The starray Package
Version 1.4

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Abstract

This package implements vector like 'structures', like in 'C' and other programming languages. It's based on `expl3` and aimed at 'package writers', and not end users. The provided 'functions' are similar the ones provided for property (or sequence, or token) lists. For most of the provided functions there is a companion 'branching version'.

Contents

1 Introduction

The main idea is to have an array like syntax when setting/recovering structured information, e.g. `\starray_get_prop:nn` {⟨student[2].work[3].reviewer[4]⟩} {⟨name⟩} where "student" is the starray root, "work" is a sub-structure (an array in itself), "reviewer" is a sub-structure of "work" and so on, ⟨name⟩ being a property of "reviewer". Moreover one can iterate over the structure, for instance `\starray_get_prop:nn` {⟨student.work.reviewer⟩} {⟨name⟩} is also a possible reference in which one is using "student's", "work's" and "reviewer's" iterators.

Internally, a `starray` is stored as a collection of property lists. Each `starray` can contain a list of property pairs (key/value as in any `expl3` property lists) and a list of sub-structures. Each sub-structure, at it's turn, can also contain a list of property pairs and a list of sub-structures.

The construction/definition of a `starray` can be done piecewise (a property/sub-structure a time) or with a keyval interface or both, either way, one has to first "create a root starray" (`\starray_new:n`), define it's elements (properties and sub-structures), then instantiate them "as needed". An instance of a `starray` (or one of it's sub-structures) is referred, in this text, as a "term".

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*https://github.com/alceu-frigeri/starray

Finally, almost all defined functions have a branching version, as per *expl3*: `T`, `F` and *TF* (note: no `_p` variants, see below). For simplicity, in the text bellow only the *TF* variant is described, as in `\starray_new:nTF`, keep in mind that all 3 variants are defined, e.g. `\starray_new:nT`, `\starray_new:nF` and `\starray_new:nTF`.

> **Note:** Could it be implemented with a single property list? It sure could, but at a cost: 1. complexity; 2. access time. The current implementation, albeit also complex, tries to reach a balance between inherent structure complexity, number of used/defined auxiliary property lists and access time.

> **Important:** *Expandability*, unfortunately most/all defined functions are not "fully expandable", in particular, most conditional/branching functions aren't, with just a few exceptions (marked with a star ★, as per *expl3* documentation convention).

2 Class Options

The package options (`key=value`) are:

prefix (default: `l__starray_`). Set the `prefix` used when declaring the property lists associated with any `starray`.

msg-err By default, the `starray` package only generates "warnings", with `msg-err` one can choose which cases will generate "package error" messages. There are 3 message classes: 1. *strict* relates to `\starray_new:n` cases (`starray` creation); 2. *syntax* relates to "term syntax" errors (student.work.reviewer in the above examples); finally 3. *reference* relates to cases whereas the syntax is correct but referring to non-existent terms/properties.

none	(default) no package message will raise an error.
strict	will raise an error on *strict* case alone.
syntax	will raise an error on *strict* and *syntax* cases.
reference	will raise an error on *strict*, *syntax* and *reference* cases.
all	will raise an error on all cases.

msg-suppress ditto, to suppress classes of messages:

none	(default) no package message will be suppressed.
reference	only *reference* level messages will be suppressed.
syntax	*reference* and *syntax* level messages will be suppressed.
strict	*reference*, *syntax* and *strict* level messages will be suppressed.
all	all messages will be suppressed.

3 Creating a starray

\starray_new:n
\starray_new:nTF

`\starray_new:n` {⟨starray⟩}
`\starray_new:nTF` {⟨starray⟩} {⟨if-true⟩} {⟨if-false⟩}

Creates a new ⟨starray⟩ or raises a warning if the name is already taken. The declaration (and associated property lists) is global. The given name is referred (in this text) as the ⟨starray-root⟩ or just ⟨root⟩.

> **Note:** A warning is raised (see 2) if the name is already taken. The branching version doesn't raise any warning.

