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Red Hat Enterprise Linux Release 9.2 Manual Pages on 'BN_mod_exp.3openssl' command

\$ man BN_mod_exp.3openssl

BN_ADD(3openssl) OpenSSL BN_ADD(3openssl)

NAME

BN_add, BN_sub, BN_mul, BN_sqr, BN_div, BN_mod, BN_nnmod, BN_mod_add,
BN_mod_sub, BN_mod_mul, BN_mod_sqr, BN_mod_sqrt, BN_exp, BN_mod_exp,
BN_gcd - arithmetic operations on BIGNUMs

SYNOPSIS

```
#include <openssl/bn.h>
```

```
int BN_add(BIGNUM *r, const BIGNUM *a, const BIGNUM *b);
```

```
int BN_sub(BIGNUM *r, const BIGNUM *a, const BIGNUM *b);
```

```
int BN_mul(BIGNUM *r, BIGNUM *a, BIGNUM *b, BN_CTX *ctx);
```

```
int BN_sqr(BIGNUM *r, BIGNUM *a, BN_CTX *ctx);
```

```
int BN_div(BIGNUM *dv, BIGNUM *rem, const BIGNUM *a, const BIGNUM *d,  
          BN_CTX *ctx);
```

```
int BN_mod(BIGNUM *rem, const BIGNUM *a, const BIGNUM *m, BN_CTX *ctx);
```

```
int BN_nnmod(BIGNUM *r, const BIGNUM *a, const BIGNUM *m, BN_CTX *ctx);
```

```
int BN_mod_add(BIGNUM *r, BIGNUM *a, BIGNUM *b, const BIGNUM *m,  
              BN_CTX *ctx);
```

```
int BN_mod_sub(BIGNUM *r, BIGNUM *a, BIGNUM *b, const BIGNUM *m,  
              BN_CTX *ctx);
```

```
int BN_mod_mul(BIGNUM *r, BIGNUM *a, BIGNUM *b, const BIGNUM *m,  
              BN_CTX *ctx);
```

```
int BN_mod_sqr(BIGNUM *r, BIGNUM *a, const BIGNUM *m, BN_CTX *ctx);
```

```
BIGNUM *BN_mod_sqrt(BIGNUM *in, BIGNUM *a, const BIGNUM *p, BN_CTX *ctx);
```

```
int BN_exp(BIGNUM *r, BIGNUM *a, BIGNUM *p, BN_CTX *ctx);
```

```
int BN_mod_exp(BIGNUM *r, BIGNUM *a, const BIGNUM *p,  
              const BIGNUM *m, BN_CTX *ctx);
```

```
int BN_gcd(BIGNUM *r, BIGNUM *a, BIGNUM *b, BN_CTX *ctx);
```

DESCRIPTION

`BN_add()` adds `a` and `b` and places the result in `r` ("`r=a+b`"). `r` may be the same BIGNUM as `a` or `b`.

`BN_sub()` subtracts `b` from `a` and places the result in `r` ("`r=a-b`"). `r` may be the same BIGNUM as `a` or `b`.

`BN_mul()` multiplies `a` and `b` and places the result in `r` ("`r=a*b`"). `r` may be the same BIGNUM as `a` or `b`. For multiplication by powers of 2, use `BN_lshift(3)`.

`BN_sqr()` takes the square of `a` and places the result in `r` (" $r=a^2$ "). `r` and `a` may be the same `BIGNUM`. This function is faster than `BN_mul(r,a,a)`.

`BN_div()` divides `a` by `d` and places the result in `dv` and the remainder in `rem` (" $dv=a/d, rem=a\%d$ "). Either of `dv` and `rem` may be `NULL`, in which case the respective value is not returned. The result is rounded towards zero; thus if `a` is negative, the remainder will be zero or negative. For division by powers of 2, use `BN_rshift(3)`.

`BN_mod()` corresponds to `BN_div()` with `dv` set to `NULL`.

`BN_nnmod()` reduces `a` modulo `m` and places the nonnegative remainder in `r`.

`BN_mod_add()` adds `a` to `b` modulo `m` and places the nonnegative result in `r`.

`BN_mod_sub()` subtracts `b` from `a` modulo `m` and places the nonnegative result in `r`.

`BN_mod_mul()` multiplies `a` by `b` and finds the nonnegative remainder respective to modulus `m` (" $r=(a*b) \bmod m$ "). `r` may be the same `BIGNUM` as `a` or `b`. For more efficient algorithms for repeated computations using the same modulus, see `BN_mod_mul_montgomery(3)` and `BN_mod_mul_reciprocal(3)`.

`BN_mod_sqr()` takes the square of `a` modulo `m` and places the result in `r`.

`BN_mod_sqrt()` returns the modular square root of `a` such that " $in^2 = a \pmod{p}$ ". The modulus `p` must be a prime, otherwise an error or an incorrect "result" will be returned. The result is stored into `in` which can be `NULL`. The result will be newly allocated in that case.

`BN_exp()` raises `a` to the `p`-th power and places the result in `r` ("`r=a^p`"). This function is faster than repeated applications of `BN_mul()`.

`BN_mod_exp()` computes `a` to the `p`-th power modulo `m` ("`r=a^p % m`"). This function uses less time and space than `BN_exp()`. Do not call this function when `m` is even and any of the parameters have the `BN_FLG_CONSTTIME` flag set.

`BN_gcd()` computes the greatest common divisor of `a` and `b` and places the result in `r`. `r` may be the same `BIGNUM` as `a` or `b`.

For all functions, `ctx` is a previously allocated `BN_CTX` used for temporary variables; see `BN_CTX_new(3)`.

Unless noted otherwise, the result `BIGNUM` must be different from the arguments.

RETURN VALUES

The `BN_mod_sqrt()` returns the result (possibly incorrect if `p` is not a prime), or `NULL`.

For all remaining functions, 1 is returned for success, 0 on error. The return value should always be checked (e.g., "`if (!BN_add(r,a,b)) goto err;`"). The error codes can be obtained by `ERR_get_error(3)`.

SEE ALSO

`ERR_get_error(3)`, `BN_CTX_new(3)`, `BN_add_word(3)`, `BN_set_bit(3)`

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