

# **Programming Language—Common Lisp**

## **11. Packages**

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## 11.1 Package Concepts

### 11.1.1 Introduction to Packages

A **package** establishes a mapping from names to *symbols*. At any given time, one *package* is current. The **current package** is the one that is the *value* of **\*package\***. When using the *Lisp reader*, it is possible to refer to *symbols* in *packages* other than the current one through the use of *package prefixes* in the printed representation of the *symbol*.

Figure 11–1 lists some *defined names* that are applicable to *packages*. Where an *operator* takes an argument that is either a *symbol* or a *list* of *symbols*, an argument of **nil** is treated as an empty *list* of *symbols*. Any *package* argument may be either a *string*, a *symbol*, or a *package*. If a *symbol* is supplied, its name will be used as the *package* name.

|                            |                                  |                         |
|----------------------------|----------------------------------|-------------------------|
| <b>*modules*</b>           | <b>import</b>                    | <b>provide</b>          |
| <b>*package*</b>           | <b>in-package</b>                | <b>rename-package</b>   |
| <b>defpackage</b>          | <b>intern</b>                    | <b>require</b>          |
| <b>do-all-symbols</b>      | <b>list-all-packages</b>         | <b>shadow</b>           |
| <b>do-external-symbols</b> | <b>make-package</b>              | <b>shadowing-import</b> |
| <b>do-symbols</b>          | <b>package-name</b>              | <b>unexport</b>         |
| <b>export</b>              | <b>package-nicknames</b>         | <b>unintern</b>         |
| <b>find-all-symbols</b>    | <b>package-shadowing-symbols</b> | <b>unuse-package</b>    |
| <b>find-package</b>        | <b>package-use-list</b>          | <b>use-package</b>      |
| <b>find-symbol</b>         | <b>package-used-by-list</b>      |                         |

Figure 11–1. Some Defined Names related to Packages

#### 11.1.1.1 Package Names and Nicknames

Each *package* has a *name* (a *string*) and perhaps some *nicknames* (also *strings*). These are assigned when the *package* is created and can be changed later.

There is a single namespace for *packages*. The *function* **find-package** translates a *package name* or *nickname* into the associated *package*. The *function* **package-name** returns the *name* of a *package*. The *function* **package-nicknames** returns a *list* of all *nicknames* for a *package*. **rename-package** removes a *package*'s current *name* and *nicknames* and replaces them with new ones specified by the caller.

#### 11.1.1.2 Symbols in a Package

#### 11.1.1.2.1 Internal and External Symbols

The mappings in a *package* are divided into two classes, external and internal. The *symbols* targeted by these different mappings are called *external symbols* and *internal symbols* of the *package*. Within a *package*, a name refers to one *symbol* or to none; if it does refer to a *symbol*, then it is either external or internal in that *package*, but not both. **External symbols** are part of the package's public interface to other *packages*. *Symbols* become *external symbols* of a given *package* if they have been *exported* from that *package*.

A *symbol* has the same *name* no matter what *package* it is *present* in, but it might be an *external symbol* of some *packages* and an *internal symbol* of others.

#### 11.1.1.2.2 Package Inheritance

*Packages* can be built up in layers. From one point of view, a *package* is a single collection of mappings from *strings* into *internal symbols* and *external symbols*. However, some of these mappings might be established within the *package* itself, while other mappings are inherited from other *packages* via **use-package**. A *symbol* is said to be **present** in a *package* if the mapping is in the *package* itself and is not inherited from somewhere else.

There is no way to inherit the *internal symbols* of another *package*; to refer to an *internal symbol* using the *Lisp* reader, a *package* containing the *symbol* must be made to be the *current package*, a *package prefix* must be used, or the *symbol* must be *imported* into the *current package*.

#### 11.1.1.2.3 Accessibility of Symbols in a Package

A *symbol* becomes **accessible** in a *package* if that is its *home package* when it is created, or if it is *imported* into that *package*, or by inheritance via **use-package**.

If a *symbol* is *accessible* in a *package*, it can be referred to when using the *Lisp* reader without a *package prefix* when that *package* is the *current package*, regardless of whether it is *present* or inherited.

*Symbols* from one *package* can be made *accessible* in another *package* in two ways.

- Any individual *symbol* can be added to a *package* by use of **import**. After the call to **import** the *symbol* is *present* in the importing *package*. The status of the *symbol* in the *package* it came from (if any) is unchanged, and the *home package* for this *symbol* is unchanged. Once *imported*, a *symbol* is *present* in the importing *package* and can be removed only by calling **unintern**.

A *symbol* is *shadowed*<sub>3</sub> by another *symbol* in some *package* if the first *symbol* would be *accessible* by inheritance if not for the presence of the second *symbol*. See **shadowing-import**.

- The second mechanism for making *symbols* from one *package* *accessible* in another is provided by **use-package**. All of the *external symbols* of the used *package* are inherited

by the using *package*. The function **unuse-package** undoes the effects of a previous **use-package**.

#### 11.1.1.2.4 Locating a Symbol in a Package

When a *symbol* is to be located in a given *package* the following occurs:

- The *external symbols* and *internal symbols* of the *package* are searched for the *symbol*.
- The *external symbols* of the used *packages* are searched in some unspecified order. The order does not matter; see the rules for handling name conflicts listed below.

#### 11.1.1.2.5 Prevention of Name Conflicts in Packages

Within one *package*, any particular name can refer to at most one *symbol*. A name conflict is said to occur when there would be more than one candidate *symbol*. Any time a name conflict is about to occur, a *correctable error* is signaled.

The following rules apply to name conflicts:

- Name conflicts are detected when they become possible, that is, when the package structure is altered. Name conflicts are not checked during every name lookup.
- If the *same symbol* is *accessible* to a *package* through more than one path, there is no name conflict. A *symbol* cannot conflict with itself. Name conflicts occur only between *distinct symbols* with the same name (under **string=**).
- Every *package* has a list of shadowing *symbols*. A shadowing *symbol* takes precedence over any other *symbol* of the same name that would otherwise be *accessible* in the *package*. A name conflict involving a shadowing symbol is always resolved in favor of the shadowing *symbol*, without signaling an error (except for one exception involving **import**). See **shadow** and **shadowing-import**.
- The functions **use-package**, **import**, and **export** check for name conflicts.
- **shadow** and **shadowing-import** never signal a name-conflict error.
- **unuse-package** and **unexport** do not need to do any name-conflict checking. **unintern** does name-conflict checking only when a *symbol* being *uninterned* is a *shadowing symbol*.
- Giving a shadowing symbol to **unintern** can uncover a name conflict that had previously been resolved by the shadowing.
- Package functions signal name-conflict errors of *type* **package-error** before making any change to the package structure. When multiple changes are to be made, it is permissible for the implementation to process each change separately. For example, when **export** is

given a *list* of *symbols*, aborting from a name conflict caused by the second *symbol* in the *list* might still export the first *symbol* in the *list*. However, a name-conflict error caused by **export** of a single *symbol* will be signaled before that *symbol*'s *accessibility* in any *package* is changed.

- Continuing from a name-conflict error must offer the user a chance to resolve the name conflict in favor of either of the candidates. The *package* structure should be altered to reflect the resolution of the name conflict, via **shadowing-import**, **unintern**, or **unexport**.
- A name conflict in **use-package** between a *symbol present* in the using *package* and an *external symbol* of the used *package* is resolved in favor of the first *symbol* by making it a shadowing *symbol*, or in favor of the second *symbol* by uninterning the first *symbol* from the using *package*.
- A name conflict in **export** or **unintern** due to a *package*'s inheriting two *distinct symbols* with the *same name* (under **string=**) from two other *packages* can be resolved in favor of either *symbol* by importing it into the using *package* and making it a *shadowing symbol*, just as with **use-package**.

## 11.1.2 Standardized Packages

This section describes the *packages* that are available in every *conforming implementation*. A summary of the *names* and *nicknames* of those *standardized packages* is given in Figure 11–2.

| Name             | Nicknames   |
|------------------|-------------|
| COMMON-LISP      | CL          |
| COMMON-LISP-USER | CL-USER     |
| KEYWORD          | <i>none</i> |

Figure 11–2. Standardized Package Names

### 11.1.2.1 The COMMON-LISP Package

The COMMON-LISP *package* contains the primitives of the Common Lisp system as defined by this specification. Its *external symbols* include all of the *defined names* (except for *defined names* in the KEYWORD *package*) that are present in the Common Lisp system, such as **car**, **cdr**, **\*package\***, etc. The COMMON-LISP *package* has the *nickname* CL.

