't currently revoking a privilege since the obj_id in the AK_group_right table is passing the value of 127. Once the issue #87 on GitHub concerning the data type is solved, the test should be working as expected.

Author

Kristina Takač, updated by Mario Peroković - added comparing by table id, and use of user_id in AK_user_right

Parameters

<i>*username</i>	username of user to whom we want to grant privilege
<i>*table</i>	name of table on which privilege will be revoked from user
<i>*right</i>	type of privilege which will be revoked from user on given table

Returns

EXIT_SUCCESS if privilege is revoked, EXIT_ERROR if it isn't

5.96.2.18 AK_user_add()

```
int AK_user_add (
    char * username,
    int * password,
    int set_id )
```

Inserts a new user in the AK_user table.

Author

Kristina Takač.

Parameters

<i>*username</i>	username of user to be added
<i>*password</i>	password of user to be added
<i>set_id</i>	obj_id of the new user

Returns

`user_id`

5.96.2.19 AK_user_check_pass()

```
int AK_user_check_pass (
    char * username,
    int * password )
```

Function that checks if there is user with given password.

Author

Fran Mlkolić.

Parameters

<i>*username</i>	username of user whose password we are checking
<i>*password</i>	password of given username whom we will check

Returns

check 0 if false or 1 if true

5.96.2.20 AK_user_get_id()

```
int AK_user_get_id (
    char * username )
```

Function that returns an ID of the given user.

Author

Kristina Takač.

Parameters

<i>*username</i>	username of user whose id we are looking for
------------------	----------------------------------------------

Returns

`user_id`, otherwise `EXIT_ERROR`

5.96.2.21 AK_user_remove_by_name()

```
int AK_user_remove_by_name (
    char * name )
```

Function that removes the given user.

Author

Ljubo Barać

Parameters

<i>name</i>	Name of the user to be removed
-------------	--------------------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.96.2.22 AK_user_rename()

```
int AK_user_rename (
    char * old_name,
    char * new_name,
    int * password )
```

Function that renames a given user.

Author

Ljubo Barać, update by Lidija Lastavec, update by Marko Flajšek

Parameters

<i>old_name</i>	Name of the user to be renamed
<i>new_name</i>	New name of the user
<i>password</i>	Password of the user to be renamed (should be provided)

Returns

EXIT_SUCCESS or EXIT_ERROR

5.97 sql/privileges.h File Reference

```
#include "../auxi/test.h"
#include "../file/table.h"
```

```
#include "../file/fileio.h"
#include "../file/id.h"
#include "../rec/archive_log.h"
#include "../aux/mempro.h"
```

Include dependency graph for privileges.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_user_add](#) (char *username, int *password, int set_id)
Inserts a new user in the AK_user table.
- int [AK_user_get_id](#) (char *username)
Function that returns an ID of the given user.
- int [AK_user_check_pass](#) (char *username, int *password)
Function that checks if there is user with given password.
- int [AK_group_add](#) (char *name, int set_id)
Function that adds a new group.
- int [AK_group_get_id](#) (char *name)
Function that returns the ID from the given group name.
- int [AK_grant_privilege_user](#) (char *username, char *table, char *right)
Function that grants a specific privilege to the desired user on a given table.
- int [AK_revoke_privilege_user](#) (char *username, char *table, char *right)
Function that revokes users privilege on the given table.
- int [AK_revoke_all_privileges_user](#) (char *username)
Function that revokes ALL user's privileges on ALL tables (for DROP user)
- int [AK_grant_privilege_group](#) (char *groupname, char *table, char *right)
Function that grants a privilege to a given group on a given table.
- int [AK_revoke_privilege_group](#) (char *groupname, char *table, char *right)
Function that revokes a groups privilege on the given table.
- int [AK_revoke_all_privileges_group](#) (char *groupname)
Function that revokes ALL privileges from the desired group on ALL tables (needed for DROP group)
- int [AK_add_user_to_group](#) (char *user, char *group)
Function that puts the desired user in the given group.
- int [AK_remove_user_from_all_groups](#) (char *user)
Function that removes user from all groups. Used for DROP user.
- int [AK_remove_all_users_from_group](#) (char *group)
Function that removes all users from a group. Used for DROP group.
- int [AK_check_privilege](#) (char *username, char *table, char *privilege)
Function that checks whether the given user has a right for the given operation on the given table.
- int [AK_check_user_privilege](#) (char *user)
Function that checks if the user has any privileges or belongs to any group. Used in drop user for restriction.
- int [AK_check_group_privilege](#) (char *group)
Function that checks if the group has any privileges. Used in drop group for restriction.
- int [AK_group_remove_by_name](#) (char *name)
Function that removes the given group.
- int [AK_user_rename](#) (char *old_name, char *new_name, int *password)
Function that renames a given user.
- int [AK_group_rename](#) (char *old_name, char *new_name)
Function that renames the given group.
- [TestResult AK_privileges_test](#) ()
Function that tests all the previous functions.

5.97.1 Detailed Description

Header file that provides functions and defines for [privileges.c](#)

5.97.2 Function Documentation

5.97.2.1 AK_add_user_to_group()

```
int AK_add_user_to_group (
    char * user,
    char * group )
```

Function that puts the desired user in the given group.

Author

Kristina Takač, updated by Mario Peroković, added verifying the existence of user in the group, updated by Maja Vračan

Parameters

<i>*user</i>	username of user which will be put in group
<i>*group</i>	name of group in which user will be put

Returns

EXIT_SUCCESS or EXIT_ERROR if the user is already in the group

5.97.2.2 AK_check_group_privilege()

```
int AK_check_group_privilege (
    char * group )
```

Function that checks if the group has any privileges. Used in drop group for restriction.

Author

Jurica Hlevnjak, updated by Lidija Lastavec, updated by Marko Flajšek

Parameters

<i>group</i>	name of group
--------------	---------------

Returns

EXIT_ERROR or EXIT_SUCCESS

5.97.2.3 AK_check_privilege()

```
int AK_check_privilege (
    char * username,
    char * table,
    char * privilege )
```

Function that checks whether the given user has a right for the given operation on the given table.

Author

Kristina Takač, updated by Marko Flajšek

Parameters

<i>*user</i>	username for which we want check privileges
<i>*table</i>	name of table for which we want to check whether user has right on
<i>*privilege</i>	privilege for which we want to check whether user has right for

Returns

EXIT_SUCCESS if user has right, EXIT_ERROR if user has no right

5.97.2.4 AK_check_user_privilege()

```
int AK_check_user_privilege (
    char * user )
```

Function that checks if the user has any privileges or belongs to any group. Used in drop user for restriction.

Author

Jurica Hlevnjak, updated by Lidija Lastavec

Parameters

<i>user</i>	name of user
-------------	--------------

Returns

EXIT_ERROR or EXIT_SUCCESS

5.97.2.5 AK_grant_privilege_group()

```
int AK_grant_privilege_group (
    char * groupname,
    char * table,
    char * right )
```

Function that grants a privilege to a given group on a given table.

Author

Kristina Takač.

Parameters

<i>*groupname</i>	name of group to which we want to grant privilege
<i>*table</i>	name of table on which privilege will be granted to user
<i>*right</i>	type of privilege which will be granted to user on given table

Returns

privilege_id or EXIT_ERROR if table or user aren't correct

5.97.2.6 AK_grant_privilege_user()

```
int AK_grant_privilege_user (
    char * username,
    char * table,
    char * right )
```

Function that grants a specific privilege to the desired user on a given table.

Author

Kristina Takač, updated by Mario Peroković, inserting user id instead of username in AK_user_right, updated by Marko Flajšek

Parameters

<i>*username</i>	username of user to whom we want to grant privilege
<i>*table</i>	name of table on which privilege will be granted to user
<i>*right</i>	type of privilege which will be granted to user on given table

Returns

privilege_id or EXIT_ERROR if table or user aren't correct

5.97.2.7 AK_group_add()

```
int AK_group_add (
    char * name,
    int set_id )
```

Function that adds a new group.

Author

Kristina Takač, edited by Ljubo Barać

Parameters

<i>*name</i>	name of group to be added
<i>set_id</i>	non default id to be passed

Returns

id of group

5.97.2.8 AK_group_get_id()

```
int AK_group_get_id (
    char * name )
```

Function that returns the ID from the given group name.

Author

Kristina Takač.

Parameters

<i>*name</i>	name of group whose id we are looking for
--------------	-------------------------------------------

Returns

id of group, otherwise EXIT_ERROR

5.97.2.9 AK_group_remove_by_name()

```
int AK_group_remove_by_name (
    char * name )
```

Function that removes the given group.

Author

Ljubo Barać

Parameters

<i>name</i>	Name of the group to be removed
-------------	---------------------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.97.2.10 AK_group_rename()

```
int AK_group_rename (
    char * old_name,
    char * new_name )
```

Function that renames the given group.

Author

Ljubo Barać, update by Lidija Lastavec

Parameters

<i>old_name</i>	Name of the group to be renamed
<i>new_name</i>	New name of the group

Returns

EXIT_SUCCESS or EXIT_ERROR

5.97.2.11 AK_privileges_test()

```
TestResult AK_privileges_test ( )
```

Function that tests all the previous functions.

