

# Documentation for db2-hash-routines

Helmut K. C. Tessarek

18<sup>th</sup> August, 2017

db2-hash-routines is a package which provides User Defined Functions and Stored Procedures for IBM<sup>®</sup> DB2<sup>®</sup> to generate and validate hashes.

<http://tessus.github.io/db2-hash-routines>

Date: 2017-08-18 21:14:59 -0400 Id: ec45924

# Contents

<b>1. db2-hash-routines</b>	<b>1</b>
1.1. Building the library and registering the UDFs and SPs . . . . .	1
1.2. Description of the UDFs and SPs . . . . .	2
<b>A. UDF and SP reference</b>	<b>3</b>
A.1. bcrypt . . . . .	3
A.2. sha256_hex . . . . .	4
A.3. sha1_hex . . . . .	5
A.4. sha256 . . . . .	6
A.5. sha512 . . . . .	8
A.6. php_md5 . . . . .	10
A.7. apr_md5 . . . . .	11
A.8. apr_crypt . . . . .	12
A.9. apr_sha1 . . . . .	13
A.10.apr_sha256 . . . . .	14
A.11.validate_pw . . . . .	15

## 1. db2-hash-routines

### 1.1. Building the library and registering the UDFs and SPs

Login as the instance user and run the script

```
Linux and AIX    ./makertn
Win32           makertn.bat
```

The `makertn` script detects the DB2 instance directory and locates `apr-1-config` and `apu-1-config` automatically. If for some reason the script cannot set either one of the necessary variables, they have to be set manually. Uncomment and change the following variables in the `makertn` script.

```
DB2PATH=
APRPATH=
APUPATH=
```

Set `DB2PATH` to the directory where DB2 is accessed. This is usually the instance home directory.

Set `APRPATH` to where `apr-1-config` is located.

Set `APUPATH` to where `apu-1-config` is located.

The UDFs and SPs are written in ANSI C and should compile on all platforms.

The only requirements are APR and APR-util. You can get APR and APR-util at <http://apr.apache.org/>

To register the UDFs and SPs, connect to your database and run the script:

```
db2 -td@ -f register.ddl
```

## 1.2. Description of the UDFs and SPs

This library delivers the following routines<sup>1</sup>:

```
bcrypt
sha256_hex
sha1_hex
sha256
sha512
php_md5
apr_md5
apr_crypt
apr_sha1
apr_sha256
validate_pw
```

The `php_md5` routine is compatible to the PHP `md5` function.

The `sha256_hex` routine returns a sha256 64-character hexadecimal hash.

The `sha1_hex` routine returns a sha1 40-character hexadecimal hash.

The `apr_md5`, `apr_crypt`, `apr_sha1` and `bcrypt` routines are compatible to the functions used in Apache's `htpasswd` utility.

The `apr_sha256` routine returns the identifier `{SHA256}` plus the base64 encoded sha256 hash.

The `sha256` and `sha512` functions return glib2's crypt hashes (if supported).

`validate_pw` can be used to validate a password against a hash.

On systems with glibc2, the `validate_pw` routine will also validate hashes of the form `$id$salt$encrypted`. The following values of `id` are supported:

ID	Method
1	MD5
2a	Blowfish (not in mainline glibc; added in some Linux distributions)
5	SHA-256 (since glibc 2.7)
6	SHA-512 (since glibc 2.7)

**Note:** In win32 environments `apr_crypt` returns the output of `bcrypt`, if available. If `bcrypt` is not available, the output of `apr_md5` is returned.

---

<sup>1</sup>see Appendix A for a reference of the UDFs and SPs

## A. UDF and SP reference

### A.1. bcrypt

```
>>-BCRYPT--(--expression--)-----<<
```

```
>>-BCRYPT--(--expression--,--hash--)-----<<
```

bcrypt algorithm. The `bcrypt` routine is compatible to the function used in Apache's `htpasswd` utility.

The argument can be a character string that is either a `CHAR` or `VARCHAR` not exceeding 4096 bytes.

The result of the function is `CHAR(60)`. The result can be null; if the argument is null, the result is the null value.

Examples:

1)

```
INSERT INTO USERS (username, password)
VALUES ('test', bcrypt('testpwd'))
```

2)

```
SELECT bcrypt( 'testpwd' ) FROM SYSIBM.SYSDUMMY1
```

```
1
```

```
-----
$2y$05$2jb66aPElSkNLT1t8e6dQepuCY2BP3JnYUh0xeV9r1PEo0GyOLkym
```

```
1 record(s) selected.
```

3)

```
CALL bcrypt('testpwd', ?)
```

```
Value of output parameters
```

```
-----
Parameter Name : HASH
```

```
Parameter Value : $2y$05$WYSu1X6PVA0Ra.aPSjrdv.S6hOp.AYSnNRT521rmLRjD4Mj9UY6ve
```

```
Return Status = 0
```

## A.2. sha256\_hex

```
>>-SHA256_HEX--(--expression--)-----><
```

```
>>-SHA256_HEX--(--expression--,--hash--)-----><
```

SHA256 algorithm. The `sha256_hex` routine returns a 64-character hexadecimal hash.