The COMMON-LISP *package* has as *external symbols* those symbols enumerated in the figures in Section 1.9 (Symbols in the COMMON-LISP Package), and no others. These *external symbols* are *present* in the COMMON-LISP *package* but their *home package* need not be the COMMON-LISP *package*.

For example, the symbol **HELP** cannot be an *external symbol* of the COMMON-LISP *package* because it is not mentioned in Section 1.9 (Symbols in the COMMON-LISP Package). In contrast, the

*symbol variable* must be an *external symbol* of the COMMON-LISP package even though it has no definition because it is listed in that section (to support its use as a valid second *argument* to the *function documentation*).

The COMMON-LISP package can have additional *internal symbols*.

#### 11.1.2.1.1 Constraints on the COMMON-LISP Package for Conforming Implementations

In a *conforming implementation*, an *external symbol* of the COMMON-LISP package can have a *function*, *macro*, or *special operator* definition, a *global variable* definition (or other status as a *dynamic variable* due to a **special proclamation**), or a *type* definition only if explicitly permitted in this standard. For example, **fboundp** yields *false* for any *external symbol* of the COMMON-LISP package that is not the *name* of a *standardized function*, *macro* or *special operator*, and **boundp** returns *false* for any *external symbol* of the COMMON-LISP package that is not the *name* of a *standardized global variable*. It also follows that *conforming programs* can use *external symbols* of the COMMON-LISP package as the *names* of local *lexical variables* with confidence that those *names* have not been *proclaimed special* by the *implementation* unless those *symbols* are *names* of *standardized global variables*.

A *conforming implementation* must not place any *property* on an *external symbol* of the COMMON-LISP package using a *property indicator* that is either an *external symbol* of any *standardized package* or a *symbol* that is otherwise *accessible* in the COMMON-LISP-USER package.

#### 11.1.2.1.2 Constraints on the COMMON-LISP Package for Conforming Programs

Except where explicitly allowed, the consequences are undefined if any of the following actions are performed on an *external symbol* of the COMMON-LISP package:

1. *Binding* or altering its value (lexically or dynamically). (Some exceptions are noted below.)
2. Defining, undefining, or *binding* it as a *function*. (Some exceptions are noted below.)
3. Defining, undefining, or *binding* it as a *macro* or *compiler macro*. (Some exceptions are noted below.)
4. Defining it as a *type specifier* (via **defstruct**, **defclass**, **deftype**, **define-condition**).
5. Defining it as a *structure* (via **defstruct**).
6. Defining it as a *declaration* with a **declaration proclamation**.
7. Defining it as a *symbol macro*.
8. Altering its *home package*.

9. Tracing it (via **trace**).
10. Declaring or proclaiming it **special** (via **declare**, **declaim**, or **proclaim**).
11. Declaring or proclaiming its **type** or **ftype** (via **declare**, **declaim**, or **proclaim**). (Some exceptions are noted below.)
12. Removing it from the **COMMON-LISP** *package*.
13. Defining a *setf expander* for it (via **defsetf** or **define-setf-method**).
14. Defining, undefining, or binding its *setf function name*.
15. Defining it as a *method combination* type (via **define-method-combination**).
16. Using it as the class-name argument to **setf** of **find-class**.
17. Binding it as a *catch tag*.
18. Binding it as a *restart name*.
19. Defining a *method* for a *standardized generic function* which is *applicable* when all of the *arguments* are *direct instances* of *standardized classes*.

#### 11.1.2.1.2.1 Some Exceptions to Constraints on the COMMON-LISP Package for Conforming Programs

If an *external symbol* of the **COMMON-LISP** *package* is not globally defined as a *standardized dynamic variable* or *constant variable*, it is allowed to lexically *bind* it and to declare the **type** of that *binding*, and it is allowed to locally *establish* it as a *symbol macro* (e.g., with **symbol-macrolet**).

Unless explicitly specified otherwise, if an *external symbol* of the **COMMON-LISP** *package* is globally defined as a *standardized dynamic variable*, it is permitted to *bind* or *assign* that *dynamic variable* provided that the “Value Type” constraints on the *dynamic variable* are maintained, and that the new *value* of the *variable* is consistent with the stated purpose of the *variable*.

If an *external symbol* of the **COMMON-LISP** *package* is not defined as a *standardized function*, *macro*, or *special operator*, it is allowed to lexically *bind* it as a *function* (e.g., with **flet**), to declare the **ftype** of that *binding*, and (in *implementations* which provide the ability to do so) to **trace** that *binding*.

If an *external symbol* of the **COMMON-LISP** *package* is not defined as a *standardized function*, *macro*, or *special operator*, it is allowed to lexically *bind* it as a *macro* (e.g., with **macrolet**).

If an *external symbol* of the **COMMON-LISP** *package* is not defined as a *standardized function*, *macro*, or *special operator*, it is allowed to lexically *bind* its *setf function name* as a *function*, and to declare the **ftype** of that *binding*.



### 11.1.2.2 The COMMON-LISP-USER Package

The COMMON-LISP-USER *package* is the *current package* when a Common Lisp system starts up. This *package* uses the COMMON-LISP *package*. The COMMON-LISP-USER *package* has the *nickname* CL-USER. The COMMON-LISP-USER *package* can have additional *symbols interned* within it; it can use other *implementation-defined packages*.

### 11.1.2.3 The KEYWORD Package

The KEYWORD *package* contains *symbols*, called *keywords*<sub>1</sub>, that are typically used as special markers in *programs* and their associated data *expressions*<sub>1</sub>.

*Symbol tokens* that start with a *package marker* are parsed by the *Lisp reader* as *symbols* in the KEYWORD *package*; see Section 2.3.4 (Symbols as Tokens). This makes it notationally convenient to use *keywords* when communicating between programs in different *packages*. For example, the mechanism for passing *keyword parameters* in a *call* uses *keywords*<sub>1</sub> to name the corresponding *arguments*; see Section 3.4.1 (Ordinary Lambda Lists).

*Symbols* in the KEYWORD *package* are, by definition, of *type* keyword.

#### 11.1.2.3.1 Interning a Symbol in the KEYWORD Package

The KEYWORD *package* is treated differently than other *packages* in that special actions are taken when a *symbol* is *interned* in it. In particular, when a *symbol* is *interned* in the KEYWORD *package*, it is automatically made to be an *external symbol* and is automatically made to be a *constant variable* with itself as a *value*.

#### 11.1.2.3.2 Notes about The KEYWORD Package

It is generally best to confine the use of *keywords* to situations in which there are a finitely enumerable set of names to be selected between. For example, if there were two states of a light switch, they might be called :on and :off.

In situations where the set of names is not finitely enumerable (*i.e.*, where name conflicts might arise) it is frequently best to use *symbols* in some *package* other than KEYWORD so that conflicts will be naturally avoided. For example, it is generally not wise for a *program* to use a *keyword*<sub>1</sub> as a *property indicator*, since if there were ever another *program* that did the same thing, each would clobber the other's data.

### 11.1.2.4 Implementation-Defined Packages

Other, *implementation-defined packages* might be present in the initial Common Lisp environment.

It is recommended, but not required, that the documentation for a *conforming implementation* contain a full list of all *package* names initially present in that *implementation* but not specified in this specification. (See also the *function* list-all-packages.)

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## package

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*System Class*

### Class Precedence List:

package, t

### Description:

A *package* is a *namespace* that maps *symbol names* to *symbols*; see Section 11.1 (Package Concepts).

### See Also:

Section 11.1 (Package Concepts), Section 22.1.3.13 (Printing Other Objects), Section 2.3.4 (Symbols as Tokens)

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## export

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*Function*

### Syntax:

`export symbols &optional package → t`

### Arguments and Values:

*symbols*—a *designator* for a *list* of *symbols*.

*package*—a *package designator*. The default is the *current package*.

### Description:

**export** makes one or more *symbols* that are *accessible* in *package* (whether directly or by inheritance) be *external symbols* of that *package*.

If any of the *symbols* is already *accessible* as an *external symbol* of *package*, **export** has no effect on that *symbol*. If the *symbol* is *present* in *package* as an internal symbol, it is simply changed to external status. If it is *accessible* as an *internal symbol* via **use-package**, it is first *imported* into *package*, then *exported*. (The *symbol* is then *present* in the *package* whether or not *package* continues to use the *package* through which the *symbol* was originally inherited.)