Author

Kristina Takač, updated by Tomislav Ilisevic, updated by Lidija Lastavec, updated by Marko Flajšek

Returns

no return value

5.97.2.12 AK_remove_all_users_from_group()

```
int AK_remove_all_users_from_group (
    char * group )
```

Function that removes all users from a group. Used for DROP group.

Author

Jurica Hlevnjak, update by Lidija Lastavec

Parameters

<i>group</i>	name of group
--------------	---------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.97.2.13 AK_remove_user_from_all_groups()

```
int AK_remove_user_from_all_groups (
    char * user )
```

Function that removes user from all groups. Used for DROP user.

Author

Jurica Hlevnjak, update by Lidija Lastavec

Parameters

<i>user</i>	name of user
-------------	--------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.97.2.14 AK_revoke_all_privileges_group()

```
int AK_revoke_all_privileges_group (  
    char * groupname )
```

Function that revokes ALL privileges from the desired group on ALL tables (needed for DROP group)

Author

Jurica Hlevnjak

Parameters

<i>groupname</i>	name of group from which we want to revoke all privileges
------------------	-----------------------------------------------------------

Returns

EXIT_SUCCESS if privilege is revoked, EXIT_ERROR if it isn't

5.97.2.15 AK_revoke_all_privileges_user()

```
int AK_revoke_all_privileges_user (  
    char * username )
```

Function that revokes ALL user's privileges on ALL tables (for DROP user)

Author

Jurica Hlevnjak, updated by Marko Flajšek

Parameters

<i>username</i>	name of user from whom we want to revoke all privileges
-----------------	---------------------------------------------------------

Returns

EXIT_SUCCESS if privilege is revoked, EXIT_ERROR if it isn't

5.97.2.16 AK_revoke_privilege_group()

```
int AK_revoke_privilege_group (
    char * groupname,
    char * table,
    char * right )
```

Function that revokes a groups privilege on the given table.

Author

Kristina Takač, updated by Mario Peroković - added comparing by table id

Parameters

<i>*grounamep</i>	name of group which user belongs to
<i>*table</i>	name of table on which privilege will be granted to group
<i>*right</i>	type of privilege which will be granted to group on a given table

Returns

EXIT_SUCCESS if privilege is revoked, EXIT_ERROR if it isn't

NOTICE: Test 9 isn't currently revoking a privilege since the obj_id in the AK_group_right table is passing the value of 127. Once the issue #87 on GitHub concerning the data type is solved, the test should be working as expected.

Author

Kristina Takač, updated by Mario Peroković - added comparing by table id

Parameters

<i>*grounamep</i>	name of group which user belongs to
<i>*table</i>	name of table on which privilege will be granted to group
<i>*right</i>	type of privilege which will be granted to group on a given table

Returns

EXIT_SUCCESS if privilege is revoked, EXIT_ERROR if it isn't

5.97.2.17 AK_revoke_privilege_user()

```
int AK_revoke_privilege_user (
    char * username,
    char * table,
    char * right )
```

Function that revokes users privilege on the given table.

Author

Kristina Takač, updated by Mario Peroković - added comparing by table id, and use of user_id in AK_user_right

Parameters

<i>*username</i>	username of user to whom we want to grant privilege
<i>*table</i>	name of table on which privilege will be revoked from user
<i>*right</i>	type of privilege which will be revoked from user on given table

Returns

EXIT_SUCCESS if privilege is revoked, EXIT_ERROR if it isn't

NOTICE: Test 12 isn't currently revoking a privilege since the obj_id in the AK_group_right table is passing the value of 127. Once the issue #87 on GitHub concerning the data type is solved, the test should be working as expected.

Author

Kristina Takač, updated by Mario Peroković - added comparing by table id, and use of user_id in AK_user_right

Parameters

<i>*username</i>	username of user to whom we want to grant privilege
<i>*table</i>	name of table on which privilege will be revoked from user
<i>*right</i>	type of privilege which will be revoked from user on given table

Returns

EXIT_SUCCESS if privilege is revoked, EXIT_ERROR if it isn't

5.97.2.18 AK_user_add()

```
int AK_user_add (
    char * username,
    int * password,
    int set_id )
```

Inserts a new user in the AK_user table.

Author

Kristina Takač.

Parameters

<i>*username</i>	username of user to be added
<i>*password</i>	password of user to be added
<i>set_id</i>	obj_id of the new user

Returns

user_id

5.97.2.19 AK_user_check_pass()

```
int AK_user_check_pass (
    char * username,
    int * password )
```

Function that checks if there is user with given password.

Author

Fran Mikolić.

Parameters

<i>*username</i>	username of user whose password we are checking
<i>*password</i>	password of given username whom we will check

Returns

check 0 if false or 1 if true

5.97.2.20 AK_user_get_id()

```
int AK_user_get_id (
    char * username )
```

Function that returns an ID of the given user.

Author

Kristina Takač.

Parameters

<i>*username</i>	username of user whose id we are looking for
------------------	----------------------------------------------

Returns

user_id, otherwise EXIT_ERROR

5.97.2.21 AK_user_rename()

```
int AK_user_rename (
    char * old_name,
    char * new_name,
    int * password )
```

Function that renames a given user.

Author

Ljubo Barać, update by Lidija Lastavec, update by Marko Flajšek

Parameters

<i>old_name</i>	Name of the user to be renamed
<i>new_name</i>	New name of the user
<i>password</i>	Password of the user to be renamed (should be provided)

Returns

EXIT_SUCCESS or EXIT_ERROR

5.98 sql/select.c File Reference

```
#include "select.h"
#include "../mm/memoman.h"
Include dependency graph for select.c:
```

Functions

- int [AK_select](#) (char *srcTable, char *destTable, struct [list_node](#) *attributes, struct [list_node](#) *condition, struct [list_node](#) *ordering)
Function that implements SELECT relational operator.
- [TestResult AK_select_test](#) ()
Function for testing the implementation.

5.98.1 Detailed Description

Provides functions for SELECT relational operator

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5.98.2 Function Documentation

5.98.2.1 AK_select()

```
int AK_select (
    char * srcTable,
    char * destTable,
    struct list_node * attributes,
    struct list_node * condition,
    struct list_node * ordering )
```

Function that implements SELECT relational operator.

Author

Filip Žmuk

Parameters

<i>srcTable</i>	- original table that is used for selection
<i>destTable</i>	- table that contains the result
<i>condition</i>	- condition for selection
<i>attributes</i>	- atributes to be selected
<i>ordering</i>	- atributes for result sorting

Returns

EXIT_SUCCESS if cache result in memory and print table else break

5.98.2.2 AK_select_test()

```
TestResult AK_select_test ( )
```

Function for testing the implementation.

Author

Renata Mesaros, updated Filip Žmuk

5.99 sql/select.h File Reference

```
#include "../file/table.h"
#include "../auxi/test.h"
#include "../file/fileio.h"
#include "../rel/selection.h"
#include "../rel/projection.h"
#include "../auxi/auxiliary.h"
#include "../auxi/mempro.h"
#include "../file/filesort.h"
```

Include dependency graph for select.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_select](#) (char *srcTable, char *destTable, struct [list_node](#) *attributes, struct [list_node](#) *condition, struct [list_node](#) *ordering)
Function that implements SELECT relational operator.
- [TestResult AK_select_test](#) ()
Function for testing the implementation.

5.99.1 Detailed Description

Header file that provides functions for [select.h](#)

5.99.2 Function Documentation

5.99.2.1 AK_select()

```
int AK_select (
    char * srcTable,
    char * destTable,
    struct list\_node * attributes,
    struct list\_node * condition,
    struct list\_node * ordering )
```

Function that implements SELECT relational operator.

Author

Filip Žmuk

Parameters

<i>srcTable</i>	- original table that is used for selection
<i>destTable</i>	- table that contains the result
<i>condition</i>	- condition for selection
<i>attributes</i>	- atributes to be selected
<i>ordering</i>	- atributes for result sorting

Returns

EXIT_SUCCESS if cache result in memory and print table else break

5.99.2.2 AK_select_test()

```
TestResult AK_select_test ( )
```

Function for testing the implementation.

Author

Renata Mesaros, updatet Filip Žmuk

5.100 sql/trigger.c File Reference

```
#include "trigger.h"
```

Include dependency graph for trigger.c:

Functions

- int [AK_trigger_save_conditions](#) (int trigger, struct [list_node](#) *condition)
Function that saves conditions for a trigger.
- int [AK_trigger_add](#) (char *name, char *event, struct [list_node](#) *condition, char *table, char *function, struct [list_node](#) *arguments_list)
Function that adds a trigger to the system table.
- int [AK_trigger_get_id](#) (char *name, char *table)
Function that gets obj_id of a trigger defined by name and table.
- int [AK_trigger_remove_by_name](#) (char *name, char *table)
Function that removes a trigger from the system table by name.
- int [AK_trigger_remove_by_obj_id](#) (int obj_id)
Function that removes a trigger by its obj_id.
- int [AK_trigger_edit](#) (char *name, char *event, struct [list_node](#) *condition, char *table, char *function)
Function that edits information about the trigger in system table. In order to identify the trigger, either obj_id or table and name parameters should be defined. The other options should be set to NULL. Values of parameters that aren't changing can be left NULL. If conditions are to be removed, condition parameter should hold an empty list.
- struct [list_node](#) * [AK_trigger_get_conditions](#) (int trigger)
Function that fetches postfix list of conditions for the trigger (compatible with selection)
- int [AK_trigger_rename](#) (char *old_name, char *new_name, char *table)
Function that renames the trigger.
- [TestResult](#) [AK_trigger_test](#) ()
Function for trigger testing.