The argument can be a character string that is either a CHAR or VARCHAR not exceeding 4096 bytes.

The result of the function is CHAR(64). The result can be null; if the argument is null, the result is the null value.

Examples:

1)

```
INSERT INTO USERS (username, password)
VALUES ('test', sha256_hex('testpwd'))
```

2)

```
SELECT sha256_hex('testpwd') FROM SYSIBM.SYSDUMMY1
```

```
1
-----
a85b6a20813c31a8b1b3f3618da796271c9aa293b3f809873053b21aec501087
```

```
1 record(s) selected.
```

3)

```
CALL sha256_hex('testpwd', ?)
```

```
Value of output parameters
```

```
-----
Parameter Name   : HASH
Parameter Value  : a85b6a20813c31a8b1b3f3618da796271c9aa293b3f809873053b21
aec501087
```

```
Return Status = 0
```

### A.3. sha1\_hex

```
>>-SHA1_HEX--(--expression--)------><
```

```
>>-SHA1_HEX--(--expression--,--hash--)------><
```

SHA1 algorithm. The `sha1_hex` routine returns a 40-character hexadecimal hash.

The argument can be a character string that is either a CHAR or VARCHAR not exceeding 4096 bytes.

The result of the function is CHAR(40). The result can be null; if the argument is null, the result is the null value.

Examples:

1)

```
INSERT INTO USERS (username, password)
VALUES ('test', sha1_hex('testpwd'))
```

2)

```
SELECT sha1_hex('testpwd') FROM SYSIBM.SYSDUMMY1
```

```
1
-----
98ef0758e6aac6f9a9e1197548c8190b72c9581d
```

```
1 record(s) selected.
```

3)

```
CALL sha1_hex('testpwd', ?)
```

```
Value of output parameters
```

```
-----
Parameter Name   : HASH
Parameter Value  : 98ef0758e6aac6f9a9e1197548c8190b72c9581d
```

```
Return Status = 0
```

**A.4. sha256**

```
>>-SHA256--(--expression--+-----+--)------><
          '-,--salt-'

>>-SHA256--(--expression--+-----+--,--hash--)------><
          '-,--salt-'
```

SHA256 algorithm. The `sha256` routine returns a glibc2's crypt hash. If the system's crypt does not support sha-256, an `SQLSTATE 39702` is returned.

The argument can be a character string that is either a `CHAR` or `VARCHAR` not exceeding 4096 bytes.

An optional salt can be specified, which must be a eight-character string chosen from the set `[a-z-Z0-9./]`. If the salt is not exactly eight characters long, an `SQLSTATE 39703` is returned. If the salt contains invalid characters, an `SQLSTATE 39704` is returned.

The result of the function is `CHAR(55)`. The result can be null; if one of the arguments is null, the result is the null value.

Examples:

1)

```
INSERT INTO USERS (username, password)
VALUES ('test', sha256('testpwd'))
```

2)

```
SELECT sha256( 'testpwd' ) FROM SYSIBM.SYSDUMMY1
```

```
1
-----
$5$S.LqPR7Z$273zPncMdmJ0dE1WdLldWVBmaHSDUD18/tW8At8Hc0A
```

```
1 record(s) selected.
```

3)

```
CALL sha256('testpwd', ?)
```

```
Value of output parameters
```

```
-----
Parameter Name   : HASH
Parameter Value  : $5$vSDCZr2d$rfh.aDopE5131m26AwwcIYnuVdV7/9QBACWukqYyV3/
```



Return Status = 0

4)

```
SELECT sha256('testpwd', '12345678') FROM SYSIBM.SYSDUMMY1
```

```
1
-----
$5$12345678$.oVAn0r/.FK8fYNiFPvoXPQvEOT9Calecygw6K9wIb9
```

1 record(s) selected.

5)

```
CALL sha256('testpwd', '12345678', ?)
```

Value of output parameters

```
-----
Parameter Name : HASH
Parameter Value : $5$12345678$.oVAn0r/.FK8fYNiFPvoXPQvEOT9Calecygw6K9wIb9
```

Return Status = 0

**A.5. sha512**

```
>>-SHA512--(--expression--+-----+--)------><
      '-,--salt-'

>>-SHA512--(--expression--+-----+--,--hash--)------><
      '-,--salt-'
```

SHA512 algorithm. The `sha512` routine returns a glibc2's crypt hash. If the system's crypt does not support sha-512, an `SQLSTATE 39702` is returned.