**export** makes each *symbol* *accessible* to all the *packages* that use *package*. All of these *packages* are checked for name conflicts: (**export** *s p*) does (**find-symbol** (symbol-name *s*) *q*) for each package *q* in (**package-used-by-list** *p*). Note that in the usual case of an **export** during the initial definition of a *package*, the result of **package-used-by-list** is **nil** and the name-conflict checking takes negligible time. When multiple changes are to be made, for example when **export** is given a *list* of *symbols*, it is permissible for the implementation to process each change separately, so that aborting from a name conflict caused by any but the first *symbol* in the *list* does not unexport the first *symbol* in the *list*. However, aborting from a name-conflict error caused by **export** of one of

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*symbols* does not leave that *symbol* *accessible* to some *packages* and *inaccessible* to others; with respect to each of *symbols* processed, **export** behaves as if it were as an atomic operation.

A name conflict in **export** between one of *symbols* being exported and a *symbol* already *present* in a *package* that would inherit the newly-exported *symbol* may be resolved in favor of the exported *symbol* by uninterning the other one, or in favor of the already-present *symbol* by making it a shadowing symbol.

### Examples:

```
(make-package 'temp :use nil) → #<PACKAGE "TEMP">
(use-package 'temp) → T
(intern "TEMP-SYM" 'temp) → TEMP::TEMP-SYM, NIL
(find-symbol "TEMP-SYM") → NIL, NIL
(export (find-symbol "TEMP-SYM" 'temp) 'temp) → T
(find-symbol "TEMP-SYM") → TEMP-SYM, :INHERITED
```

### Side Effects:

The package system is modified.

### Affected By:

*Accessible symbols.*

### Exceptional Situations:

If any of the *symbols* is not *accessible* at all in *package*, an error of *type* **package-error** is signaled that is *correctable* by permitting the *user* to interactively specify whether that *symbol* should be *imported*.

### See Also:

**import**, **unexport**, Section 11.1 (Package Concepts)

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## find-symbol

*Function*

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### Syntax:

**find-symbol** *string* &optional *package* → *symbol*, *status*

### Arguments and Values:

*string*—a *string*.

*package*—a *package designator*. The default is the *current package*.

*symbol*—a *symbol* accessible in the *package*, or **nil**.

*status*—one of **:inherited**, **:external**, **:internal**, or **nil**.

## find-symbol

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### Description:

**find-symbol** locates a *symbol* whose *name* is *string* in a *package*. If a *symbol* named *string* is found in *package*, directly or by inheritance, the *symbol* found is returned as the first value; the second value is as follows:

**:internal**

If the *symbol* is present in *package* as an *internal symbol*.

**:external**

If the *symbol* is present in *package* as an *external symbol*.

**:inherited**

If the *symbol* is inherited by *package* through **use-package**, but is not *present* in *package*.

If no such *symbol* is *accessible* in *package*, both values are **nil**.

### Examples:

```
(find-symbol "NEVER-BEFORE-USED") → NIL, NIL
(find-symbol "NEVER-BEFORE-USED") → NIL, NIL
(intern "NEVER-BEFORE-USED") → NEVER-BEFORE-USED, NIL
(intern "NEVER-BEFORE-USED") → NEVER-BEFORE-USED, :INTERNAL
(find-symbol "NEVER-BEFORE-USED") → NEVER-BEFORE-USED, :INTERNAL
(find-symbol "never-before-used") → NIL, NIL
(find-symbol "CAR" 'common-lisp-user) → CAR, :INHERITED
(find-symbol "CAR" 'common-lisp) → CAR, :EXTERNAL
(find-symbol "NIL" 'common-lisp-user) → NIL, :INHERITED
(find-symbol "NIL" 'common-lisp) → NIL, :EXTERNAL
(find-symbol "NIL" (progl (make-package "JUST-TESTING" :use '())
                          (intern "NIL" "JUST-TESTING")))
→ JUST-TESTING::NIL, :INTERNAL
(export 'just-testing:nil 'just-testing)
(find-symbol "NIL" 'just-testing) → JUST-TESTING:NIL, :EXTERNAL
(find-symbol "NIL" "KEYWORD")
→ NIL, NIL
or
→ :NIL, :EXTERNAL
(find-symbol (symbol-name :nil) "KEYWORD") → :NIL, :EXTERNAL
```

### Affected By:

**intern**, **import**, **export**, **use-package**, **unintern**, **unexport**, **unuse-package**

### See Also:

**intern**, **find-all-symbols**

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**Notes:**

`find-symbol` is operationally equivalent to `intern`, except that it never creates a new *symbol*.

---

## **find-package**

*Function*

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**Syntax:**

`find-package name` → *package*

**Arguments and Values:**

*name*—a *string designator* or a *package object*.

*package*—a *package object* or `nil`.

**Description:**

If *name* is a *string designator*, **find-package** locates and returns the *package* whose name or nickname is *name*. This search is case sensitive. If there is no such *package*, **find-package** returns `nil`.

If *name* is a *package object*, that *package object* is returned.

**Examples:**

```
(find-package 'common-lisp) → #<PACKAGE "COMMON-LISP">
(find-package "COMMON-LISP-USER") → #<PACKAGE "COMMON-LISP-USER">
(find-package 'not-there) → NIL
```

**Affected By:**

The set of *packages* created by the *implementation*.

`defpackage`, `delete-package`, `make-package`, `rename-package`

**See Also:**

`make-package`

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## find-all-symbols

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*Function*

### Syntax:

`find-all-symbols string` → *symbols*

### Arguments and Values:

*string*—a *string* designator.

*symbols*—a *list* of *symbols*.

### Description:

**find-all-symbols** searches every *registered package* for *symbols* that have a *name* that is the *same* (under **string=**) as *string*. A *list* of all such *symbols* is returned. Whether or how the *list* is ordered is *implementation-dependent*.

### Examples:

```
(find-all-symbols 'car)
→ (CAR)
or
→ (CAR VEHICLES:CAR)
or
→ (VEHICLES:CAR CAR)
(intern "CAR" (make-package 'temp :use nil)) → TEMP::CAR, NIL
(find-all-symbols 'car)
→ (TEMP::CAR CAR)
or
→ (CAR TEMP::CAR)
or
→ (TEMP::CAR CAR VEHICLES:CAR)
or
→ (CAR TEMP::CAR VEHICLES:CAR)
```

### See Also:

`find-symbol`

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## import

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*Function*

### Syntax:

`import symbols &optional package` → *t*

### Arguments and Values:

*symbols*—a *designator* for a *list* of *symbols*.

*package*—a *package designator*. The default is the *current package*.

## Description:

**import** adds *symbol* or *symbols* to the internals of *package*, checking for name conflicts with existing *symbols* either *present* in *package* or *accessible* to it. Once the *symbols* have been *imported*, they may be referenced in the *importing package* without the use of a *package prefix* when using the *Lisp reader*.

A name conflict in **import** between the *symbol* being imported and a symbol inherited from some other *package* can be resolved in favor of the *symbol* being *imported* by making it a shadowing symbol, or in favor of the *symbol* already *accessible* by not doing the **import**. A name conflict in **import** with a *symbol* already *present* in the *package* may be resolved by uninterning that *symbol*, or by not doing the **import**.

The imported *symbol* is not automatically exported from the *current package*, but if it is already *present* and external, then the fact that it is external is not changed. If any *symbol* to be *imported* has no home package (*i.e.*, (symbol-package *symbol*) → nil), **import** sets the *home package* of the *symbol* to *package*.

If the *symbol* is already *present* in the importing *package*, **import** has no effect.

## Examples:

```
(import 'common-lisp::car (make-package 'temp :use nil)) → T
(find-symbol "CAR" 'temp) → CAR, :INTERNAL
(find-symbol "CDR" 'temp) → NIL, NIL
```

The form (import 'editor:buffer) takes the external symbol named **buffer** in the **EDITOR** *package* (this symbol was located when the form was read by the *Lisp reader*) and adds it to the *current package* as an *internal symbol*. The symbol **buffer** is then *present* in the *current package*.

## Side Effects:

The package system is modified.

## Affected By:

Current state of the package system.

## Exceptional Situations:

**import** signals a *correctable* error of type **package-error** if any of the *symbols* to be *imported* has the *same name* (under **string=**) as some distinct *symbol* (under **eql**) already *accessible* in the *package*, even if the conflict is with a *shadowing symbol* of the *package*.

## See Also:

shadow, export

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## list-all-packages

---

*Function*

### Syntax:

`list-all-packages` *(no arguments)*  $\rightarrow$  *packages*

### Arguments and Values:

*packages*—a list of *package objects*.

### Description:

`list-all-packages` returns a *fresh list* of all *registered packages*.