5.100.1 Detailed Description

Provides functions for triggers

5.100.2 Function Documentation

5.100.2.1 AK_trigger_add()

```
int AK_trigger_add (
    char * name,
    char * event,
    struct list_node * condition,
    char * table,
    char * function,
    struct list_node * arguments_list )
```

Function that adds a trigger to the system table.

Author

Unknown updated by Aleksandra Polak

Parameters

<i>*name</i>	name of the trigger
<i>*event</i>	event that calls the trigger - this should perhaps be an integer with defined constants...
<i>*condition</i>	AK_list list of conditions in postfix
<i>*table</i>	name of the table trigger is hooked on
<i>*function</i>	function that is being called by the trigger

Returns

trigger id or EXIT_ERROR

5.100.2.2 AK_trigger_edit()

```
int AK_trigger_edit (
    char * name,
    char * event,
    struct list_node * condition,
    char * table,
    char * function )
```

Function that edits information about the trigger in system table. In order to identify the trigger, either obj_id or table and name parameters should be defined. The other options should be set to NULL. Values of parameters that aren't changing can be left NULL. If conditions are to be removed, condition parameter should hold an empty list.

Function that edits information about the trigger in system table.

Author

Unknown

Parameters

<i>*name</i>	name of the trigger (or NULL if using obj_id)
<i>*event</i>	event of the trigger (or NULL if it isn't changing)
<i>*condition</i>	list of conditions for trigger (or NULL if it isn't changing; empty list if all conditions are to be removed)
<i>*table</i>	name of the connected table (or NULL id using obj_id)
<i>*function</i>	name of the connected function (or NULL if it isn't changing)

Returns

EXIT_SUCCESS or EXIT_ERROR @IMPORTANT: *AK_dbg_messg.. need to be fixed then we could un-comment lines with this function, by then we use *printf.

5.100.2.3 AK_trigger_get_conditions()

```
struct list_node* AK_trigger_get_conditions (
    int trigger )
```

Function that fetches postfix list of conditions for the trigger (compatible with selection)

Author

Unknown, updated by Mario Peroković

Parameters

<i>trigger</i>	obj_id of the trigger
----------------	-----------------------

Returns

list of conditions for the trigger

5.100.2.4 AK_trigger_get_id()

```
int AK_trigger_get_id (
    char * name,
    char * table )
```

Function that gets obj_id of a trigger defined by name and table.

Author

Parameters

<i>*name</i>	name of the trigger
<i>*table</i>	name of the table on which the trigger is hooked

Returns

obj_id of the trigger or EXIT_ERROR

5.100.2.5 AK_trigger_remove_by_name()

```
int AK_trigger_remove_by_name (
    char * name,
    char * table )
```

Function that removes a trigger from the system table by name.

Author

Unknown

Parameters

<i>*name</i>	name of the trigger
<i>*table</i>	name of the table

Returns

EXIT_SUCCESS or EXIT_ERROR

5.100.2.6 AK_trigger_remove_by_obj_id()

```
int AK_trigger_remove_by_obj_id (
    int obj_id )
```

Function that removes a trigger by its obj_id.

Author

Unknown

Parameters

<i>obj_id</i>	obj_id of the trigger
---------------	-----------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.100.2.7 AK_trigger_rename()

```
int AK_trigger_rename (
    char * old_name,
    char * new_name,
    char * table )
```

Function that renames the trigger.

Author

Ljubo Barać

Parameters

<i>old_name</i>	Name of the trigger to be renamed
<i>new_name</i>	New name of the trigger

Returns

EXIT_SUCCESS or EXIT_ERROR

5.100.2.8 AK_trigger_save_conditions()

```
int AK_trigger_save_conditions (
    int trigger,
    struct list_node * condition )
```

Function that saves conditions for a trigger.

Author

Unknown, updated by Mario Peroković, check if data is TYPE_INT

Parameters

<i>trigger</i>	obj_id of the trigger in question
<i>*condition</i>	AK_list list of conditions

Returns

EXIT_SUCCESS or EXIT_ERROR

5.100.2.9 AK_trigger_test()

`TestResult AK_trigger_test ()`

Function for trigger testing.

Author

Unknown updated by Aleksandra Polak

5.101 sql/trigger.h File Reference

```
#include "../auxi/test.h"
#include "../rec/archive_log.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include "../file/id.h"
#include "../sql/function.h"
#include "../rel/selection.h"
#include "../auxi/mempro.h"
```

Include dependency graph for trigger.h: This graph shows which files directly or indirectly include this file:

Functions

- int [AK_trigger_save_conditions](#) (int trigger, struct [list_node](#) *condition)
Function that saves conditions for a trigger.
- int [AK_trigger_add](#) (char *name, char *event, struct [list_node](#) *condition, char *table, char *function, struct [list_node](#) *arguments_list)
Function that adds a trigger to the system table.
- int [AK_trigger_get_id](#) (char *name, char *table)
Function that gets obj_id of a trigger defined by name and table.
- int [AK_trigger_remove_by_name](#) (char *name, char *table)
Function that removes a trigger from the system table by name.
- int [AK_trigger_remove_by_obj_id](#) (int obj_id)
Function that removes a trigger by its obj_id.
- int [AK_trigger_edit](#) (char *name, char *event, struct [list_node](#) *condition, char *table, char *function)
Function that edits information about the trigger in system table.
- struct [list_node](#) * [AK_trigger_get_conditions](#) (int trigger)
Function that fetches postfix list of conditions for the trigger (compatible with selection)
- int [AK_trigger_rename](#) (char *old_name, char *new_name, char *table)
Function that renames the trigger.
- `TestResult AK_trigger_test ()`
Function for trigger testing.

5.101.1 Detailed Description

Header file that provides functions and defines for [trigger.c](#)

5.101.2 Function Documentation

5.101.2.1 AK_trigger_add()

```
int AK_trigger_add (
    char * name,
    char * event,
    struct list_node * condition,
    char * table,
    char * function,
    struct list_node * arguments_list )
```

Function that adds a trigger to the system table.

Author

Unknown updated by Aleksandra Polak

Parameters

<i>*name</i>	name of the trigger
<i>*event</i>	event that calls the trigger - this should perhaps be an integer with defined constants...
<i>*condition</i>	AK_list list of conditions in postfix
<i>*table</i>	name of the table trigger is hooked on
<i>*function</i>	function that is being called by the trigger

Returns

trigger id or EXIT_ERROR

5.101.2.2 AK_trigger_edit()

```
int AK_trigger_edit (
    char * name,
    char * event,
    struct list_node * condition,
    char * table,
    char * function )
```

Function that edits information about the trigger in system table.

Author

Unknown

Parameters

<i>*name</i>	name of the trigger (or NULL if using obj_id)
<i>*event</i>	event of the trigger (or NULL if it isn't changing)
<i>*condition</i>	list of conditions for trigger (or NULL if it isn't changing; empty list if all conditions are to be removed)
<i>*table</i>	name of the connected table (or NULL id using obj_id)
<i>*function</i>	name of the connected function (or NULL if it isn't changing)

Returns

EXIT_SUCCESS or EXIT_ERROR

Function that edits information about the trigger in system table.

Author

Unknown

Parameters

<i>*name</i>	name of the trigger (or NULL if using obj_id)
<i>*event</i>	event of the trigger (or NULL if it isn't changing)
<i>*condition</i>	list of conditions for trigger (or NULL if it isn't changing; empty list if all conditions are to be removed)
<i>*table</i>	name of the connected table (or NULL id using obj_id)
<i>*function</i>	name of the connected function (or NULL if it isn't changing)

Returns

EXIT_SUCCESS or EXIT_ERROR @IMPORTANT: *AK_dbg_messg.. need to be fixed then we could un-comment lines with this function, by then we use *printf.

5.101.2.3 AK_trigger_get_conditions()

```
struct list_node* AK_trigger_get_conditions (
    int trigger )
```

Function that fetches postfix list of conditions for the trigger (compatible with selection)

Author

Unknown, updated by Mario Peroković

Parameters

<i>trigger</i>	obj_id of the trigger
----------------	-----------------------

Returns

list of conditions for the trigger

5.101.2.4 AK_trigger_get_id()

```
int AK_trigger_get_id (
    char * name,
    char * table )
```

Function that gets obj_id of a trigger defined by name and table.

Author**Parameters**

<i>*name</i>	name of the trigger
<i>*table</i>	name of the table on which the trigger is hooked

Returns

obj_id of the trigger or EXIT_ERROR

5.101.2.5 AK_trigger_remove_by_name()

```
int AK_trigger_remove_by_name (
    char * name,
    char * table )
```

Function that removes a trigger from the system table by name.

Author

Unknown

Parameters

<i>*name</i>	name of the trigger
<i>*table</i>	name of the table

Returns

EXIT_SUCCESS or EXIT_ERROR

5.101.2.6 AK_trigger_remove_by_obj_id()

```
int AK_trigger_remove_by_obj_id (  
    int obj_id )
```

Function that removes a trigger by its obj_id.