3.1 Conditionals

`\starray_if_exist_p:n` ⋆	`\starray_if_exist_p:n` {⟨starray⟩}
`\starray_if_exist:n`*TF* ⋆	`\starray_if_exist:n`*TF* {⟨starray⟩} {⟨if-true⟩} {⟨if-false⟩}
`\starray_if_valid_p:n` ⋆	`\starray_if_valid_p:n` {⟨starray⟩}
`\starray_if_valid:n`*TF* ⋆	`\starray_if_valid:n`*TF* {⟨starray⟩} {⟨if-true⟩} {⟨if-false⟩}

`\starray_if_exist:n`*TF* only tests if ⟨starray⟩ (the base property) is defined. It doesn't verifies if it really is a `starray`. `\starray_if_valid:n`*TF* further tests if an internal boolean (`is_starray`) is also defined. This doesn't necessary mean it is a `starray` or if it's a really valid one (chances are that it is, but...), see `\starray_term_syntax:n`*TF*, section 7, for a more reliable validity test.

> *Note:* The predicate versions, `_p`, expand to either `\prg_return_true:` or `\prg_return_false:`.

4   Defining and initialising a starray structure

`\starray_def_prop:nnn`	`\starray_def_prop:nnn` {⟨starray-ref⟩} {⟨prop-key⟩} {⟨initial-value⟩}
`\starray_def_prop:nnn`*TF*	`\starray_def_prop:nnn`*TF* {⟨starray-ref⟩} {⟨prop-key⟩} {⟨initial-value⟩} {⟨if-true⟩} {⟨if-false⟩}

Adds an entry, ⟨prop-key⟩, to the ⟨starray-ref⟩ (see 5.1) definition and set its initial value. If ⟨prop-key⟩ is already present its initial value is updated. Both ⟨prop-key⟩ and ⟨initial-value⟩ may contain any ⟨balanced text⟩. ⟨prop-key⟩ is an (`expl3`) property list ⟨key⟩ meaning that category codes are ignored.
The definition/assignment of a ⟨prop-key⟩ to a ⟨starray-ref⟩ is global.

> *Note:* A warning is raised (see 2) in case of a ⟨starray-ref⟩ syntax/reference error. The branching version doesn't raise any warning.

`\starray_def_structure:nn`	`\starray_def_struct:nn` {⟨starray-ref⟩} {⟨struct-name⟩}
`\starray_def_structure:nn`*TF*	`\starray_def_struct:nn`*TF* {⟨starray-ref⟩} {⟨struct-name⟩} {⟨if-true⟩} {⟨if-false⟩}

Adds a sub-structure (a `starray` in itself) to ⟨starray-ref⟩ (see 5.1). If ⟨struct-name⟩ is already present nothing happens. The definition/assignment of a ⟨struct-name⟩ to a ⟨starray-ref⟩ is global.

> *Note:* Do not use a dot when defining a (sub-)structure name, it might seems to work but it will breaks further down (see 5.1).

> *Note 2:* A warning is raised (see 2) in case of a ⟨starray-ref⟩ syntax error. The branching version doesn't raise any warning.

`\starray_def_from_keyval:nn`	`\starray_def_from_keyval:nn` {⟨starray-ref⟩} {⟨keyval-lst⟩}
`\starray_def_from_keyval:nn`*TF*	`\starray_def_from_keyval:nn`*TF* {⟨starray-ref⟩} {⟨keyval-lst⟩} {⟨if-true⟩} {⟨if-false⟩}

Adds a set of ⟨keys⟩ / ⟨values⟩ and/or ⟨structures⟩ to ⟨starray-ref⟩ (see 5.1). The ⟨keyval-lst⟩ is pretty straightforward, the construction ⟨key⟩ . `struct` denotes a nested structure :

```
\starray_def_from_keyval:nn {root.substructure}
  {
    keyA = valA ,
    keyB = valB ,
    subZ . struct =
      {
        keyZA = valZA ,
        keyZB = valZB ,
      }
    subY . struct =
      {
        keyYA = valYA ,
        keyYB = valYB ,
        subYYY . struct =
          {
            keyYYYa = valYYYa ,
            keyYYYb = valYYYb
          }
      }
  }
```

The definitions/assignments to ⟨starray-ref⟩ are all global.