### Examples:

```
(let ((before (list-all-packages)))  
  (make-package 'temp)  
  (set-difference (list-all-packages) before))  $\rightarrow$  (#<PACKAGE "TEMP">)
```

### Affected By:

`defpackage`, `delete-package`, `make-package`

---

## rename-package

---

*Function*

### Syntax:

`rename-package` *package new-name &optional new-nicknames*  $\rightarrow$  *package-object*

### Arguments and Values:

*package*—a *package designator*.

*new-name*—a *package designator*.

*new-nicknames*—a list of *string designators*. The default is the *empty list*.

*package-object*—the renamed *package object*.

### Description:

Replaces the name and nicknames of *package*. The old name and all of the old nicknames of *package* are eliminated and are replaced by *new-name* and *new-nicknames*.

The consequences are undefined if *new-name* or any *new-nickname* conflicts with any existing package names.



---

## Examples:

```
(make-package 'temporary :nicknames '("TEMP")) → #<PACKAGE "TEMPORARY">
(rename-package 'temp 'ephemeral) → #<PACKAGE "EPHEMERAL">
(package-nicknames (find-package 'ephemeral)) → ()
(find-package 'temporary) → NIL
(rename-package 'ephemeral 'temporary '(temp fleeting))
→ #<PACKAGE "TEMPORARY">
(package-nicknames (find-package 'temp)) → ("TEMP" "FLEETING")
```

## See Also:

make-package

---

# shadow

*Function*

---

## Syntax:

shadow *symbol-names* &optional *package* → t

## Arguments and Values:

*symbol-names*—a *designator* for a list of *string* *designators*.

*package*—a *package* *designator*. The default is the *current* *package*.

## Description:

**shadow** assures that *symbols* with names given by *symbol-names* are *present* in the *package*.

Specifically, *package* is searched for *symbols* with the *names* supplied by *symbol-names*. For each such *name*, if a corresponding *symbol* is not *present* in *package* (directly, not by inheritance), then a corresponding *symbol* is created with that *name*, and inserted into *package* as an *internal* *symbol*. The corresponding *symbol*, whether pre-existing or newly created, is then added, if not already present, to the *shadowing* *symbols* list of *package*.

## Examples:

```
(package-shadowing-symbols (make-package 'temp)) → NIL
(find-symbol 'car 'temp) → CAR, :INHERITED
(shadow 'car 'temp) → T
(find-symbol 'car 'temp) → TEMP::CAR, :INTERNAL
(package-shadowing-symbols 'temp) → (TEMP::CAR)

(make-package 'test-1) → #<PACKAGE "TEST-1">
(intern "TEST" (find-package 'test-1)) → TEST-1::TEST, NIL
(shadow 'test-1::test (find-package 'test-1)) → T
```

```
(shadow 'TEST (find-package 'test-1)) → T
(assert (not (null (member 'test-1::test (package-shadowing-symbols
                                         (find-package 'test-1))))))

(make-package 'test-2) → #<PACKAGE "TEST-2">
(intern "TEST" (find-package 'test-2)) → TEST-2::TEST, NIL
(export 'test-2::test (find-package 'test-2)) → T
(use-package 'test-2 (find-package 'test-1)) ;should not error
```

### Side Effects:

**shadow** changes the state of the package system in such a way that the package consistency rules do not hold across the change.

### Affected By:

Current state of the package system.

### See Also:

**package-shadowing-symbols**, Section 11.1 (Package Concepts)

### Notes:

If a *symbol* with a name in *symbol-names* already exists in *package*, but by inheritance, the inherited symbol becomes *shadowed*<sub>3</sub> by a newly created *internal symbol*.

---

## shadowing-import

*Function*

---

### Syntax:

**shadowing-import** *symbols* &optional *package* → *t*

### Arguments and Values:

*symbols*—a *designator* for a list of *symbols*.

*package* —a *package designator*. The default is the *current package*.

### Description:

**shadowing-import** is like **import**, but it does not signal an error even if the importation of a *symbol* would shadow some *symbol* already *accessible* in *package*.

**shadowing-import** inserts each of *symbols* into *package* as an internal symbol, regardless of whether another *symbol* of the same name is shadowed by this action. If a different *symbol* of the same name is already *present* in *package*, that *symbol* is first *uninterned* from *package*. The new *symbol* is added to *package*'s shadowing-symbols list.

**shadowing-import** does name-conflict checking to the extent that it checks whether a distinct existing *symbol* with the same name is *accessible*; if so, it is shadowed by the new *symbol*, which implies that it must be uninterned if it was *present* in *package*.

### Examples:

```
(in-package "COMMON-LISP-USER") → #<PACKAGE "COMMON-LISP-USER">
(setq sym (intern "CONFLICT")) → CONFLICT
(intern "CONFLICT" (make-package 'temp)) → TEMP::CONFLICT, NIL
(package-shadowing-symbols 'temp) → NIL
(shadowing-import sym 'temp) → T
(package-shadowing-symbols 'temp) → (CONFLICT)
```

### Side Effects:

**shadowing-import** changes the state of the package system in such a way that the consistency rules do not hold across the change.

*package*'s shadowing-symbols list is modified.

### Affected By:

Current state of the package system.

### See Also:

import, unintern, package-shadowing-symbols

---

## delete-package

*Function*

---

### Syntax:

`delete-package package` → *generalized-boolean*

### Arguments and Values:

*package*—a *package designator*.

*generalized-boolean*—a *generalized boolean*.

### Description:

**delete-package** deletes *package* from all package system data structures. If the operation is successful, **delete-package** returns true, otherwise **nil**. The effect of **delete-package** is that the name and nicknames of *package* cease to be recognized package names. The package *object* is still a *package* (*i.e.*, **packagep** is true of it) but **package-name** returns **nil**. The consequences of deleting the **COMMON-LISP** *package* or the **KEYWORD** *package* are undefined. The consequences of invoking any other package operation on *package* once it has been deleted are unspecified. In particular, the consequences of invoking **find-symbol**, **intern** and other functions that look for a

## delete-package

---

symbol name in a *package* are unspecified if they are called with **\*package\*** bound to the deleted *package* or with the deleted *package* as an argument.

If *package* is a *package object* that has already been deleted, **delete-package** immediately returns **nil**.

After this operation completes, the *home package* of any *symbol* whose *home package* had previously been *package* is *implementation-dependent*. Except for this, *symbols accessible* in *package* are not modified in any other way; *symbols* whose *home package* is not *package* remain unchanged.

### Examples:

```
(setq *foo-package* (make-package "FOO" :use nil))
(setq *foo-symbol* (intern "FOO" *foo-package*))
(export *foo-symbol* *foo-package*)

(setq *bar-package* (make-package "BAR" :use '("FOO")))
(setq *bar-symbol* (intern "BAR" *bar-package*))
(export *foo-symbol* *bar-package*)
(export *bar-symbol* *bar-package*)

(setq *baz-package* (make-package "BAZ" :use '("BAR")))

(symbol-package *foo-symbol*) → #<PACKAGE "FOO">
(symbol-package *bar-symbol*) → #<PACKAGE "BAR">

(prin1-to-string *foo-symbol*) → "FOO:FOO"
(prin1-to-string *bar-symbol*) → "BAR:BAR"

(find-symbol "FOO" *bar-package*) → FOO:FOO, :EXTERNAL
(find-symbol "FOO" *baz-package*) → FOO:FOO, :INHERITED
(find-symbol "BAR" *baz-package*) → BAR:BAR, :INHERITED

(packagep *foo-package*) → true
(packagep *bar-package*) → true
(packagep *baz-package*) → true

(package-name *foo-package*) → "FOO"
(package-name *bar-package*) → "BAR"
(package-name *baz-package*) → "BAZ"

(package-use-list *foo-package*) → ()
(package-use-list *bar-package*) → (#<PACKAGE "FOO">)
(package-use-list *baz-package*) → (#<PACKAGE "BAR">)
```

## delete-package

---

```
(package-used-by-list *foo-package*) → (#<PACKAGE "BAR">)
(package-used-by-list *bar-package*) → (#<PACKAGE "BAZ">)
(package-used-by-list *baz-package*) → ()

(delete-package *bar-package*)
▷ Error: Package BAZ uses package BAR.
▷ If continued, BAZ will be made to unuse-package BAR,
▷ and then BAR will be deleted.
▷ Type :CONTINUE to continue.
▷ Debug> :CONTINUE
→ T

(symbol-package *foo-symbol*) → #<PACKAGE "FOO">
(symbol-package *bar-symbol*) is unspecified

(print1-to-string *foo-symbol*) → "FOO:FOO"
(print1-to-string *bar-symbol*) is unspecified

(find-symbol "FOO" *bar-package*) is unspecified

(find-symbol "FOO" *baz-package*) → NIL, NIL
(find-symbol "BAR" *baz-package*) → NIL, NIL

(packagep *foo-package*) → T
(packagep *bar-package*) → T
(packagep *baz-package*) → T

(package-name *foo-package*) → "FOO"
(package-name *bar-package*) → NIL
(package-name *baz-package*) → "BAZ"

(package-use-list *foo-package*) → ()
(package-use-list *bar-package*) is unspecified
(package-use-list *baz-package*) → ()

(package-used-by-list *foo-package*) → ()
(package-used-by-list *bar-package*) is unspecified
(package-used-by-list *baz-package*) → ()
```

### Exceptional Situations:

If the *package designator* is a *name* that does not currently name a *package*, a *correctable* error of *type* **package-error** is signaled. If correction is attempted, no deletion action is attempted; instead, **delete-package** immediately returns **nil**.