Author

Unknown

Parameters

<i>obj_id</i>	obj_id of the trigger
---------------	-----------------------

Returns

EXIT_SUCCESS or EXIT_ERROR

5.101.2.7 AK_trigger_rename()

```
int AK_trigger_rename (  
    char * old_name,  
    char * new_name,  
    char * table )
```

Function that renames the trigger.

Author

Ljubo Barać

Parameters

<i>old_name</i>	Name of the trigger to be renamed
<i>new_name</i>	New name of the trigger

Returns

EXIT_SUCCESS or EXIT_ERROR

5.101.2.8 AK_trigger_save_conditions()

```
int AK_trigger_save_conditions (
    int trigger,
    struct list_node * condition )
```

Function that saves conditions for a trigger.

Author

Unknown, updated by Mario Peroković, check if data is TYPE_INT

Parameters

<i>trigger</i>	obj_id of the trigger in question
<i>*condition</i>	AK_list list of conditions

Returns

EXIT_SUCCESS or EXIT_ERROR

5.101.2.9 AK_trigger_test()

```
TestResult AK_trigger_test ( )
```

Function for trigger testing.

Author

Unknown updated by Aleksandra Polak

5.102 sql/view.c File Reference

```
#include "view.h"
Include dependency graph for view.c:
```

Functions

- char * [AK_check_view_name](#) (char *name)
Function that checks if the name of the view already exists in AK_view table.
- int [AK_get_view_obj_id](#) (char *name)
Function that finds an object's id by its name.
- char * [AK_get_view_query](#) (char *name)
Function that returns a query by its name.
- char * [AK_get_rel_exp](#) (char *name)
Function that returns a relation expression by its name param name name of the view.
- int [AK_view_add](#) (char *name, char *query, char *rel_exp, int set_id)
Function that adds a new view to the view table with the corresponding name and value (view query); set_id is optional, if it's not set, the system will determine the new id automatically.
- int [AK_view_remove_by_obj_id](#) (int obj_id)
Function that removes the view by its object id.
- int [AK_view_rename](#) (char *name, char *new_name)
Function that renames a view (based on it's name) from "name" to "new_name".
- int [AK_view_remove_by_name](#) (char *name)
Function that removes the view by its name by identifying the view's id and passing id to AK_view_remove_by_obj_id.
- int [AK_view_change_query](#) (char *name, char *query, char *rel_exp)
Function that changes the query from a view (determined by it's name) to "query".
- int [AK_test_get_view_data](#) (char *rel_exp)
Function that shows the data from test view query. Only for test purpose.
- [TestResult AK_view_test](#) ()
A testing function for [view.c](#) functions.

5.102.1 Detailed Description

Provides functions for views

5.102.2 Function Documentation

5.102.2.1 [AK_check_view_name\(\)](#)

```
char* AK_check_view_name (
    char * name )
```

Function that checks if the name of the view already exists in AK_view table.

Author

Sara Kisic

Parameters

<i>name</i>	Name of the view
-------------	------------------

Returns

EXIT_ERROR if the name already exists or name

5.102.2.2 AK_get_rel_exp()

```
char* AK_get_rel_exp (
    char * name )
```

Function that returns a relation expression by its name param name name of the view.

Author

Danko Sačer

Returns

rel_exp string or EXIT_ERROR

5.102.2.3 AK_get_view_obj_id()

```
int AK_get_view_obj_id (
    char * name )
```

Function that finds an object's id by its name.

Author

Kresimir Ivkovic

Parameters

<i>name</i>	name of the view
-------------	------------------

Returns

View's id or EXIT_ERROR

5.102.2.4 AK_get_view_query()

```
char* AK_get_view_query (
    char * name )
```

Function that returns a query by its name.

Author

Danko Sačer

Parameters

<i>name</i>	name of the view
-------------	------------------

Returns

query string or EXIT_ERROR

5.102.2.5 AK_test_get_view_data()

```
int AK_test_get_view_data (
    char * rel_exp )
```

Function that shows the data from test view query. Only for test purpose.

Author

Darko Hranic

Parameters

<i>rel_exp</i>	conditions as string
----------------	----------------------

5.102.2.6 AK_view_add()

```
int AK_view_add (
    char * name,
    char * query,
    char * rel_exp,
    int set_id )
```

Function that adds a new view to the view table with the corresponding name and value (view query); *set_id* is optional, if it's not set, the system will determine the new id automatically.

Author

Kresimir Ivkovic

Parameters

<i>name</i>	name og the view
<i>query</i>	query of the view
<i>rel_exp</i>	relation expression of the view
<i>set_id</i>	id of view

Returns

Id of the newly inserted view

5.102.2.7 AK_view_change_query()

```
int AK_view_change_query (
    char * name,
    char * query,
    char * rel_exp )
```

Function that changes the query from a view (determined by it's name) to "query".

Author

Kresimir Ivkovic

Parameters

<i>name</i>	of the query
<i>query</i>	new query of the view
<i>rel_exp</i>	relation expression of the view

Returns

error or success

5.102.2.8 AK_view_remove_by_name()

```
int AK_view_remove_by_name (
    char * name )
```

Function that removes the view by its name by identifying the view's id and passing id to AK_view_remove_by_↔
obj_id.

Author

Kresimir Ivkovic

Parameters

<i>name</i>	name of the view
-------------	------------------

Returns

Result of AK_view_remove_by_obj_id or EXIT_ERROR if no id is found

5.102.2.9 AK_view_remove_by_obj_id()

```
int AK_view_remove_by_obj_id (
    int obj_id )
```

Function that removes the view by its object id.

Author

Kresimir Ivkovic

Parameters

<i>obj_id</i>	object id of the view
---------------	-----------------------

Returns

Result of AK_delete_row for the view (success or error)

5.102.2.10 AK_view_rename()

```
int AK_view_rename (
    char * name,
    char * new_name )
```

Function that renames a view (based on it's name) from "name" to "new_name".

Author

Kresimir Ivkovic

Parameters

<i>name</i>	name of the view
<i>new_name</i>	new name of the view

Returns

error or success

5.102.2.11 AK_view_test()

```
TestResult AK_view_test ( )
```

A testing function for [view.c](#) functions.

Author

Kresimir Ivkovic, updated by Lidija Lastavec

5.103 tools/comments.py File Reference

Functions

- def [comments.getcommentsFiles](#) ()
This function is searching for file that ends with either .py extension or .c extension and appending the same in constant cFiles/pyFiles.
- def [comments.detectLanguage](#) ()
Function is detecting language (is it croatian or alike) of a newly created commentsFile.
- def [comments.makeCommentsFile](#) ()
Function is parsing comments from file with .c extension and .py extension.

Variables

- string **comments.commentsFile** = "all_comments.tmp"
- list **comments.cFiles** = []
- list **comments.pyFiles** = []

5.103.1 Detailed Description

```
//!
```

5.104 tools/getFiles.sh File Reference

5.104.1 Detailed Description

Finding all files that ends with extension .py or .c and storing them into file.txt

5.105 tools/parseC.sh File Reference

5.105.1 Detailed Description

Parsing every C file

5.106 tools/parsePy.sh File Reference

5.106.1 Detailed Description

Parsing every Py file

5.107 tools/updateVersion.sh File Reference

5.107.1 Detailed Description

Updating project version

5.108 trans/transaction.c File Reference

```
#include "transaction.h"
Include dependency graph for transaction.c:
```

Functions

- int [AK_memory_block_hash](#) (int blockMemoryAddress)
Function that calculates the hash value for a given memory address. Hash values are used to identify location of locked resources.
- [AK_transaction_elem_P AK_search_existing_link_for_hook](#) (int blockAddress)
Function that searches for a existing entry in hash list of active blocks.
- [AK_transaction_elem_P AK_search_empty_link_for_hook](#) (int blockAddress)
Function that searches for a empty link for new active block, helper method in case of address collision.
- [AK_transaction_elem_P AK_add_hash_entry_list](#) (int blockAddress, int type)
Function that adds an element to the doubly linked list.
- int [AK_delete_hash_entry_list](#) (int blockAddress)
Function that deletes a specific element in the lockTable doubly linked list.
- [AK_transaction_lock_elem_P AK_search_lock_entry_list_by_key](#) ([AK_transaction_elem_P](#) Lockslist, int memoryAddress, pthread_t id)
Function that searches for a specific entry in the Locks doubly linked list using the transaction id as it's key.
- int [AK_delete_lock_entry_list](#) (int blockAddress, pthread_t id)
Function that deletes a specific entry in the Locks doubly linked list using the transaction id as it's key.
- int [AK_isLock_waiting](#) ([AK_transaction_elem_P](#) lockHolder, int type, pthread_t transactionId, [AK_transaction_lock_elem_P](#) lock)
Function that, based on the parameters, puts an transaction action in waiting phase or let's the transaction do it's actions.
- [AK_transaction_lock_elem_P AK_add_lock](#) ([AK_transaction_elem_P](#) HashList, int type, pthread_t transactionId)
Function that adds an element to the locks doubly linked list.
- [AK_transaction_lock_elem_P AK_create_lock](#) (int blockAddress, int type, pthread_t transactionId)
Helper function that determines if there is a hash LockTable entry that corresponds to the given memory address. And if there isn't an entry the function calls for the creation of the Locks list holder.
- int [AK_acquire_lock](#) (int memoryAddress, int type, pthread_t transactionId)