> ***Note:*** The non-branching version raises a warning (see 2) in case of a ⟨starray-ref⟩ syntax error. The branching version doesn't raise any warning. Also note that, syntax errors on the ⟨keyval-lst⟩ might raise low level (TeX) errors.

4.1 Fixing an ill-instantiated starray

When instantiating (see 5) a `starray`, the associated structured will be constructed based on it's "current definition" (see 4). A problem that migh arise, when one extends the definition of an already instantiated `starray` (better said, if one adds a sub-structure), is a *quark loop* (from `l3quark`). To avoid a *quark loop* it is necessary to "fix" the structure of already instantiated terms.

\starray_fix_terms:n \starray_fix_terms:n {⟨starray-ref⟩}

The sole purpose of this function is to "fix" the already instantiated terms of a `starray`. Note, this can be an expensive operation depending on the number of terms (it has to craw over all the terms of an instantiated `starray` adding any missing sub-structure references), but one doesn't need to run it "right away" it is possible to add a bunch of sub-structures and than run this just once.

5 Instantiating starray terms

\starray_new_term:n   \starray_new_term:n {⟨starray-ref⟩}
\starray_new_term:nn   \starray_new_term:nn {⟨starray-ref⟩} {⟨hash⟩}
\starray_new_term:n*TF*   \starray_new_term:n*TF* {⟨starray-ref⟩} {⟨if-true⟩} {⟨if-false⟩}
\starray_new_term:nn*TF* \starray_new_term:nn*TF* {⟨starray-ref⟩} {⟨hash⟩} {⟨if-true⟩} {⟨if-false⟩}

This create a new *term* (in fact a property list) of the (sub-)struture referenced by ⟨starray-ref⟩. Note that the newly created *term* will have all properties (key/values) as defined by the associated \starray_prop_def:nn {⟨starray-ref⟩}, with the respective "initial values". For instance, given the following

```
\starray_new:n {st-root}

\starray_def_from_keyval:nn {st-root}
  {
    keyA = valA ,
    keyB = valB ,
    subZ . struct =
      {
        keyZA = valZA ,
        keyZB = valZB ,
      }
    subY . struct =
      {
        keyYA = valYA ,
        keyYB = valYB ,
        subYYY . struct =
          {
            keyYYYa = valYYYa ,
            keyYYYb = valYYYb
          }
      }
  }

\starray_new_term:n {st-root}
\starray_new_term:n {st-root.subZ}
\starray_new_term:n {st-root.subZ}
\starray_new_term:n {st-root.subY}
\starray_new_term:nn {st-root}{hash-A}
\starray_new_term:n {st-root.subZ}
```

One will have created 6 *terms*:

1. 2 ⟨st-root⟩ *terms*
    (a) the first one with index 1 and
        i. 2 sub-structures ⟨subZ⟩ (indexes 1 and 2)
        ii. 1 sub-structure ⟨subY⟩ (index 1)
    (b) the second one with indexes 2 and "hash-A" and
        i. 1 sub-structure ⟨subZ⟩ (index 1)

Note that, in the above example, it was used the "implicit" indexing (aka. iterator, see 5.1). Also note that no *term* of kind ⟨subYYY⟩ was created.

> **Note:** A warning is raised (see 2) in case of a ⟨starray-ref⟩ syntax error. The branching version doesn't raise any warning.

5.1   referencing terms

When typing a ⟨starray-ref⟩ there are 3 cases to consider:

1. structure definition
2. term instantiation
3. getting/setting a property

The first case is the simplest one, in which, one (starting by ⟨starray-root⟩ will use a construct like ⟨starray-root⟩.⟨sub-struct⟩.⟨sub-struct⟩. . . For example, an equivalent construct to the one shown in 5 :

```
\starray_new:n {st-root}

\starray_def_struct:nn {st-root}{subZ}

\starray_def_prop:nnn {st-root}{keyA}{valA}
\starray_def_prop:nnn {st-root}{keyB}{valB}

\starray_def_prop:nnn {st-root.subZ}{keyZA}{valZA}
\starray_def_prop:nnn {st-root.subZ}{keyZB}{valZB}

\starray_def_struct:nn {st-root}{subY}
\starray_def_prop:nnn {st-root.subY}{keyYA}{valYA}
\starray_def_prop:nnn {st-root.subY}{keyYB}{valYB}

\starray_def_struct:nn {st-root.subY}{subYYY}
\starray_def_prop:nnn {st-root.subY.subYYY}{keyYYYA}{valYYYA}
\starray_def_prop:nnn {st-root.subY.subYYY}{keyYYYB}{valYYYB}
```