The argument can be a character string that is either a `CHAR` or `VARCHAR` not exceeding 4096 bytes.

An optional salt can be specified, which must be a eight-character string chosen from the set `[a-z-Z0-9./]`. If the salt is not exactly eight characters long, an `SQLSTATE 39703` is returned. If the salt contains invalid characters, an `SQLSTATE 39704` is returned.

The result of the function is `CHAR(98)`. The result can be null; if one of the arguments is null, the result is the null value.

Examples:

1)

```
INSERT INTO USERS (username, password)
VALUES ('test', sha512('testpwd'))
```

2)

```
SELECT sha512( 'testpwd' ) FROM SYSIBM.SYSDUMMY1
```

```
1
-----
-----
$6$cD33haq7$d1.RqEaLamlesTPVzSIQr4N1MY3BsVZ76VS8qNte0IOIW02XorMg8U797KKOFGm
X8dJhT3WuF6p17HmvvoQ6Q/
```

```
1 record(s) selected.
```

3)

```
CALL sha512('testpwd', ?)
```

```
Value of output parameters
-----
Parameter Name : HASH
```

Parameter Value : \$6\$1W.m9JN1\$Dh.VP17vy.igGaeDUdDw6Z1D0xufwDwm0ukpOYknPt  
djxiSM2yzWBkzHffalb/2axNHPqEi9UUzXUbSm4LGa/

Return Status = 0

4)

```
SELECT sha512('testpwd', '12345678') FROM SYSIBM.SYSDUMMY1
```

1

-----  
-----

\$6\$12345678\$t1HrypdWTz6FqubBpgL/ePlxr4lZuQ80K1zfV6zWUmGJSz.5kGwWQGjg69Qm1Bm  
3.DvILruqA61o3EHsxSoko1

1 record(s) selected.

5)

```
CALL sha512('testpwd', '12345678', ?)
```

Value of output parameters

-----

Parameter Name : HASH

Parameter Value : \$6\$12345678\$t1HrypdWTz6FqubBpgL/ePlxr4lZuQ80K1zfV6zWUmGJS  
z.5kGwWQGjg69Qm1Bm3.DvILruqA61o3EHsxSoko1

Return Status = 0

## A.6. php\_md5

```
>>-PHP_MD5--(--expression--)-><
```

```
>>-PHP_MD5--(--expression--,--hash--)-><
```

MD5 hash. The `php_md5` routine is compatible to the PHP `md5` function.

The argument can be a character string that is either a `CHAR` or `VARCHAR` not exceeding 4096 bytes.

The result of the function is `CHAR(32)`. The result can be null; if the argument is null, the result is the null value.

Examples:

1)

```
INSERT INTO USERS (username, password)
VALUES ('test', php_md5('testpwd'))
```

2)

```
SELECT php_md5( 'testpwd' ) FROM SYSIBM.SYSDUMMY1
```

```
1
-----
342df5b036b2f28184536820af6d1caf
```

```
1 record(s) selected.
```

3)

```
CALL php_md5('testpwd', ?)
```

```
Value of output parameters
```

```
-----
Parameter Name   : HASH
Parameter Value  : 342df5b036b2f28184536820af6d1caf
```

```
Return Status = 0
```

## A.7. apr\_md5

```
>>-APR_MD5--(--expression--)-----><
```

```
>>-APR_MD5--(--expression--,--hash--)-----><
```

Seeded MD5 hash. The `apr_md5` routine is compatible to the function used in Apache's `htpasswd` utility.

The argument can be a character string that is either a CHAR or VARCHAR not exceeding 4096 bytes.

The result of the function is CHAR(37). The result can be null; if the argument is null, the result is the null value.

Examples:

1)

```
INSERT INTO USERS (username, password)
VALUES ('test', apr_md5('testpwd'))
```

2)

```
SELECT apr_md5( 'testpwd' ) FROM SYSIBM.SYSDUMMY1
```

```
1
-----
$apr1$GfVmOTyJ$n7F1Vkw1/kX8MLgTJq11p1
```

```
1 record(s) selected.
```

3)

```
CALL apr_md5('testpwd', ?)
```

```
Value of output parameters
```

```
-----
Parameter Name  : HASH
Parameter Value : $apr1$GfVmOTyJ$n7F1Vkw1/kX8MLgTJq11p1
```

```
Return Status = 0
```

## A.8. apr\_crypt

```
>>-APR_CRYPT--(--expression--)------><
```

```
>>-APR_CRYPT--(--expression--,--hash--)------><
```

Unix crypt. The `apr_crypt` routine is compatible to the function used in Apache's `htpasswd` utility.