- Main interface function for the transaction API. It is responsible for the whole process of creating a new lock.*
- void [AK_release_locks](#) ([AK_memoryAddresses_link](#) addressesTmp, pthread_t transactionId)
- Main interface function for the transaction API. It is responsible for the whole process releasing locks acquired by a transaction. The locks are released either by COMMIT or ABORT .*
- int [AK_get_memory_blocks](#) (char *tblName, [AK_memoryAddresses_link](#) addressList)
- Function that appends all addresses affected by the transaction.*
- int [AK_execute_commands](#) (command *commandArray, int lengthOfArray)
- Function that is called in a separate thread that is responsible for acquiring locks, releasing them and finding the associated block addresses.*
- void * [AK_execute_transaction](#) (void *params)
- Function that is the thread start point all relevant functions. It acts as an intermediary between the main thread and other threads.*
- int [AK_remove_transaction_thread](#) (pthread_t transaction_thread)
- Function for deleting one of active threads from array of all active transactions threads.*
- int [AK_create_new_transaction_thread](#) ([AK_transaction_data](#) *transaction_data)
- Function for creating new thread. Function also adds thread ID to pthread_t array.*
- void [AK_transaction_manager](#) (command *commandArray, int lengthOfArray)
- Function that receives all the data and gives an id to that data and starts a thread that executes the transaction.*
- int [AK_transaction_register_observer](#) ([AK_observable_transaction](#) *observable_transaction, [AK_observer](#) *observer)
- Function for registering new observer of AK_observable_transaction type.*
- int [AK_transaction_unregister_observer](#) ([AK_observable_transaction](#) *observable_transaction, [AK_observer](#) *observer)
- Function for unregistering observer from AK_observable_transaction type.*
- void [handle_transaction_notify](#) ([AK_observer_lock](#) *observer_lock)
- Function for handling AK_observable_transaction notify. Function is associated to some observer instance.*
- void [AK_on_observable_notify](#) (void *observer, void *observable, AK_ObservableType_Enum type)
- Function for handling notify from some observable type.*
- void [AK_on_transaction_end](#) (pthread_t transaction_thread)
- Function for handling event when some transaction is finished.*
- void [AK_on_all_transactions_end](#) ()
- Function for handling event when all transactions are finished.*
- void [AK_on_lock_release](#) ()
- Function for handling event when one of lock is released.*
- void [AK_handle_observable_transaction_action](#) (NoticeType *noticeType)
- Function for handling action which is called from observable_transaction type.*
- void [AK_lock_released](#) ()
- Function which is called when the lock is released.*
- void [AK_transaction_finished](#) ()
- Function that is called when some transaction is finished.*
- void [AK_all_transactions_finished](#) ()
- Function that is called when all transactions are finished.*
- [AK_observable_transaction](#) * [AK_init_observable_transaction](#) ()
- Function for initialization of AK_observable_transaction type.*
- [AK_observer_lock](#) * [AK_init_observer_lock](#) ()
- Function for initialization of AK_observer_lock type.*
- [TestResult](#) [AK_test_Transaction](#) ()

Variables

- [AK_transaction_list](#) **LockTable** [[NUMBER_OF_KEYS](#)]
- pthread_mutex_t **accessLockMutex** = PTHREAD_MUTEX_INITIALIZER
- pthread_mutex_t **acquireLockMutex** = PTHREAD_MUTEX_INITIALIZER
- pthread_mutex_t **newTransactionLockMutex** = PTHREAD_MUTEX_INITIALIZER
- pthread_mutex_t **endTransationTestLockMutex** = PTHREAD_MUTEX_INITIALIZER
- pthread_cond_t **cond_lock** = PTHREAD_COND_INITIALIZER
- [AK_observable_transaction](#) * **observable_transaction**
- pthread_t **activeThreads** [[MAX_ACTIVE_TRANSACTIONS_COUNT](#)]
- int **activeTransactionsCount** = 0
- int **transactionsCount** = 0

5.108.1 Detailed Description

Defines functions for transaction execution

5.108.2 Function Documentation

5.108.2.1 AK_acquire_lock()

```
int AK_acquire_lock (
    int memoryAddress,
    int type,
    pthread_t transactionId )
```

Main interface function for the transaction API. It is responsible for the whole process of creating a new lock.

Author

Frane Jakelić updated by Ivan Pusic

Todo Implement a better deadlock detection. This method uses a very simple approach. It waits for 60sec before it restarts a transaction.

Parameters

<i>memoryAddress</i>	integer representation of memory address.
<i>type</i>	of lock issued to the provided memory address.
<i>transactionId</i>	integer representation of transaction id.

Returns

OK or NOT_OK based on the success of the function.

```
#####\n# Lock Granted after wait\n#-----\n# Lock ID:lu TYPE:i #\n#-----\n\n# LockedAddress:i #\n#####\n\n", (unsigned long)lock->TransactionId, lock->lock_type, memoryAddress); */
```

```
#####\n# Lock Granted #\n#-----\n# Lock ID:lu TYPE:i #\n#-----\n\n# LockedAddress:i #\n#####\n\n", (unsigned long)lock->TransactionId, lock->lock_type, memoryAddress); */
```

5.108.2.2 AK_add_hash_entry_list()

```
AK_transaction_elem_P AK_add_hash_entry_list (
    int blockAddress,
    int type )
```

Function that adds an element to the doubly linked list.

Author

Frane Jakelić

Parameters

<i>blockAddress</i>	integer representation of memory address.
<i>type</i>	of lock issued to the provided memory address.

Returns

pointer to the newly created doubly linked element.

5.108.2.3 AK_add_lock()

```
AK_transaction_lock_elem_P AK_add_lock (
    AK_transaction_elem_P HashList,
    int type,
    pthread_t transactionId )
```

Function that adds an element to the locks doubly linked list.

Author

Frane Jakelić

Parameters

<i>memoryAddress</i>	integer representation of memory address.
<i>type</i>	of lock issued to the provided memory address.
<i>transactionId</i>	integer representation of transaction id.

Returns

pointer to the newly created Locks doubly linked element.

5.108.2.4 AK_all_transactions_finished()

```
void AK_all_transactions_finished ( )
```

Function that is called when all transactions are finished.

Author

Ivan Pusic

5.108.2.5 AK_create_lock()

```
AK_transaction_lock_elem_P AK_create_lock (
    int blockAddress,
    int type,
    pthread_t transactionId )
```

Helper function that determines if there is a hash LockTable entry that corresponds to the given memory address. And if there isn't an entry the function calls for the creation of the Locks list holder.

Author

Frane Jakelić

Parameters

<i>memoryAddress</i>	integer representation of memory address.
<i>type</i>	of lock issued to the provided memory address.
<i>transactionId</i>	integer representation of transaction id.

Returns

pointer to the newly created Locks doubly linked element.

5.108.2.6 AK_create_new_transaction_thread()

```
int AK_create_new_transaction_thread (
    AK_transaction_data * transaction_data )
```

Function for creating new thread. Function also adds thread ID to pthread_t array.

Author

Ivan Pusic

Parameters

<i>transaction_data</i>	Data for executing transaction
-------------------------	--------------------------------

Returns

Exit status (OK or NOT_OK)

5.108.2.7 AK_delete_hash_entry_list()

```
int AK_delete_hash_entry_list (  
    int blockAddress )
```

Function that deletes a specific element in the lockTable doubly linked list.

Author

Frane Jakelić

Parameters

<i>blockAddress</i>	integer representation of memory address.
---------------------	-------------------------------------------

Returns

integer OK or NOT_OK based on success of finding the specific element in the list.

5.108.2.8 AK_delete_lock_entry_list()

```
int AK_delete_lock_entry_list (  
    int blockAddress,  
    pthread_t id )
```

Function that deletes a specific entry in the Locks doubly linked list using the transaction id as it's key.

Author

Frane Jakelić

Parameters

<i>blockAddress</i>	integer representation of memory address.
<i>id</i>	integer representation of transaction id.

Returns

int OK or NOT_OK based on success of finding the specific element in the list.

5.108.2.9 AK_execute_commands()

```
int AK_execute_commands (
    command * commandArray,
    int lengthOfArray )
```

Function that is called in a separate thread that is responsible for acquiring locks, releasing them and finding the associated block addresses.

Author

Frane Jakelić updated by Ivan Pusic

Todo Check multithreading, check if it's working correctly

Parameters

<i>commandArray</i>	array filled with commands that need to be secured using transactions
<i>lengthOfArray</i>	length of commandArray
<i>transactionId</i>	associated with the transaction

Returns

ABORT or COMMIT based on the success of the function.

5.108.2.10 AK_execute_transaction()

```
void* AK_execute_transaction (
    void * params )
```

Function that is the thread start point all relevant functions. It acts as an intermediary between the main thread and other threads.

Author

Frane Jakelić updated by Ivan Pusic

Parameters

<i>data</i>	transmitted to the thread from the main thread
-------------	------------------------------------------------

5.108.2.11 AK_get_memory_blocks()

```
int AK_get_memory_blocks (
    char * tblName,
    AK_memoryAddresses_link addressList )
```

Function that appends all addresses affected by the transaction.

Author

Frane Jakelić

Parameters

<i>addressList</i>	pointer to the linked list where the addresses are stored.
<i>tblName</i>	table name used in the transaction

Returns

OK or NOT_OK based on the success of the function.

5.108.2.12 AK_handle_observable_transaction_action()

```
void AK_handle_observable_transaction_action (
    NoticeType * noticeType )
```

Function for handling action which is called from [observable_transaction](#) type.