---

If *package* is used by other *packages*, a *correctable* error of *type* **package-error** is signaled. If correction is attempted, **unuse-package** is effectively called to remove any dependencies, causing *package*'s *external symbols* to cease being *accessible* to those *packages* that use *package*. **delete-package** then deletes *package* just as it would have had there been no *packages* that used it.

### See Also:

**unuse-package**

---

## make-package

*Function*

---

### Syntax:

**make-package** *package-name* &key *nicknames use* → *package*

### Arguments and Values:

*package-name*—a *string designator*.

*nicknames*—a *list of string designators*. The default is the *empty list*.

*use*—a *list of package designators*. The default is *implementation-defined*.

*package*—a *package*.

### Description:

Creates a new *package* with the name *package-name*.

*Nicknames* are additional *names* which may be used to refer to the new *package*.

*use* specifies zero or more *packages* the *external symbols* of which are to be inherited by the new *package*. See the *function* **use-package**.

### Examples:

```
(make-package 'temporary :nicknames '("TEMP" "temp")) → #<PACKAGE "TEMPORARY">
(make-package "OWNER" :use '("temp")) → #<PACKAGE "OWNER">
(package-used-by-list 'temp) → (#<PACKAGE "OWNER">)
(package-use-list 'owner) → (#<PACKAGE "TEMPORARY">)
```

### Affected By:

The existence of other *packages* in the system.

### Exceptional Situations:

The consequences are unspecified if *packages* denoted by *use* do not exist.

---

A *correctable* error is signaled if the *package-name* or any of the *nicknames* is already the *name* or *nickname* of an existing *package*.

### See Also:

**defpackage**, **use-package**

### Notes:

In situations where the *packages* to be used contain symbols which would conflict, it is necessary to first create the package with **:use '()**, then to use **shadow** or **shadowing-import** to address the conflicts, and then after that to use **use-package** once the conflicts have been addressed.

When packages are being created as part of the static definition of a program rather than dynamically by the program, it is generally considered more stylistically appropriate to use **defpackage** rather than **make-package**.

---

## with-package-iterator

*Macro*

---

### Syntax:

**with-package-iterator** (*name package-list-form &rest symbol-types*) {*declaration*}\* {*form*}\*  
→ {*result*}\*

### Arguments and Values:

*name*—a *symbol*.

*package-list-form*—a *form*; evaluated once to produce a *package-list*.

*package-list*—a *designator* for a list of *package designators*.

*symbol-type*—one of the *symbols* **:internal**, **:external**, or **:inherited**.

*declaration*—a **declare expression**; not evaluated.

*forms*—an *implicit progn*.

*results*—the *values* of the *forms*.

### Description:

Within the lexical scope of the body *forms*, the *name* is defined via **macrolet** such that successive invocations of (*name*) will return the *symbols*, one by one, from the *packages* in *package-list*.

It is unspecified whether *symbols* inherited from multiple *packages* are returned more than once. The order of *symbols* returned does not necessarily reflect the order of *packages* in *package-list*. When *package-list* has more than one element, it is unspecified whether duplicate *symbols* are returned once or more than once.

## with-package-iterator

---

*Symbol-types* controls which *symbols* that are *accessible* in a *package* are returned as follows:

`:internal`

The *symbols* that are *present* in the *package*, but that are not *exported*.

`:external`

The *symbols* that are *present* in the *package* and are *exported*.

`:inherited`

The *symbols* that are *exported* by used *packages* and that are not *shadowed*.

When more than one argument is supplied for *symbol-types*, a *symbol* is returned if its *accessibility* matches any one of the *symbol-types* supplied. Implementations may extend this syntax by recognizing additional symbol accessibility types.

An invocation of (*name*) returns four values as follows:

1. A flag that indicates whether a *symbol* is returned (true means that a *symbol* is returned).
2. A *symbol* that is *accessible* in one the indicated *packages*.
3. The accessibility type for that *symbol*; *i.e.*, one of the symbols `:internal`, `:external`, or `:inherited`.
4. The *package* from which the *symbol* was obtained. The *package* is one of the *packages* present or named in *package-list*.

After all *symbols* have been returned by successive invocations of (*name*), then only one value is returned, namely `nil`.

The meaning of the second, third, and fourth *values* is that the returned *symbol* is *accessible* in the returned *package* in the way indicated by the second return value as follows:

`:internal`

Means *present* and not *exported*.

`:external`

Means *present* and *exported*.

`:inherited`

Means not *present* (thus not *shadowed*) but inherited from some used *package*.

It is unspecified what happens if any of the implicit interior state of an iteration is returned outside the dynamic extent of the **with-package-iterator** form such as by returning some *closure* over the invocation *form*.



---

## with-package-iterator

---

Any number of invocations of **with-package-iterator** can be nested, and the body of the innermost one can invoke all of the locally *established macros*, provided all those *macros* have distinct names.

### Examples:

The following function should return **t** on any *package*, and signal an error if the usage of **with-package-iterator** does not agree with the corresponding usage of **do-symbols**.

```
(defun test-package-iterator (package)
  (unless (packagep package)
    (setq package (find-package package)))
  (let ((all-entries '())
        (generated-entries '()))
    (do-symbols (x package)
      (multiple-value-bind (symbol accessibility)
        (find-symbol (symbol-name x) package)
        (push (list symbol accessibility) all-entries)))
    (with-package-iterator (generator-fn package
                                      :internal :external :inherited)
      (loop
        (multiple-value-bind (more? symbol accessibility pkg)
          (generator-fn)
          (unless more? (return))
          (let ((l (multiple-value-list (find-symbol (symbol-name symbol)
                                                      package))))
            (unless (equal 1 (list symbol accessibility))
              (error "Symbol ~S not found as ~S in package ~A [~S]"
                     symbol accessibility (package-name package) l))
            (push l generated-entries))))
        (unless (and (subsetp all-entries generated-entries :test #'equal)
                     (subsetp generated-entries all-entries :test #'equal))
          (error "Generated entries and Do-Symbols entries don't correspond"))
        t))
```

The following function prints out every *present symbol* (possibly more than once):

```
(defun print-all-symbols ()
  (with-package-iterator (next-symbol (list-all-packages)
                                      :internal :external)
    (loop
      (multiple-value-bind (more? symbol) (next-symbol)
        (if more?
          (print symbol)
          (return))))))
```

---

### Exceptional Situations:

**with-package-iterator** signals an error of *type* **program-error** if no *symbol-types* are supplied or if a *symbol-type* is not recognized by the implementation is supplied.

The consequences are undefined if the local function named *name established* by **with-package-iterator** is called after it has returned *false* as its *primary value*.

### See Also:

Section 3.6 (Traversal Rules and Side Effects)

---

## unexport

*Function*

---

### Syntax:

**unexport** *symbols* &optional *package* → *t*

### Arguments and Values:

*symbols*—a *designator* for a *list* of *symbols*.

*package*—a *package designator*. The default is the *current package*.

### Description:

**unexport** reverts external *symbols* in *package* to internal status; it undoes the effect of **export**.

**unexport** works only on *symbols present* in *package*, switching them back to internal status. If **unexport** is given a *symbol* that is already *accessible* as an *internal symbol* in *package*, it does nothing.

### Examples:

```
(in-package "COMMON-LISP-USER") → #<PACKAGE "COMMON-LISP-USER">
(export (intern "CONTRABAND" (make-package 'temp)) 'temp) → T
(find-symbol "CONTRABAND") → NIL, NIL
(use-package 'temp) → T
(find-symbol "CONTRABAND") → CONTRABAND, :INHERITED
(unexport 'contraband 'temp) → T
(find-symbol "CONTRABAND") → NIL, NIL
```

### Side Effects:

Package system is modified.