The argument can be a character string that is either a CHAR or VARCHAR not exceeding 4096 bytes.

The result of the function is CHAR(13). The result can be null; if the argument is null, the result is the null value.

Examples:

1)

```
INSERT INTO USERS (username, password)
VALUES ('test', apr_crypt('testpwd'))
```

2)

```
SELECT apr_crypt( 'testpwd' ) FROM SYSIBM.SYSDUMMY1
```

```
1
-----
cqs7u0vz8KBlk
```

```
1 record(s) selected.
```

3)

```
CALL apr_crypt('testpwd', ?)
```

```
Value of output parameters
```

```
-----
Parameter Name : HASH
Parameter Value : cqs7u0vz8KBlk
```

```
Return Status = 0
```

## A.9. apr\_sha1

```
>>-APR_SHA1--(--expression--)-----><
```

```
>>-APR_SHA1--(--expression--,--hash--)-----><
```

SHA1 algorithm. The `apr_sha1` routine is compatible to the function used in Apache's `htpasswd` utility.

The argument can be a character string that is either a CHAR or VARCHAR not exceeding 4096 bytes.

The result of the function is CHAR(33). The result can be null; if the argument is null, the result is the null value.

Examples:

1)

```
INSERT INTO USERS (username, password)
VALUES ('test', apr_sha1('testpwd'))
```

2)

```
SELECT apr_sha1( 'testpwd' ) FROM SYSIBM.SYSDUMMY1
```

```
1
-----
{SHA}m08HW0aqxvmp4Rl1SMgZC3LJWB0=
```

```
1 record(s) selected.
```

3)

```
CALL apr_sha1('testpwd', ?)
```

```
Value of output parameters
```

```
-----
Parameter Name  : HASH
Parameter Value : {SHA}m08HW0aqxvmp4Rl1SMgZC3LJWB0=
```

```
Return Status = 0
```

## A.10. apr\_sha256

```
>>-APR_SHA256--(--expression--)------><
```

```
>>-APR_SHA256--(--expression--,--hash--)------><
```

SHA256 algorithm. The `apr_sha256` routine returns the identifier `{SHA256}` plus the base64 encoded sha256 hash.

The argument can be a character string that is either a CHAR or VARCHAR not exceeding 4096 bytes.

The result of the function is CHAR(52). The result can be null; if the argument is null, the result is the null value.

Examples:

1)

```
INSERT INTO USERS (username, password)
VALUES ('test', apr_sha256('testpwd'))
```

2)

```
SELECT apr_sha256( 'testpwd' ) FROM SYSIBM.SYSDUMMY1
```

```
1
-----
{SHA256}qFtqIIE8Maixs/NhjaeWJxyaopOz+AmHMF0yGuxQEIc=
```

```
1 record(s) selected.
```

3)

```
CALL apr_sha256('testpwd', ?)
```

```
Value of output parameters
```

```
-----
Parameter Name  : HASH
Parameter Value : {SHA256}qFtqIIE8Maixs/NhjaeWJxyaopOz+AmHMF0yGuxQEIc=
```

```
Return Status = 0
```



**A.11. validate\_pw**

```
>>-VALIDATE_PW--(--password--,--hash--)-----><
```

```
>>-VALIDATE_PW--(--password--,--hash--,--is_valid--)-----><
```

This routine can be used to validate a password against a hash.

The two input arguments can be character strings that are either a CHAR or VARCHAR not exceeding 4096 bytes (password) and 120 bytes (hash). The second parameter (hash) must not be empty, otherwise an SQLSTATE 39701 is returned.

The result of the routine is an INTEGER. If the password is valid, 1 is returned. If the password is not valid, 0 is returned. The result can be null; if the argument is null, the result is the null value.

Examples:

1)

```
SELECT validate_pw('testpwd', 'cqs7u0vz8KBlk') FROM SYSIBM.SYSDUMMY1"
```

```
1
-----
      1
```

1 record(s) selected.

2)

```
CALL validate_pw('testpwd', 'cqs7u0vz8KBlk', ?)
```

Value of output parameters

```
-----
Parameter Name  : IS_VALID
Parameter Value : 1
```

Return Status = 0

3)

```
CALL validate_pw('testpwd', '0123456789abcdef', ?)
```

Value of output parameters

```
-----
Parameter Name  : IS_VALID
```

Parameter Value : 0

Return Status = 0

Date: 2017-08-18 21:14:59 -0400 Id: ec459246be7c48f7dbf85d29408e392c977f3c77