Developers Guide to the NASA Libraries

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1 Naming Conventions

A uniform naming convention can greatly aid the prover in remembering the names of lemmas and theorems.

1.1 Functions: Definition and Property

Lemmas should begin with the function name. The key defining property should be labeled `_def`. Although this may be just a duplication of the body, it is convenient to have a lemma as well. If there is a very common useful rewrite label it `_rew`. If there is a common alternate or simpler version label it `_lem`.

`_def`	definitional
`_lem`	common simplification of alternate def
`_rew`	common useful rewrite:

Typical abbreviations include:

abbrev	meaning
`_0`	value of function at 0
`_eq_0`	function equals 0: `f(x) = 0 IFF ...`
`_eq_args`	`f(a,a) = ...`
`_neg`	value of function for negated argument `f(-x)`
`_plus`	value of function for sum of arguments `f(x+y)`
`_plus1`	value of function for `f(x+1)`
`_minus`	value of function for difference of arguments `f(x-y)`
`_disj`	disjoint
`_dist`	distributive
`_comm`	commutative: `f(a,b) = f(b,a)`
`_assoc`	associative: `f(a,f(b,c))) = f(f(a,b),c)`
`_sym`	symmetry: `f(-a) = f(a)`
`_incr`	`f(a) <= f(b) IFF a <= b`
`_decr`	`f(a) >= f(b) IFF a <= b`
`_strict_incr`	`f(a) < f(b) IFF a < b`
`_strict_decr`	`f(a) > f(b) IFF a < b`
`_fix_pt`	value of the defined function is a fixed point
`_card`	cardinality value
`_lb`	lower bound
`_ub`	upper bound
`_lub`	least upper bound
`_glb`	greatest lower bound

1.2 Inequalities

_gt_0	function gt 0: ... IMPLIES f(x) > 0
_ge_0	function gt 0: ... IMPLIES f(x) >= 0
_lt_0	function lt 0: ... IMPLIES f(x) < 0
_le_0	function lt 0: ... IMPLIES f(x) <= 0

1.3 Types and Constants

nz_	non zero
zero	a constant of the type which is the addition identity

_refl	reflexive: R(a,a)
_trans	transitive: R(x, y) & R(y, z) => R(x, z)
_sym	symmetry property: f(-a) = f(a)

1.4 Speculative

:

_diff	f(x) - f(y) = ...
_diff_lt	f(x) - f(y) < ...
_diff_ge	f(x) - f(y) >= ...
_scal	f(a*x) = a * f(x)
_pos	... IMPLIES f(x) > 0

2 Examples

```
sqrt_def     : LEMMA sqrt(nnx) * sqrt(nnx) = nnx

sqrt_lem     : LEMMA sqrt(nny) = nnz IFF nnz * nnz = nny

sq_rew           : LEMMA a*a = sq(a)


sin_0        : LEMMA sin(0) = 0

cos_plus     : LEMMA cos(a + b) = cos(a)*cos(b) - sin(a)*sin(b)

sin_eq_0     : LEMMA sin(a) = 0 IFF EXISTS (i: int): a = i * pi

abs_diff     : LEMMA abs(x) - abs(y) <= abs(x - y)
```

```
sigma_eq_arg : LEMMA sigma(low, low, F) = F(low)

sq_pos       : LEMMA sq(a) >= 0

sqrt_newton_ub(a,n)    : posreal = sqrt_newton(a,n)
```

3 Theory Names

One theory per file and exactly the same name as the file.