Note that, all it's needed in order to be able to use ⟨starray-root⟩.⟨sub-A⟩ is that ⟨sub-A⟩ is an already declared sub-structure of ⟨starray-root⟩. The property definitions can be made in any order.

In all other cases, term instantiation, getting/setting a property, one has to address/reference a specific instance/term, implicitly (using iterators) or explicitly using indexes. The general form, of a ⟨starray-ref⟩, is:

⟨starray-root⟩⟨idx⟩.⟨sub-A⟩⟨idxA⟩.⟨sub-B⟩⟨idxB⟩

In the case of term instantiation the last ⟨sub-⟩ cannot be indexed, after all one is creating a new term/index. Moreover, all ⟨idx⟩ are optional like:

⟨starray-root⟩.⟨sub-A⟩⟨idxA⟩.⟨sub-B⟩

in which case, one is using the "iterator" of ⟨starray-root⟩ and ⟨sub-B⟩ (more later, but keep in mind the ⟨sub-B⟩ iterator is the ⟨sub-B⟩ associated with the ⟨sub-A⟩⟨idxA⟩).

Since one has to explicitly instantiate all (sub)terms of a starray, one can end with a highly asymmetric structure. Starting at the ⟨starray-root⟩ one has a first counter (representing, indexing the root structure terms), then for all sub-strutures of ⟨starray-root⟩ one will have an additional counter for every term of ⟨starray-root⟩ !

So, for example:

```
\starray_new:n {st-root}
\starray_def_struct:nn {st-root}{subZ}
\starray_def_struct:nn {st-root}{subY}
\starray_def_struct:nn {st-root.subY}{subYYY}

\starray_new_term:n {st-root}
\starray_new_term:n {st-root.subZ}
\starray_new_term:n {st-root.subZ}
\starray_new_term:n {st-root.subY}
\starray_new_term:n {st-root.subY}
\starray_new_term:n {st-root.subY.subYYY}
\starray_new_term:n {st-root.subY}

\starray_new_term:n {st-root}
\starray_new_term:n {st-root.subZ}
\starray_new_term:n {st-root.subZ}
\starray_new_term:n {st-root.subY}
```

One has a single ⟨st-root⟩ iterator (pointing to one of the 3 ⟨st-root⟩ terms), then 3 "⟨subZ⟩ iterators", in fact, one ⟨subZ⟩ iterator for each ⟨st-root⟩ term. Likewise there are 3 "⟨subY⟩ iterators" and 4 (four) "⟨subYYY⟩ iterators" one for each instance of ⟨subY⟩.

Every time a new term is created/instantiated, the corresponding iterator will points to it, which allows the notation used in this last example, keep in mind that one could instead, using explicit indexes:

```
\starray_new:n {st-root}
\starray_def_struct:nn {st-root}{subZ}
\starray_def_struct:nn {st-root}{subY}
\starray_def_struct:nn {st-root.subY}{subYYY}

\starray_new_term:n {st-root}
\starray_new_term:n {st-root[1].subZ}
\starray_new_term:n {st-root[1].subZ}
\starray_new_term:n {st-root[1].subY}
\starray_new_term:n {st-root[1].subY}
\starray_new_term:n {st-root[1].subY[2].subYYY}
\starray_new_term:n {st-root[1].subY}

\starray_new_term:n {st-root}
\starray_new_term:n {st-root[2].subZ}
\starray_new_term:n {st-root[2].subZ}
\starray_new_term:n {st-root[2].subY}
```

Finally, observe that, when creating a new term, one has the option to assign a "hash" to it, in which case that term can be referred to using an iterator, the explicit index or the hash:

```
\starray_new:n {st-root}
\starray_def_struct:nn {st-root}{subZ}
\starray_def_struct:nn {st-root}{subY}
\starray_def_struct:nn {st-root.subY}{subYYY}

\starray_new_term:nn {st-root}{hash-A}
\starray_new_term:n {st-root.subZ}
\starray_new_term:n {st-root[1].subZ}
\starray_new_term:n {st-root[hash-A].subZ}
```

Will create 3 ⟨subZ⟩ terms associated with the first (index = 1) ⟨st-root⟩.