Author

Ivan Pusic

Parameters

<i>noticeType</i>	Type of action (event)
-------------------	------------------------

5.108.2.13 AK_init_observable_transaction()

```
AK_observable_transaction* AK_init_observable_transaction ( )
```

Function for initialization of AK_observable_transaction type.

Author

Ivan Pusic

Returns

Pointer to new AK_observable_transaction instance

5.108.2.14 AK_init_observer_lock()

```
AK_observer_lock* AK_init_observer_lock ( )
```

Function for initialization of AK_observer_lock type.

Author

Ivan Pusic

Returns

Pointer to new AK_observer_lock instance

5.108.2.15 AK_isLock_waiting()

```
int AK_isLock_waiting (
    AK_transaction_elem_P lockHolder,
    int type,
    pthread_t transactionId,
    AK_transaction_lock_elem_P lock )
```

Function that, based on the parameters, puts an transaction action in waiting phase or let's the transaction do it's actions.

Author

Frane Jakelić updated by Ivan Pusic

Parameters

<i>lockHolder</i>	pointer to the hash list entry that is entitled to the specific memory address.
<i>type</i>	of lock issued to the provided memory address.
<i>transaction↔ id</i>	integer representation of transaction id.
<i>lock</i>	pointer to the lock element that is being tested.

Returns

int PASS_LOCK_QUEUE or WAIT_FOR_UNLOCK based on the rules described inside the function.

5.108.2.16 AK_lock_released()

```
void AK_lock_released ( )
```

Function which is called when the lock is released.

Author

Ivan Pusic

5.108.2.17 AK_memory_block_hash()

```
int AK_memory_block_hash (
    int blockMemoryAddress )
```

Function that calculates the hash value for a given memory address. Hash values are used to identify location of locked resources.

Author

Frane Jakelić

Todo The current implementation is very limited it doesn't cope well with collision. recommendation use some better version of hash calculation. Maybe Knuth's memory address hashing function.

Parameters

<i>blockMemoryAddress</i>	integer representation of memory address, the hash value is calculated from this parameter.
---------------------------	---------------------------------------------------------------------------------------------

Returns

integer containing the hash value of the passed memory address

5.108.2.18 AK_on_all_transactions_end()

```
void AK_on_all_transactions_end ( )
```

Function for handling event when all transactions are finished.

Author

Ivan Pusic

5.108.2.19 AK_on_lock_release()

```
void AK_on_lock_release ( )
```

Function for handling event when one of lock is released.

Author

Ivan Pusic

5.108.2.20 AK_on_observable_notify()

```
void AK_on_observable_notify (
    void * observer,
    void * observable,
    AK_ObservableType_Enum type )
```

Function for handling notify from some observable type.

Author

Ivan Pusic

Parameters

<i>observer</i>	Observer type
<i>observable</i>	Observable type
<i>type</i>	Type of observable who sent some notice

5.108.2.21 AK_on_transaction_end()

```
void AK_on_transaction_end (
    pthread_t transaction_thread )
```

Function for handling event when some transaction is finished.

Author

Ivan Pusic

Parameters

<i>transaction_thread</i>	Thread ID of transaction which is finished
---------------------------	--------------------------------------------

5.108.2.22 AK_release_locks()

```
void AK_release_locks (
    AK_memoryAddresses_link addressesTmp,
    pthread_t transactionId )
```

Main interface function for the transaction API. It is responsible for the whole process releasing locks acquired by a transaction. The locks are released either by COMMIT or ABORT .

Author

Frane Jakelić updated by Ivan Pusic

Parameters

<i>adresses</i>	linked list of memory addresses locked by the transaction.
<i>transaction↔ Id</i>	integer representation of transaction id.

5.108.2.23 AK_remove_transaction_thread()

```
int AK_remove_transaction_thread (
    pthread_t transaction_thread )
```

Function for deleting one of active threads from array of all active transactions threads.

Author

Ivan Pusic

Parameters

<i>transaction_thread</i>	Active thread to delete
---------------------------	-------------------------

Returns

Exit status (OK or NOT_OK)

5.108.2.24 AK_search_empty_link_for_hook()

```
AK_transaction_elem_P AK_search_empty_link_for_hook (  
    int blockAddress )
```

Function that searches for a empty link for new active block, helper method in case of address collision.

Author

Frane Jakelić

Parameters

<i>blockAddress</i>	integer representation of memory address.
---------------------	-------------------------------------------

Returns

pointer to empty location to store new active address

5.108.2.25 AK_search_existing_link_for_hook()

```
AK_transaction_elem_P AK_search_existing_link_for_hook (  
    int blockAddress )
```

Function that searches for a existing entry in hash list of active blocks.

Author

Frane Jakelić

Parameters

<i>blockAddress</i>	integer representation of memory address.
---------------------	-------------------------------------------

Returns

pointer to the existing hash list entry

5.108.2.26 AK_search_lock_entry_list_by_key()

```
AK_transaction_lock_elem_P AK_search_lock_entry_list_by_key (
    AK_transaction_elem_P Lockslist,
    int memoryAddress,
    pthread_t id )
```

Function that searches for a specific entry in the Locks doubly linked list using the transaction id as it's key.

Author

Frane Jakelić

Parameters

<i>memoryAddress</i>	integer representation of memory address.
<i>id</i>	integer representation of transaction id.

Returns

NULL pointer if the element is not found otherwise it returns a pointer to the found element

5.108.2.27 AK_transaction_finished()

```
void AK_transaction_finished ( )
```

Function that is called when some transaction is finished.

Author

Ivan Pusic

5.108.2.28 AK_transaction_manager()

```
void AK_transaction_manager (
    command * commandArray,
    int lengthOfArray )
```

Function that receives all the data and gives an id to that data and starts a thread that executes the transaction.

Author

Frane Jakelić updated by Ivan Pusic

Parameters

<i>commandArray</i>	array filled with commands that need to be secured using transactions
<i>lengthOfArray</i>	length of commandArray

5.108.2.29 AK_transaction_register_observer()

```
int AK_transaction_register_observer (
    AK_observable_transaction * observable_transaction,
    AK_observer * observer )
```

Function for registering new observer of AK_observable_transaction type.

Author

Ivan Pusic

Parameters

<i>observable_transaction</i>	Observable type instance
<i>observer</i>	Observer instance

Returns

Exit status (OK or NOT_OK)

5.108.2.30 AK_transaction_unregister_observer()

```
int AK_transaction_unregister_observer (
    AK_observable_transaction * observable_transaction,
    AK_observer * observer )
```

Function for unregistering observer from AK_observable_transaction type.

Author

Ivan Pusic

Parameters

<i>observable_transaction</i>	Observable type instance
<i>observer</i>	Observer instance

Returns

Exit status (OK or NOT_OK)

5.108.2.31 handle_transaction_notify()

```
void handle_transaction_notify (
    AK_observer_lock * observer_lock )
```

Function for handling AK_observable_transaction notify. Function is associated to some observer instance.

Author

Ivan Pusic

Parameters

observer_lock	Observer type instance
-------------------------------	------------------------

5.109 trans/transaction.h File Reference

```
#include <pthread.h>
#include "../auxi/test.h"
#include "../auxi/constants.h"
#include "../auxi/configuration.h"
#include "../mm/memoman.h"
#include "../sql/command.h"
#include "../auxi/observable.h"
#include "../file/table.h"
#include "../file/fileio.h"
#include <string.h>
#include "../auxi/mempro.h"
```

Include dependency graph for transaction.h: This graph shows which files directly or indirectly include this file:

Classes

- struct [observable_transaction_struct](#)
- struct [observer_lock](#)

Structure which defines transaction lock observer type.
- struct [transaction_locks_list_elem](#)

Structure that represents LockTable entry about transaction resource lock.
- struct [transaction_list_elem](#)

Structure that represents LockTable entry about transaction lock holder.Element indexed by Hash table.
- struct [transaction_list_head](#)

Structure that represents LockTable entry about doubly linked list of collision in Hash table.
- struct [memoryAddresses](#)

- *Structure that represents a linked list of locked addresses.*
- struct [transactionData](#)
 - *Structure used to transport transaction data to the thread.*
- struct [threadContainer](#)
 - *Structure that represents a linked list of threads.*

Typedefs

- typedef struct [observable_transaction_struct](#) **AK_observable_transaction**
- typedef struct [observer_lock](#) **AK_observer_lock**
- typedef struct [transactionData](#) **AK_transaction_data**
- typedef struct [memoryAddresses](#) **AK_memoryAddresses**
- typedef struct [memoryAddresses](#) * **AK_memoryAddresses_link**
- typedef struct [transaction_list_head](#) **AK_transaction_list**
- typedef struct [transaction_list_elem](#) * **AK_transaction_elem_P**
- typedef struct [transaction_list_elem](#) **AK_transaction_elem**
- typedef struct [transaction_locks_list_elem](#) * **AK_transaction_lock_elem_P**
- typedef struct [transaction_locks_list_elem](#) **AK_transaction_lock_elem**
- typedef struct [threadContainer](#) * **AK_thread_elem**
- typedef struct [threadContainer](#) **AK_thread_Container**

Enumerations

- enum [NoticeType](#) { **AK_LOCK_RELEASED**, **AK_TRANSACTION_FINISHED**, **AK_ALL_TRANSACTION_↵**
_FINISHED }
- *Enumeration which define notice types for transactions.*