### Affected By:

Current state of the package system.

---

### Exceptional Situations:

If **unexport** is given a *symbol* not *accessible* in *package* at all, an error of *type* **package-error** is signaled.

The consequences are undefined if *package* is the **KEYWORD** *package* or the **COMMON-LISP** *package*.

### See Also:

**export**, Section 11.1 (Package Concepts)

---

## unintern

*Function*

---

### Syntax:

**unintern** *symbol* &optional *package* → *generalized-boolean*

### Arguments and Values:

*symbol*—a *symbol*.

*package*—a *package designator*. The default is the *current package*.

*generalized-boolean*—a *generalized boolean*.

### Description:

**unintern** removes *symbol* from *package*. If *symbol* is *present* in *package*, it is removed from *package* and also from *package*'s *shadowing symbols list* if it is present there. If *package* is the *home package* for *symbol*, *symbol* is made to have no *home package*. *Symbol* may continue to be *accessible* in *package* by inheritance.

Use of **unintern** can result in a *symbol* that has no recorded *home package*, but that in fact is *accessible* in some *package*. Common Lisp does not check for this pathological case, and such *symbols* are always printed preceded by **#:**.

**unintern** returns *true* if it removes *symbol*, and **nil** otherwise.

### Examples:

```
(in-package "COMMON-LISP-USER") → #<PACKAGE "COMMON-LISP-USER">
(setq temps-unpack (intern "UNPACK" (make-package 'temp))) → TEMP::UNPACK
(unintern temps-unpack 'temp) → T
(find-symbol "UNPACK" 'temp) → NIL, NIL
temps-unpack → #:UNPACK
```

### Side Effects:

**unintern** changes the state of the package system in such a way that the consistency rules do not hold across the change.

---

**Affected By:**

Current state of the package system.

**Exceptional Situations:**

Giving a shadowing symbol to **unintern** can uncover a name conflict that had previously been resolved by the shadowing. If package A uses packages B and C, A contains a shadowing symbol **x**, and B and C each contain external symbols named **x**, then removing the shadowing symbol **x** from A will reveal a name conflict between **b:x** and **c:x** if those two *symbols* are distinct. In this case **unintern** will signal an error.

**See Also:**

Section 11.1 (Package Concepts)

---

## in-package

*Macro*

---

**Syntax:**

**in-package** *name* → *package*

**Arguments and Values:**

*name*—a *string designator*; not evaluated.

*package*—the *package* named by *name*.

**Description:**

Causes the the *package* named by *name* to become the *current package*—that is, the *value* of **\*package\***. If no such *package* already exists, an error of *type* **package-error** is signaled.

Everything **in-package** does is also performed at compile time if the call appears as a *top level form*.

**Side Effects:**

The *variable* **\*package\*** is assigned. If the **in-package** *form* is a *top level form*, this assignment also occurs at compile time.

**Exceptional Situations:**

An error of *type* **package-error** is signaled if the specified *package* does not exist.

**See Also:**

**\*package\***

---

---

## unuse-package

---

*Function*

### Syntax:

`unuse-package packages-to-unuse &optional package` → `t`

### Arguments and Values:

*packages-to-unuse*—a designator for a list of package designators.

*package*—a package designator. The default is the *current package*.

### Description:

**unuse-package** causes *package* to cease inheriting all the *external symbols* of *packages-to-unuse*; **unuse-package** undoes the effects of **use-package**. The *packages-to-unuse* are removed from the *use list* of *package*.

Any *symbols* that have been *imported* into *package* continue to be *present* in *package*.

### Examples:

```
(in-package "COMMON-LISP-USER") → #<PACKAGE "COMMON-LISP-USER">
(export (intern "SHOES" (make-package 'temp)) 'temp) → T
(find-symbol "SHOES") → NIL, NIL
(use-package 'temp) → T
(find-symbol "SHOES") → SHOES, :INHERITED
(find (find-package 'temp) (package-use-list 'common-lisp-user)) → #<PACKAGE "TEMP">
(unuse-package 'temp) → T
(find-symbol "SHOES") → NIL, NIL
```

### Side Effects:

The *use list* of *package* is modified.

### Affected By:

Current state of the package system.

### See Also:

`use-package`, `package-use-list`

---

---

## use-package

---

*Function*

### Syntax:

`use-package packages-to-use &optional package` → `t`

### Arguments and Values:

*packages-to-use*—a *designator* for a list of *package designators*. The **KEYWORD** *package* may not be supplied.

*package*—a *package designator*. The default is the *current package*. The *package* cannot be the **KEYWORD** *package*.

### Description:

**use-package** causes *package* to inherit all the *external symbols* of *packages-to-use*. The inherited *symbols* become *accessible* as *internal symbols* of *package*.

*Packages-to-use* are added to the *use list* of *package* if they are not there already. All *external symbols* in *packages-to-use* become *accessible* in *package* as *internal symbols*. **use-package** does not cause any new *symbols* to be *present* in *package* but only makes them *accessible* by inheritance.

**use-package** checks for name conflicts between the newly imported symbols and those already *accessible* in *package*. A name conflict in **use-package** between two external symbols inherited by *package* from *packages-to-use* may be resolved in favor of either *symbol* by *importing* one of them into *package* and making it a shadowing symbol.

### Examples:

```
(export (intern "LAND-FILL" (make-package 'trash)) 'trash) → T
(find-symbol "LAND-FILL" (make-package 'temp)) → NIL, NIL
(package-use-list 'temp) → (#<PACKAGE "TEMP">)
(use-package 'trash 'temp) → T
(package-use-list 'temp) → (#<PACKAGE "TEMP"> #<PACKAGE "TRASH">)
(find-symbol "LAND-FILL" 'temp) → TRASH:LAND-FILL, :INHERITED
```

### Side Effects:

The *use list* of *package* may be modified.

### See Also:

**unuse-package**, **package-use-list**, Section 11.1 (Package Concepts)

### Notes:

It is permissible for a *package*  $P_1$  to *use* a *package*  $P_2$  even if  $P_2$  already uses  $P_1$ . The using of *packages* is not transitive, so no problem results from the apparent circularity.

---

---

## defpackage

Macro

---

### Syntax:

`defpackage` *defined-package-name* [`↓option`]  $\rightarrow$  *package*

*option* ::= { (:nicknames {*nickname*}\*) }\* |  
          (:documentation *string*) |  
          { (:use {*package-name*}\*) }\* |  
          { (:shadow {*↓symbol-name*}\*) }\* |  
          { (:shadowing-import-from *package-name* {*↓symbol-name*}\*) }\* |  
          { (:import-from *package-name* {*↓symbol-name*}\*) }\* |  
          { (:export {*↓symbol-name*}\*) }\* |  
          { (:intern {*↓symbol-name*}\*) }\* |  
          (:size *integer*)

### Arguments and Values:

*defined-package-name*—a *string designator*.

*package-name*—a *package designator*.

*nickname*—a *string designator*.

*symbol-name*—a *string designator*.

*package*—the *package* named *package-name*.

### Description:

`defpackage` creates a *package* as specified and returns the *package*.

If *defined-package-name* already refers to an existing *package*, the name-to-package mapping for that name is not changed. If the new definition is at variance with the current state of that *package*, the consequences are undefined; an implementation might choose to modify the existing *package* to reflect the new definition. If *defined-package-name* is a *symbol*, its *name* is used.

The standard *options* are described below.

`:nicknames`

The arguments to `:nicknames` set the *package*'s nicknames to the supplied names.

`:documentation`

The argument to `:documentation` specifies a *documentation string*; it is attached as a

## defpackage

---

*documentation string* to the *package*. At most one `:documentation` option can appear in a single **defpackage** form.

### `:use`

The arguments to `:use` set the *packages* that the *package* named by *package-name* will inherit from. If `:use` is not supplied, it defaults to the same *implementation-dependent* value as the `:use` argument to **make-package**.

### `:shadow`

The arguments to `:shadow`, *symbol-names*, name *symbols* that are to be created in the *package* being defined. These *symbols* are added to the list of shadowing *symbols* effectively as if by **shadow**.

### `:shadowing-import-from`

The *symbols* named by the argument *symbol-names* are found (involving a lookup as if by **find-symbol**) in the specified *package-name*. The resulting *symbols* are *imported* into the *package* being defined, and placed on the shadowing symbols list as if by **shadowing-import**. In no case are *symbols* created in any *package* other than the one being defined.

### `:import-from`

The *symbols* named by the argument *symbol-names* are found in the *package* named by *package-name* and they are *imported* into the *package* being defined. In no case are *symbols* created in any *package* other than the one being defined.