5.2 iterators

\starray_set_iter:nn	\starray_set_iter:nn {⟨starray-ref⟩} {⟨int-val⟩}
\starray_set_iter:nn*TF*	\starray_set_iter:n*TF* {⟨starray-ref⟩} {⟨int-val⟩} {⟨if-true⟩} {⟨if-false⟩}
\starray_reset_iter:nn	\starray_reset_iter:nn {⟨starray-ref⟩}
\starray_reset_iter:nn*TF*	\starray_reset_iter:n*TF* {⟨starray-ref⟩} {⟨if-true⟩} {⟨if-false⟩}
\starray_next_iter:nn	\starray_next_iter:nn {⟨starray-ref⟩}
\starray_next_iter:nn*TF*	\starray_next_iter:n*TF* {⟨starray-ref⟩} {⟨if-true⟩} {⟨if-false⟩}

Those functions allows to `set` an iterator to a given ⟨int-val⟩, `reset` it (i.e. assign 1 to the iterator), or increase the iterator by one. An iterator might have a value between 1 and the number of instantiated terms (if the given (sub-)structure was already instantiated). If the (sub-)structure hasn't been instantiated yet, the iterator will always end being set to 0. The branching versions allows to catch those cases, like trying to set a value past its maximum, or a value smaller than one.

> **Important:** Please observe that, when setting/resetting/incrementing the iterator of a (sub-)structure, all "descending" iterators will be also be reset.

> **Note:** A warning is raised (see 2) in case of a ⟨starray-ref⟩ syntax error. The branching version doesn't raise any warning.

```
\starray_new:n {st-root}
\starray_def_struct:nn {st-root}{subZ}
\starray_def_struct:nn {st-root}{subY}
\starray_def_struct:nn {st-root.subY}{subYYY}

\starray_new_term:n {st-root}
\starray_new_term:n {st-root.subZ}
\starray_new_term:n {st-root.subZ}
\starray_new_term:n {st-root.subY}
\starray_new_term:n {st-root.subY.subYYY}
\starray_new_term:n {st-root.subY.subYYY}
\starray_new_term:n {st-root.subY}
\starray_new_term:n {st-root.subY.subYYY}
\starray_new_term:n {st-root.subY.subYYY}
\starray_new_term:n {st-root}
\starray_new_term:n {st-root.subZ}
\starray_new_term:n {st-root.subZ}
\starray_new_term:n {st-root.subY}
\starray_new_term:n {st-root.subY.subYYY}
\starray_new_term:n {st-root.subY.subYYY}
\starray_new_term:n {st-root.subY}
\starray_new_term:n {st-root.subY.subYYY}
\starray_new_term:n {st-root.subY.subYYY}

\starray_set_prop:nnn {st-root.subY.subYYY}{key}{val}
\starray_set_prop:nnn {st-root[2].subY[2].subYYY[2]}{key}{val}

\starray_reset_iter:n {st-root[2].subY}

\starray_set_prop:nnn {st-root.subY.subYYY}{key}{val}
\starray_set_prop:nnn {st-root[2].subY[1].subYYY[1]}{key}{val}
```

Before the reset ⟨st-root.subY.subYYY⟩ was equivalent to ⟨st-root[2].subY[2]. subYYY[2]⟩, given that each iterator was pointing to the "last term", since the reset was of the ⟨subY⟩ iterator, only it and the descending ones (in this example just ⟨subYYY⟩) where reseted, and therefore ⟨st-root.subY.subYYY⟩ was then equivalent to ⟨st-root[2].subY[1].subYYY[1]⟩

\starray_set_iter_from_hash:nn   \starray_set_iter_from_hash:nn {⟨starray-ref⟩} {⟨hash⟩}
\starray_set_iter_from_hash:nn_TF   \starray_set_iter_from_hash:nn_TF {⟨starray-ref⟩} {⟨hash⟩} {⟨if-true⟩} {⟨if-false⟩}

\starray_set_iter_from_hash:nn {⟨starray-ref⟩} {⟨hash⟩} will set iter based on the ⟨hash⟩ used when instantiating a term (see 5).