Functions

- int [AK_memory_block_hash](#) (int)
 - *Function that calculates the hash value for a given memory address. Hash values are used to identify location of locked resources.*
- [AK_transaction_elem_P](#) [AK_search_existing_link_for_hook](#) (int)
 - *Function that searches for a existing entry in hash list of active blocks.*
- [AK_transaction_elem_P](#) [AK_search_empty_link_for_hook](#) (int)
 - *Function that searches for a empty link for new active block, helper method in case of address collision.*
- [AK_transaction_elem_P](#) [AK_add_hash_entry_list](#) (int, int)
 - *Function that adds an element to the doubly linked list.*
- int [AK_delete_hash_entry_list](#) (int)
 - *Function that deletes a specific element in the lockTable doubly linked list.*
- [AK_transaction_lock_elem_P](#) [AK_search_lock_entry_list_by_key](#) ([AK_transaction_elem_P](#), int, pthread_t)
 - *Function that searches for a specific entry in the Locks doubly linked list using the transaction id as it's key.*
- int [AK_delete_lock_entry_list](#) (int, pthread_t)
 - *Function that deletes a specific entry in the Locks doubly linked list using the transaction id as it's key.*
- int [AK_isLock_waiting](#) ([AK_transaction_elem_P](#), int, pthread_t, [AK_transaction_lock_elem_P](#))
 - *Function that, based on the parameters, puts an transaction action in waiting phase or let's the transaction do it's actions.*
- [AK_transaction_lock_elem_P](#) [AK_add_lock](#) ([AK_transaction_elem_P](#), int, pthread_t)
 - *Function that adds an element to the locks doubly linked list.*

- [AK_transaction_lock_elem_P AK_create_lock](#) (int, int, pthread_t)
Helper function that determines if there is a hash LockTable entry that corresponds to the given memory address. And if there isn't an entry the function calls for the creation of the Locks list holder.
- int [AK_acquire_lock](#) (int, int, pthread_t)
Main interface function for the transaction API. It is responsible for the whole process of creating a new lock.
- void [AK_release_locks](#) (AK_memoryAddresses_link, pthread_t)
Main interface function for the transaction API. It is responsible for the whole process releasing locks acquired by a transaction. The locks are released either by COMMIT or ABORT .
- int [AK_get_memory_blocks](#) (char *, AK_memoryAddresses_link)
Function that appends all addresses affected by the transaction.
- int [AK_execute_commands](#) (command *, int)
Function that is called in a separate thread that is responsible for acquiring locks, releasing them and finding the associated block addresses.
- void * [AK_execute_transaction](#) (void *)
Function that is the thread start point all relevant functions. It acts as an intermediary between the main thread and other threads.
- void [AK_transaction_manager](#) (command *, int)
Function that receives all the data and gives an id to that data and starts a thread that executes the transaction.
- [TestResult AK_test_Transaction](#) ()
- int [AK_create_new_transaction_thread](#) (AK_transaction_data *)
Function for creating new thread. Function also adds thread ID to pthread_t array.
- int [AK_remove_transaction_thread](#) (pthread_t)
Function for deleting one of active threads from array of all active transactions threads.
- void [handle_transaction_notify](#) (AK_observer_lock *)
Function for handling AK_observable_transaction notify. Function is associated to some observer instance.
- void [AK_on_observable_notify](#) (void *, void *, AK_ObservableType_Enum)
Function for handling notify from some observable type.
- void [AK_on_transaction_end](#) (pthread_t)
Function for handling event when some transaction is finished.
- void [AK_on_lock_release](#) ()
Function for handling event when one of lock is released.
- void [AK_on_all_transactions_end](#) ()
Function for handling event when all transactions are finished.
- void [AK_handle_observable_transaction_action](#) (NoticeType *)
Function for handling action which is called from observable_transaction type.
- void [AK_lock_released](#) ()
Function which is called when the lock is released.
- void [AK_transaction_finished](#) ()
Function that is called when some transaction is finished.
- void [AK_all_transactions_finished](#) ()
Function that is called when all transactions are finished.
- int [AK_transaction_register_observer](#) (AK_observable_transaction *, AK_observer *)
Function for registering new observer of AK_observable_transaction type.
- int [AK_transaction_unregister_observer](#) (AK_observable_transaction *, AK_observer *)
Function for unregistering observer from AK_observable_transaction type.
- [AK_observable_transaction * AK_init_observable_transaction](#) ()
Function for initialization of AK_observable_transaction type.
- [AK_observer_lock * AK_init_observer_lock](#) ()
Function for initialization of AK_observer_lock type.

5.109.1 Detailed Description

Header file that contains data structures, functions and defines for the transaction execution

5.109.2 Enumeration Type Documentation

5.109.2.1 NoticeType

```
enum NoticeType
```

Enumeration which define notice types for transactions.

Author

Ivan Pusic

5.109.3 Function Documentation

5.109.3.1 AK_acquire_lock()

```
int AK_acquire_lock (
    int memoryAddress,
    int type,
    pthread_t transactionId )
```

Main interface function for the transaction API. It is responsible for the whole process of creating a new lock.

Author

Frane Jakelić updated by Ivan Pusic

Todo Implement a better deadlock detection. This method uses a very simple approach. It waits for 60sec before it restarts a transaction.

Parameters

<i>memoryAddress</i>	integer representation of memory address.
<i>type</i>	of lock issued to the provided memory address.
<i>transactionId</i>	integer representation of transaction id.

Returns

OK or NOT_OK based on the success of the function.

Author

Frane Jakelić updated by Ivan Pusic

Todo Implement a better deadlock detection. This method uses a very simple approach. It waits for 60sec before it restarts a transaction.

Parameters

<i>memoryAddress</i>	integer representation of memory address.
<i>type</i>	of lock issued to the provided memory address.
<i>transactionId</i>	integer representation of transaction id.

Returns

OK or NOT_OK based on the success of the function.

```
#####\n# Lock Granted after wait\n#-----#\n# Lock ID:lu TYPE:i #\n#-----\n#\n# LockedAddress:i #\n#####\n\n", (unsigned long)lock->TransactionId, lock->lock_type, memoryAddress); */
```

```
#####\n# Lock Granted #\n#-----#\n# Lock ID:lu TYPE:i #\n#-----\n#\n# LockedAddress:i #\n#####\n\n", (unsigned long)lock->TransactionId, lock->lock_type, memoryAddress); */
```

5.109.3.2 AK_add_hash_entry_list()

```
AK_transaction_elem_P AK_add_hash_entry_list (
    int blockAddress,
    int type )
```

Function that adds an element to the doubly linked list.

Author

Frane Jakelić

Parameters

<i>blockAddress</i>	integer representation of memory address.
<i>type</i>	of lock issued to the provided memory address.

Returns

pointer to the newly created doubly linked element.

5.109.3.3 AK_add_lock()

```
AK_transaction_lock_elem_P AK_add_lock (
    AK_transaction_elem_P HashList,
    int type,
    pthread_t transactionId )
```

Function that adds an element to the locks doubly linked list.

Author

Frane Jakelić

Parameters

<i>memoryAddress</i>	integer representation of memory address.
<i>type</i>	of lock issued to the provided memory address.
<i>transactionId</i>	integer representation of transaction id.

Returns

pointer to the newly created Locks doubly linked element.

5.109.3.4 AK_all_transactions_finished()

```
void AK_all_transactions_finished ( )
```

Function that is called when all transactions are finished.

Author

Ivan Pusic

5.109.3.5 AK_create_lock()

```
AK_transaction_lock_elem_P AK_create_lock (
    int blockAddress,
    int type,
    pthread_t transactionId )
```

Helper function that determines if there is a hash LockTable entry that corresponds to the given memory address. And if there isn't an entry the function calls for the creation of the Locks list holder.

Author

Frane Jakelić

Parameters

<i>memoryAddress</i>	integer representation of memory address.
<i>type</i>	of lock issued to the provided memory address.
<i>transactionId</i>	integer representation of transaction id.

Returns

pointer to the newly created Locks doubly linked element.

5.109.3.6 AK_create_new_transaction_thread()

```
int AK_create_new_transaction_thread (
    AK_transaction_data * transaction_data )
```

Function for creating new thread. Function also adds thread ID to pthread_t array.

Author

Ivan Pusic

Parameters

<i>transaction_data</i>	Data for executing transaction
-------------------------	--------------------------------

Returns

Exit status (OK or NOT_OK)

5.109.3.7 AK_delete_hash_entry_list()

```
int AK_delete_hash_entry_list (
    int blockAddress )
```

Function that deletes a specific element in the lockTable doubly linked list.

Author

Frane Jakelić

Parameters

<i>blockAddress</i>	integer representation of memory address.
---------------------	-------------------------------------------

Returns

integer OK or NOT_OK based on success of finding the specific element in the list.

5.109.3.8 AK_delete_lock_entry_list()

```
int AK_delete_lock_entry_list (
    int blockAddress,
    pthread_t id )
```

Function that deletes a specific entry in the Locks doubly linked list using the transaction id as it's key.

Author

Frane Jakelić

Parameters

<i>blockAddress</i>	integer representation of memory address.
<i>id</i>	integer representation of transaction id.

Returns

int OK or NOT_OK based on success of finding the specific element in the list.