### `:export`

The *symbols* named by the argument *symbol-names* are found or created in the *package* being defined and *exported*. The `:export` option interacts with the `:use` option, since inherited *symbols* can be used rather than new ones created. The `:export` option interacts with the `:import-from` and `:shadowing-import-from` options, since *imported* symbols can be used rather than new ones created. If an argument to the `:export` option is *accessible* as an (inherited) *internal symbol* via **use-package**, that the *symbol* named by *symbol-name* is first *imported* into the *package* being defined, and is then *exported* from that *package*.

### `:intern`

The *symbols* named by the argument *symbol-names* are found or created in the *package* being defined. The `:intern` option interacts with the `:use` option, since inherited *symbols* can be used rather than new ones created.

### `:size`



## defpackage

---

The argument to the `:size` option declares the approximate number of *symbols* expected in the *package*. This is an efficiency hint only and might be ignored by an implementation.

The order in which the options appear in a **defpackage** form is irrelevant. The order in which they are executed is as follows:

1. `:shadow` and `:shadowing-import-from`.
2. `:use`.
3. `:import-from` and `:intern`.
4. `:export`.

Shadows are established first, since they might be necessary to block spurious name conflicts when the `:use` option is processed. The `:use` option is executed next so that `:intern` and `:export` options can refer to normally inherited *symbols*. The `:export` option is executed last so that it can refer to *symbols* created by any of the other options; in particular, *shadowing symbols* and *imported symbols* can be made external.

If a *defpackage form* appears as a *top level form*, all of the actions normally performed by this *macro* at load time must also be performed at compile time.

### Examples:

```
(defpackage "MY-PACKAGE"
  (:nicknames "MYPKG" "MY-PKG")
  (:use "COMMON-LISP")
  (:shadow "CAR" "CDR")
  (:shadowing-import-from "VENDOR-COMMON-LISP" "CONS")
  (:import-from "VENDOR-COMMON-LISP" "GC")
  (:export "EQ" "CONS" "FROBOLA")
)

(defpackage my-package
  (:nicknames mypkg :MY-PKG) ; remember Common Lisp conventions for case
  (:use common-lisp)         ; conversion on symbols
  (:shadow CAR :cdr #:cons)
  (:export "CONS")           ; this is the shadowed one.
)
```

### Affected By:

Existing *packages*.

### Exceptional Situations:

If one of the supplied `:nicknames` already refers to an existing *package*, an error of *type package-error* is signaled.

## defpackage

---

An error of *type* **program-error** should be signaled if `:size` or `:documentation` appears more than once.

Since *implementations* might allow extended *options* an error of *type* **program-error** should be signaled if an *option* is present that is not actually supported in the host *implementation*.

The collection of *symbol-name* arguments given to the options `:shadow`, `:intern`, `:import-from`, and `:shadowing-import-from` must all be disjoint; additionally, the *symbol-name* arguments given to `:export` and `:intern` must be disjoint. Disjoint in this context is defined as no two of the *symbol-names* being **string=** with each other. If either condition is violated, an error of *type* **program-error** should be signaled.

For the `:shadowing-import-from` and `:import-from` options, a *correctable error of type* **package-error** is signaled if no *symbol* is *accessible* in the *package* named by *package-name* for one of the argument *symbol-names*.

Name conflict errors are handled by the underlying calls to **make-package**, **use-package**, **import**, and **export**. See Section 11.1 (Package Concepts).

### See Also:

**documentation**, Section 11.1 (Package Concepts), Section 3.2 (Compilation)

### Notes:

The `:intern` option is useful if an `:import-from` or a `:shadowing-import-from` option in a subsequent call to **defpackage** (for some other *package*) expects to find these *symbols accessible* but not necessarily external.

It is recommended that the entire *package* definition is put in a single place, and that all the *package* definitions of a program are in a single file. This file can be *loaded* before *loading* or compiling anything else that depends on those *packages*. Such a file can be read in the **COMMON-LISP-USER** *package*, avoiding any initial state issues.

**defpackage** cannot be used to create two “mutually recursive” packages, such as:

```
(defpackage my-package
  (:use common-lisp your-package)    ;requires your-package to exist first
  (:export "MY-FUN"))
(defpackage your-package
  (:use common-lisp)
  (:import-from my-package "MY-FUN") ;requires my-package to exist first
  (:export "MY-FUN"))
```

However, nothing prevents the user from using the *package*-affecting functions such as **use-package**, **import**, and **export** to establish such links after a more standard use of **defpackage**.

The macroexpansion of **defpackage** could usefully canonicalize the names into *strings*, so that even if a source file has random *symbols* in the **defpackage** form, the compiled file would only contain *strings*.

---

Frequently additional *implementation-dependent* options take the form of a *keyword* standing by itself as an abbreviation for a list (**keyword** T); this syntax should be properly reported as an unrecognized option in implementations that do not support it.

---

## do-symbols, do-external-symbols, do-all-symbols

*Macro*

---

### Syntax:

```
do-symbols (var [package [result-form]])
            {declaration}* {tag | statement}*
    → {result}*

do-external-symbols (var [package [result-form]])
                    {declaration}* {tag | statement}*
    → {result}*

do-all-symbols (var [result-form])
                {declaration}* {tag | statement}*
    → {result}*
```

### Arguments and Values:

*var*—a *variable name*; not evaluated.

*package*—a *package designator*; evaluated. The default in **do-symbols** and **do-external-symbols** is the *current package*.

*result-form*—a *form*; evaluated as described below. The default is **nil**.

*declaration*—a **declare expression**; not evaluated.

*tag*—a *go tag*; not evaluated.

*statement*—a *compound form*; evaluated as described below.

*results*—the *values* returned by the *result-form* if a *normal return* occurs, or else, if an *explicit return* occurs, the *values* that were transferred.

### Description:

**do-symbols**, **do-external-symbols**, and **do-all-symbols** iterate over the *symbols* of *packages*. For each *symbol* in the set of *packages* chosen, the *var* is bound to the *symbol*, and the *statements* in the body are executed. When all the *symbols* have been processed, *result-form* is evaluated and returned as the value of the macro.

## do-symbols, do-external-symbols, do-all-symbols

---

**do-symbols** iterates over the *symbols accessible* in *package*. *Statements* may execute more than once for *symbols* that are inherited from multiple *packages*.

**do-all-symbols** iterates on every *registered package*. **do-all-symbols** will not process every *symbol* whatsoever, because a *symbol* not *accessible* in any *registered package* will not be processed. **do-all-symbols** may cause a *symbol* that is *present* in several *packages* to be processed more than once.

**do-external-symbols** iterates on the external symbols of *package*.

When *result-form* is evaluated, *var* is bound and has the value **nil**.

An *implicit block* named **nil** surrounds the entire **do-symbols**, **do-external-symbols**, or **do-all-symbols form**. **return** or **return-from** may be used to terminate the iteration prematurely.

If execution of the body affects which *symbols* are contained in the set of *packages* over which iteration is occurring, other than to remove the *symbol* currently the value of *var* by using **unintern**, the consequences are undefined.

For each of these macros, the *scope* of the name binding does not include any initial value form, but the optional result forms are included.

Any *tag* in the body is treated as with **tagbody**.

### Examples:

```
(make-package 'temp :use nil) → #<PACKAGE "TEMP">
(intern "SHY" 'temp) → TEMP::SHY, NIL ;SHY will be an internal symbol
                                ;in the package TEMP
(export (intern "BOLD" 'temp) 'temp) → T ;BOLD will be external
(let ((lst ()))
  (do-symbols (s (find-package 'temp)) (push s lst))
  lst)
→ (TEMP::SHY TEMP:BOLD)
or
→ (TEMP:BOLD TEMP::SHY)
(let ((lst ()))
  (do-external-symbols (s (find-package 'temp) lst) (push s lst))
  lst)
→ (TEMP:BOLD)
(let ((lst ()))
  (do-all-symbols (s lst)
    (when (eq (find-package 'temp) (symbol-package s)) (push s lst)))
  lst)
→ (TEMP::SHY TEMP:BOLD)
or
→ (TEMP:BOLD TEMP::SHY)
```

---

**See Also:**

**intern**, **export**, Section 3.6 (Traversal Rules and Side Effects)

---

## **intern**

*Function*

---

**Syntax:**

**intern** *string* &optional *package* → *symbol*, *status*

**Arguments and Values:**

*string*—a *string*.

*package*—a *package designator*. The default is the *current package*.

*symbol*—a *symbol*.

*status*—one of `:inherited`, `:external`, `:internal`, or `nil`.