> **Note:** A warning is raised (see 2) in case of a ⟨starray-ref⟩ syntax error or invalid ⟨hash⟩. The branching version doesn't raise any warning.

\starray_get_iter:n   \starray_get_iter:n {⟨starray-ref⟩}
\starray_get_iter:nN   \starray_get_iter:nN {⟨starray-ref⟩} {⟨int-var⟩}
\starray_get_iter:nN_TF   \starray_get_iter:nN_TF {⟨starray-ref⟩} {⟨int-var⟩} {⟨if-true⟩} {⟨if-false⟩}

\starray_get_iter:n {⟨starray-ref⟩} will type in the current value of a given iterator, whilst the other two functions will save it's value in a integer variable (*expl3*).

> **Note:** A warning is raised (see 2) in case of a ⟨starray-ref⟩ syntax error. The branching version doesn't raise any warning.

\starray_parsed_get_iter: ⋆   \starray_parsed_get_iter:

\starray_parsed_get_iter: will place in the current iterator's value, using \int_use:N, of the last parsed term in the input stream.

> **Warning:** This can be used after any command which 'parses a term', for instance \starray_term_syntax:n, see section 7, but it only makes sense (and returns a reliable/meaningful result) IF the last parser operation was successfully executed.

`\starray_get_cnt:n`	`\starray_get_cnt:n {⟨starray-ref⟩}`
`\starray_get_cnt:nN`	`\starray_get_cnt:nN {⟨starray-ref⟩} {⟨integer⟩}`
`\starray_get_cnt:nNTF`	`\starray_get_cnt:nNTF {⟨starray-ref⟩} {⟨integer⟩} {⟨if-true⟩} {⟨if-false⟩}`

`\starray_get_cnt:n {⟨starray-ref⟩}` will type in the current number of terms of a given (sub-)structure, whilst the other two functions will save it's value in a integer variable (`expl3`).

> ***Note:*** A warning is raised (see 2) in case of a ⟨starray-ref⟩ syntax error. The branching version doesn't raise any warning.

`\starray_parsed_get_cnt:` ⋆	`\starray_parsed_get_cnt:`

`\starray_parsed_get_cnt:` will place the current number of terms, using `\int_use:N`, of the last parsed term, in the input stream.

> ***Warning:*** This can be used after any command which 'parses a term', for instance `\starray_term_syntax:n`, see section 7, but it only makes sense (and returns a reliable/meaningful result) IF the last parser operation was successfully executed.

`\starray_iterate_over:nn`	`\starray_iterate_over:nn {⟨starray-ref⟩} {⟨code⟩}`
`\starray_iterate_over:nnTF`	`\starray_iterate_over:nnTF {⟨starray-ref⟩} {⟨code⟩} {⟨if-true⟩} {⟨if-false⟩}`

`\starray_iterate_over:nn` will reset the ⟨starray-ref⟩ iterator, and then execute ⟨code⟩ for each valid value of `iter`. At the loop's end, the ⟨starray-ref⟩ iterator will point to the last element of it. The ⟨if-true⟩ is executed, at the loop's end if there is no syntax error. Similarly ⟨if-false⟩ is only execute if a syntax error is detected.

> ***Note:*** `\starray_iterate_over:nn` Creates a local group, so that one can recurse over sub-structures. Be aware, then, that ⟨code⟩ is executed in said local group.

> ***Note:*** A warning is raised (see 2) in case of a ⟨starray-ref⟩ syntax error. The branching version doesn't raise any warning.