5.109.3.9 AK_execute_commands()

```
int AK_execute_commands (
    command * commandArray,
    int lengthOfArray )
```

Function that is called in a separate thread that is responsible for acquiring locks, releasing them and finding the associated block addresses.

Author

Frane Jakelić updated by Ivan Pusic

Todo Check multithreading, check if it's working correctly

Parameters

<i>commandArray</i>	array filled with commands that need to be secured using transactions
<i>lengthOfArray</i>	length of commandArray
<i>transactionId</i>	associated with the transaction

Returns

ABORT or COMMIT based on the success of the function.

Author

Frane Jakelić updated by Ivan Pusic

Todo Check multithreading, check if it's working correctly

Parameters

<i>commandArray</i>	array filled with commands that need to be secured using transactions
<i>lengthOfArray</i>	length of commandArray
<i>transactionId</i>	associated with the transaction

Returns

ABORT or COMMIT based on the success of the function.

5.109.3.10 AK_execute_transaction()

```
void* AK_execute_transaction (
    void * params )
```

Function that is the thread start point all relevant functions. It acts as an intermediary between the main thread and other threads.

Author

Frane Jakelić updated by Ivan Pusic

Parameters

<i>data</i>	transmitted to the thread from the main thread
-------------	------------------------------------------------

5.109.3.11 AK_get_memory_blocks()

```
int AK_get_memory_blocks (
    char * tblName,
    AK_memoryAddresses_link addressList )
```

Function that appends all addresses affected by the transaction.

Author

Frane Jakelić

Parameters

<i>addressList</i>	pointer to the linked list where the addresses are stored.
<i>tblName</i>	table name used in the transaction

Returns

OK or NOT_OK based on the success of the function.

5.109.3.12 AK_handle_observable_transaction_action()

```
void AK_handle_observable_transaction_action (
    NoticeType * noticeType )
```

Function for handling action which is called from [observable_transaction](#) type.

Author

Ivan Pusic

Parameters

<i>noticeType</i>	Type of action (event)
-------------------	------------------------

5.109.3.13 AK_init_observable_transaction()

```
AK_observable_transaction* AK_init_observable_transaction ( )
```

Function for initialization of [AK_observable_transaction](#) type.

Author

Ivan Pusic

ReturnsPointer to new [AK_observable_transaction](#) instance

5.109.3.14 AK_init_observer_lock()

```
AK_observer_lock* AK_init_observer_lock ( )
```

Function for initialization of AK_observer_lock type.

Author

Ivan Pusic

Returns

Pointer to new AK_observer_lock instance

5.109.3.15 AK_isLock_waiting()

```
int AK_isLock_waiting (
    AK_transaction_elem_P lockHolder,
    int type,
    pthread_t transactionId,
    AK_transaction_lock_elem_P lock )
```

Function that, based on the parameters, puts an transaction action in waiting phase or let's the transaction do it's actions.

Author

Frane Jakelić updated by Ivan Pusic

Parameters

<i>lockHolder</i>	pointer to the hash list entry that is entitled to the specific memory address.
<i>type</i>	of lock issued to the provided memory address.
<i>transactionId</i>	integer representation of transaction id.
<i>lock</i>	pointer to the lock element that is being tested.

Returns

int PASS_LOCK_QUEUE or WAIT_FOR_UNLOCK based on the rules described inside the function.

5.109.3.16 AK_lock_released()

```
void AK_lock_released ( )
```

Function which is called when the lock is released.

Author

Ivan Pusic

5.109.3.17 AK_memory_block_hash()

```
int AK_memory_block_hash (
    int blockMemoryAddress )
```

Function that calculates the hash value for a given memory address. Hash values are used to identify location of locked resources.

Author

Frane Jakelić

Todo The current implementation is very limited it doesn't cope well with collision. recommendation use some better version of hash calculation. Maybe Knuth's memory address hashing function.

Parameters

<i>blockMemoryAddress</i>	integer representation of memory address, the hash value is calculated from this parameter.
---------------------------	---------------------------------------------------------------------------------------------

Returns

integer containing the hash value of the passed memory address

Author

Frane Jakelić

Todo The current implementation is very limited it doesn't cope well with collision. recommendation use some better version of hash calculation. Maybe Knuth's memory address hashing function.

Parameters

<i>blockMemoryAddress</i>	integer representation of memory address, the hash value is calculated from this parameter.
---------------------------	---------------------------------------------------------------------------------------------

Returns

integer containing the hash value of the passed memory address

5.109.3.18 AK_on_all_transactions_end()

```
void AK_on_all_transactions_end ( )
```

Function for handling event when all transactions are finished.

Author

Ivan Pusic

5.109.3.19 AK_on_lock_release()

```
void AK_on_lock_release ( )
```

Function for handling event when one of lock is released.

Author

Ivan Pusic

5.109.3.20 AK_on_observable_notify()

```
void AK_on_observable_notify (
    void * observer,
    void * observable,
    AK_ObservableType_Enum type )
```

Function for handling notify from some observable type.

Author

Ivan Pusic

Parameters

<i>observer</i>	Observer type
<i>observable</i>	Observable type
<i>type</i>	Type of observable who sent some notice

5.109.3.21 AK_on_transaction_end()

```
void AK_on_transaction_end (
    pthread_t transaction_thread )
```

Function for handling event when some transaction is finished.

Author

Ivan Pusic

Parameters

<i>transaction_thread</i>	Thread ID of transaction which is finished
---------------------------	--------------------------------------------

5.109.3.22 AK_release_locks()

```
void AK_release_locks (
    AK_memoryAddresses_link addressesTmp,
    pthread_t transactionId )
```

Main interface function for the transaction API. It is responsible for the whole process releasing locks acquired by a transaction. The locks are released either by COMMIT or ABORT .

Author

Frane Jakelić updated by Ivan Pusic

Parameters

<i>adresses</i>	linked list of memory addresses locked by the transaction.
<i>transaction↔ id</i>	integer representation of transaction id.

5.109.3.23 AK_remove_transaction_thread()

```
int AK_remove_transaction_thread (
    pthread_t transaction_thread )
```

Function for deleting one of active threads from array of all active transactions threads.

Author

Ivan Pusic

Parameters

<i>transaction_thread</i>	Active thread to delete
---------------------------	-------------------------

Returns

Exit status (OK or NOT_OK)

5.109.3.24 AK_search_empty_link_for_hook()

```
AK_transaction_elem_P AK_search_empty_link_for_hook (
    int blockAddress )
```

Function that searches for a empty link for new active block, helper method in case of address collision.

Author

Frane Jakelić

Parameters

<i>blockAddress</i>	integer representation of memory address.
---------------------	-------------------------------------------

Returns

pointer to empty location to store new active address

5.109.3.25 AK_search_existing_link_for_hook()

```
AK_transaction_elem_P AK_search_existing_link_for_hook (
    int blockAddress )
```

Function that searches for a existing entry in hash list of active blocks.

Author

Frane Jakelić

Parameters

<i>blockAddress</i>	integer representation of memory address.
---------------------	-------------------------------------------

Returns

pointer to the existing hash list entry

5.109.3.26 AK_search_lock_entry_list_by_key()

```
AK_transaction_lock_elem_P AK_search_lock_entry_list_by_key (
    AK_transaction_elem_P Lockslist,
    int memoryAddress,
    pthread_t id )
```

Function that searches for a specific entry in the Locks doubly linked list using the transaction id as it's key.

Author

Frane Jakelić

Parameters

<i>memoryAddress</i>	integer representation of memory address.
<i>id</i>	integer representation of transaction id.

Returns

NULL pointer if the element is not found otherwise it returns a pointer to the found element

5.109.3.27 AK_transaction_finished()

```
void AK_transaction_finished ( )
```

Function that is called when some transaction is finished.

Author

Ivan Pusic

5.109.3.28 AK_transaction_manager()

```
void AK_transaction_manager (
    command * commandArray,
    int lengthOfArray )
```

Function that receives all the data and gives an id to that data and starts a thread that executes the transaction.

Author

Frane Jakelić updated by Ivan Pusic

Parameters

<i>commandArray</i>	array filled with commands that need to be secured using transactions
<i>lengthOfArray</i>	length of commandArray

5.109.3.29 AK_transaction_register_observer()

```
int AK_transaction_register_observer (
    AK_observable_transaction * observable_transaction,
    AK_observer * observer )
```

Function for registering new observer of AK_observable_transaction type.

Author

Ivan Pusic

Parameters

<i>observable_transaction</i>	Observable type instance
<i>observer</i>	Observer instance

Returns

Exit status (OK or NOT_OK)

5.109.3.30 AK_transaction_unregister_observer()

```
int AK_transaction_unregister_observer (
    AK_observable_transaction * observable_transaction,
    AK_observer * observer )
```

Function for unregistering observer from AK_observable_transaction type.

Author

Ivan Pusic

Parameters

<i>observable_transaction</i>	Observable type instance
<i>observer</i>	Observer instance

Returns

Exit status (OK or NOT_OK)

5.109.3.31 handle_transaction_notify()

```
void handle_transaction_notify (
    AK_observer_lock * observer_lock )
```

Function for handling AK_observable_transaction notify. Function is associated to some observer instance.

Author

Ivan Pusic

Parameters

<i>observer_lock</i>	Observer type instance
----------------------	------------------------

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