**Description:**

**intern** enters a *symbol* named *string* into *package*. If a *symbol* whose name is the same as *string* is already *accessible* in *package*, it is returned. If no such *symbol* is *accessible* in *package*, a new *symbol* with the given name is created and entered into *package* as an *internal symbol*, or as an *external symbol* if the *package* is the **KEYWORD package**; *package* becomes the *home package* of the created *symbol*.

The first value returned by **intern**, *symbol*, is the *symbol* that was found or created. The meaning of the *secondary value*, *status*, is as follows:

`:internal`

The *symbol* was found and is *present* in *package* as an *internal symbol*.

`:external`

The *symbol* was found and is *present* as an *external symbol*.

`:inherited`

The *symbol* was found and is inherited via **use-package** (which implies that the *symbol* is internal).

`nil`

No pre-existing *symbol* was found, so one was created.

---

It is *implementation-dependent* whether the *string* that becomes the new *symbol's name* is the given *string* or a copy of it. Once a *string* has been given as the *string argument* to *intern* in this situation where a new *symbol* is created, the consequences are undefined if a subsequent attempt is made to alter that *string*.

### Examples:

```
(in-package "COMMON-LISP-USER") → #<PACKAGE "COMMON-LISP-USER">
(intern "Never-Before") → |Never-Before|, NIL
(intern "Never-Before") → |Never-Before|, :INTERNAL
(intern "NEVER-BEFORE" "KEYWORD") → :NEVER-BEFORE, NIL
(intern "NEVER-BEFORE" "KEYWORD") → :NEVER-BEFORE, :EXTERNAL
```

### See Also:

`find-symbol`, `read`, `symbol`, `unintern`, Section 2.3.4 (Symbols as Tokens)

### Notes:

`intern` does not need to do any name conflict checking because it never creates a new *symbol* if there is already an *accessible symbol* with the name given.

---

## package-name

*Function*

---

### Syntax:

`package-name package` → *name*

### Arguments and Values:

*package*—a *package designator*.

*name*—a *string* or `nil`.

### Description:

`package-name` returns the *string* that names *package*, or `nil` if the *package designator* is a *package object* that has no name (see the *function* `delete-package`).

### Examples:

```
(in-package "COMMON-LISP-USER") → #<PACKAGE "COMMON-LISP-USER">
(package-name *package*) → "COMMON-LISP-USER"
(package-name (symbol-package :test)) → "KEYWORD"
(package-name (find-package 'common-lisp)) → "COMMON-LISP"

(defvar *foo-package* (make-package "FOO"))
```

---

```
(rename-package "F00" "F000")  
(package-name *foo-package*) → "F000"
```

### Exceptional Situations:

Should signal an error of *type* **type-error** if *package* is not a *package designator*.

---

## package-nicknames

*Function*

---

### Syntax:

`package-nicknames` *package* → *nicknames*

### Arguments and Values:

*package*—a *package designator*.

*nicknames*—a *list* of *strings*.

### Description:

Returns the *list* of nickname *strings* for *package*, not including the name of *package*.

### Examples:

```
(package-nicknames (make-package 'temporary  
                               :nicknames '("TEMP" "temp")))  
→ ("temp" "TEMP")
```

### Exceptional Situations:

Should signal an error of *type* **type-error** if *package* is not a *package designator*.

---

## package-shadowing-symbols

*Function*

---

### Syntax:

`package-shadowing-symbols` *package* → *symbols*

### Arguments and Values:

*package*—a *package designator*.

*symbols*—a *list* of *symbols*.

---

### Description:

Returns a *list* of *symbols* that have been declared as *shadowing symbols* in *package* by **shadow** or **shadowing-import** (or the equivalent **defpackage** options). All *symbols* on this *list* are *present* in *package*.

### Examples:

```
(package-shadowing-symbols (make-package 'temp)) → ()  
(shadow 'cdr 'temp) → T  
(package-shadowing-symbols 'temp) → (TEMP::CDR)  
(intern "PILL" 'temp) → TEMP::PILL, NIL  
(shadowing-import 'pill 'temp) → T  
(package-shadowing-symbols 'temp) → (PILL TEMP::CDR)
```

### Exceptional Situations:

Should signal an error of *type* **type-error** if *package* is not a *package designator*.

### See Also:

**shadow**, **shadowing-import**

### Notes:

Whether the list of *symbols* is *fresh* is *implementation-dependent*.

---

## package-use-list

*Function*

---

### Syntax:

**package-use-list** *package* → *use-list*

### Arguments and Values:

*package*—a *package designator*.

*use-list*—a *list* of *package objects*.

### Description:

Returns a *list* of other *packages* used by *package*.

### Examples:

```
(package-use-list (make-package 'temp)) → (#<PACKAGE "COMMON-LISP">)  
(use-package 'common-lisp-user 'temp) → T  
(package-use-list 'temp) → (#<PACKAGE "COMMON-LISP"> #<PACKAGE "COMMON-LISP-USER">)
```



---

**Exceptional Situations:**

Should signal an error of *type* **type-error** if *package* is not a *package designator*.

**See Also:**

use-package, unuse-package

---

## package-used-by-list

*Function*

---

**Syntax:**

`package-used-by-list package` → *used-by-list*

**Arguments and Values:**

*package*—a *package designator*.

*used-by-list*—a *list* of *package objects*.

**Description:**

`package-used-by-list` returns a *list* of other *packages* that use *package*.

**Examples:**

```
(package-used-by-list (make-package 'temp)) → ()  
(make-package 'trash :use '(temp)) → #<PACKAGE "TRASH">  
(package-used-by-list 'temp) → (#<PACKAGE "TRASH">)
```

**Exceptional Situations:**

Should signal an error of *type* **type-error** if *package* is not a *package*.

**See Also:**

use-package, unuse-package

---

---

## packagep

---

*Function*

### Syntax:

`packagep object`  $\rightarrow$  *generalized-boolean*

### Arguments and Values:

*object*—an *object*.

*generalized-boolean*—a *generalized boolean*.

### Description:

Returns *true* if *object* is of *type* **package**; otherwise, returns *false*.

### Examples:

```
(packagep *package*)  $\rightarrow$  true
(packagep 'common-lisp)  $\rightarrow$  false
(packagep (find-package 'common-lisp))  $\rightarrow$  true
```

### Notes:

`(packagep object)`  $\equiv$  `(typep object 'package)`

---

## \*package\*

---

*Variable*

### Value Type:

a *package object*.

### Initial Value:

the COMMON-LISP-USER *package*.

### Description:

Whatever *package object* is currently the *value* of **\*package\*** is referred to as the *current package*.

### Examples:

```
(in-package "COMMON-LISP-USER")  $\rightarrow$  #<PACKAGE "COMMON-LISP-USER">
*package*  $\rightarrow$  #<PACKAGE "COMMON-LISP-USER">
(make-package "SAMPLE-PACKAGE" :use '("COMMON-LISP"))
 $\rightarrow$  #<PACKAGE "SAMPLE-PACKAGE">
(list
```

---

```
(symbol-package
  (let ((*package* (find-package 'sample-package)))
    (setq *some-symbol* (read-from-string "just-testing"))))
*package*)
→ (#<PACKAGE "SAMPLE-PACKAGE"> #<PACKAGE "COMMON-LISP-USER">)
(list (symbol-package (read-from-string "just-testing"))
      *package*)
→ (#<PACKAGE "COMMON-LISP-USER"> #<PACKAGE "COMMON-LISP-USER">)
(eq 'foo (intern "FOO")) → true
(eq 'foo (let ((*package* (find-package 'sample-package)))
              (intern "FOO")))
→ false
```

**Affected By:**

load, compile-file, in-package

**See Also:**

compile-file, in-package, load, package

---

## package-error

*Condition Type*

---

**Class Precedence List:**

package-error, error, serious-condition, condition, t

**Description:**

The *type* **package-error** consists of *error conditions* related to operations on *packages*. The offending *package* (or *package name*) is initialized by the **:package** initialization argument to **make-condition**, and is *accessed* by the *function* **package-error-package**.

**See Also:**

**package-error-package**, Chapter 9 (Conditions)

---

## package-error-package

---

### package-error-package

*Function*

---

#### Syntax:

`package-error-package condition` → *package*

#### Arguments and Values:

*condition*—a *condition* of type `package-error`.

*package*—a *package designator*.

#### Description:

Returns a *designator* for the offending *package* in the *situation* represented by the *condition*.

#### Examples:

```
(package-error-package
 (make-condition 'package-error
  :package (find-package "COMMON-LISP")))
→ #<Package "COMMON-LISP">
```

#### See Also:

`package-error`

---