6   Changing and recovering starray properties

`\starray_set_prop:nnn`	`\starray_set_prop:nnn {⟨starray-ref⟩} {⟨prop-key⟩} {⟨value⟩}`
`\starray_set_prop:nnV`	`\starray_set_prop:nnV {⟨starray-ref⟩} {⟨prop-key⟩} {⟨value⟩}`
`\starray_set_prop:nnnTF`	`\starray_set_prop:nnnTF {⟨starray-ref⟩} {⟨prop-key⟩} {⟨value⟩} {⟨if-true⟩} {⟨if-false⟩}`
`\starray_set_prop:nnVTF`	`\starray_set_prop:nnVTF {⟨starray-ref⟩} {⟨prop-key⟩} {⟨value⟩} {⟨if-true⟩} {⟨if-false⟩}`
`\starray_gset_prop:nnn`	`\starray_gset_prop:nnn {⟨starray-ref⟩} {⟨prop-key⟩} {⟨value⟩}`
`\starray_gset_prop:nnV`	`\starray_gset_prop:nnV {⟨starray-ref⟩} {⟨prop-key⟩} {⟨value⟩}`
`\starray_gset_prop:nnnTF`	`\starray_gset_prop:nnnTF {⟨starray-ref⟩} {⟨prop-key⟩} {⟨value⟩} {⟨if-true⟩} {⟨if-false⟩}`
`\starray_gset_prop:nnVTF`	`\starray_gset_prop:nnVTF {⟨starray-ref⟩} {⟨prop-key⟩} {⟨value⟩} {⟨if-true⟩} {⟨if-false⟩}`

Those are the functions that allow to (g)set (change) the value of a term's property. If the ⟨prop-key⟩ isn't already present it will be added just for that term ⟨starray-ref⟩. The ⟨nnV⟩ variants allow to save any variable like a token list, property list, etc...

> ***Note:*** A warning is raised (see 2) in case of a ⟨starray-ref⟩ syntax error. The branching version doesn't raise any warning.

`\starray_set_from_keyval:nn`	`\starray_set_from_keyval:nnn` {⟨starray-ref⟩} {⟨keyval-lst⟩}
`\starray_set_from_keyval:nn`*TF*	`\starray_set_from_keyval:nnn`*TF* {⟨starray-ref⟩} {⟨keyval-lst⟩} {⟨if-true⟩}
`\starray_gset_from_keyval:nn`	{⟨if-false⟩}
`\starray_gset_from_keyval:nn`*TF*	`\starray_gset_from_keyval:nnn` {⟨starray-ref⟩} {⟨keyval-lst⟩}
	`\starray_gset_from_keyval:nnn`*TF* {⟨starray-ref⟩} {⟨keyval-lst⟩} {⟨if-true⟩}
	{⟨if-false⟩}

it is possible to set a collection of properties using a key/val syntax, similar to the one used to define a `starray` from keyvals (see 4), with a few distinctions:

1. when referring a (sub-)structure one can either explicitly use an index, or

2. implicitly use it's iterator

3. if a given key isn't already presented it will be added only to the given term

Note that, in the following example, TWO iterators are being used, the one for ⟨st-root⟩ and then ⟨subY⟩.

```
\starray_set_from_keyval:nn {st-root}
  {
    keyA = valA ,
    keyB = valB ,
    subZ[2] =
      {
        keyZA = valZA ,
        keyZB = valZB ,
      }
    subY  =
      {
        keyYA = valYA ,
        keyYB = valYB ,
        subYYY[1] =
          {
            keyYYYa = valYYYa ,
            keyYYYb = valYYYb
          }
      }
  }
```

Also note that the above example is fully equivalent to:

```
\starray_set_prop:nnn {st-root} {keyA} {valA}
\starray_set_prop:nnn {st-root} {keyB} {valB}
\starray_set_prop:nnn {st-root.subZ[2]} {keyZA} {valZA}
\starray_set_prop:nnn {st-root.subZ[2]} {keyZB} {valZB}
\starray_set_prop:nnn {st-root.subY} {keyYA} {valYA}
\starray_set_prop:nnn {st-root.subY} {keyYB} {valYB}
\starray_set_prop:nnn {st-root.subY.subYYY[1]} {keyYYYa} {valYYYa}
\starray_set_prop:nnn {st-root.subY.subYYY[1]} {keyYYYb} {valYYYb}
```

`\starray_get_prop:nn`	`\starray_get_prop:nn` {⟨starray-ref⟩} {⟨key⟩}
`\starray_get_prop:nnN`	`\starray_get_prop:nnN` {⟨starray-ref⟩} {⟨key⟩} {⟨tl-var⟩}
`\starray_get_prop:nnN`*TF*	`\starray_get_prop:nnN`*TF* {⟨starray-ref⟩} {⟨key⟩} {⟨tl-var⟩} {⟨if-true⟩} {⟨if-false⟩}

`\starray_get_prop:nn` {⟨starray-ref⟩} {⟨key⟩} places the value of ⟨key⟩ in the input stream. `\starray_get_prop:nnN` {⟨starray-ref⟩} {⟨key⟩} {⟨tl-var⟩} recovers the value of ⟨key⟩ and places it in ⟨tl-var⟩ (a token list variable), this is specially useful in conjunction with `\starray_set_prop:nnV`, whilst the `\starray_get_prop:nnN`*TF* version branches accordly.

> **Note:** In case of a syntax error, or ⟨key⟩ doesn't exist, an empty value is left in the stream (or ⟨tl-var⟩).

> **Note:** A warning is raised (see 2) in case of a ⟨starray-ref⟩ syntax error. The branching version doesn't raise any warning.

`\starray_parsed_get_prop:n` ★ `\starray_parsed_get_prop:nn` {⟨key⟩}

`\starray_parsed_get_prop:n` {⟨key⟩} places the value of ⟨key⟩, if it exists, from the last parsed term, in the input stream.

> **Warning:** This can be used after any command which 'parses a term', for instance `\starray_term_syntax:n`, see section 7, but it only makes sense (and returns a reliable/meaningful result) IF the last parser operation was successfully executed.

7 Additional Commands and Conditionals

`\starray_if_in:nnTF`   `\starray_if_in:nnTF` {⟨starray-ref⟩} {⟨key⟩} {⟨if-true⟩} {⟨if-false⟩}
`\starray_term_syntax:nTF` `\starray_term_syntax:nTF` {⟨starray-ref⟩} {⟨if-true⟩} {⟨if-false⟩}

The `\starray_if_in:nnTF` {⟨starray-ref⟩} {⟨key⟩} {⟨...⟩} {⟨...⟩} tests if a given ⟨key⟩ is present, whilst `\starray_term_syntax:nTF` {⟨starray-ref⟩} {⟨if-true⟩} {⟨if-false⟩} just verifies if the ⟨starray-ref⟩ syntax is valid or not, branching accordly.

`\starray_term_syntax:n` `\starray_term_syntax:n` {⟨starray-ref⟩}

This will just parse a ⟨starray-ref⟩ reference, and set interval variables so that commands like `\starray_parsed_` can be used.

> **Warning:** The main idea is to allow some expandable commands, but be aware that all `\starray_` commands that use a ⟨starray-ref⟩ use the very same parser variables.

`\starray_parsed_if_in_p:n` ★ `\starray_parsed_if_in_p:nTF` {⟨key⟩}
`\starray_parsed_if_in:nTF` ★ `\starray_parsed_if_in:nTF` {⟨key⟩} {⟨if-true⟩} {⟨if-false⟩}

This will test if the given `key` is present in the "last parsed term".

> **Note:** The predicate version, `_p`, expands to either `\prg_return_true:` or `\prg_return_false:`.

> **Warning:** This can be used after any command which 'parses a term', for instance `\starray_term_syntax:n`, but it only makes sense (and returns a reliable/meaningful result) IF the last parser operation was successfully executed.

8 Showing (debugging) starrays

`\starray_show_def:n`   `\starray_show_def:n` {⟨starray-ref⟩}
`\starray_show_def_in_text:n` `\starray_show_def_in_text:n` {⟨starray-ref⟩}

Displays the ⟨starray⟩ structure definition and initial property values in the terminal or directly in text.

`\starray_show_terms:n`   `\starray_show_terms:n` {⟨starray-ref⟩}
`\starray_show_terms_in_text:n` `\starray_show_terms_in_text:n` {⟨starray-ref⟩}

Displays the ⟨starray⟩ instantiated terms and current property values in the terminal or directly in text.