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27.2. pdb — The Python Debugger¶

The module `pdb` defines an interactive source code debugger for Python programs. It supports setting (conditional) breakpoints and single stepping at the source line level, inspection of stack frames, source code listing, and evaluation of arbitrary Python code in the context of any stack frame. It also supports post-mortem debugging and can be called under program control.

The debugger is extensible — it is actually defined as the class `Pdb`. This is currently undocumented but easily understood by reading the source. The extension interface uses the modules [bdb](#) (undocumented) and [cmd](#).

The debugger's prompt is `(Pdb)`. Typical usage to run a program under control of the debugger is:

```
>>> import pdb
>>> import mymodule
>>> pdb.run('mymodule.test()')
> <string>(0)?()
(Pdb) continue
> <string>(1)?()
(Pdb) continue
NameError: 'spam'
> <string>(1)?()
(Pdb)
```

`pdb.py` can also be invoked as a script to debug other scripts. For example:

```
python -m pdb myscript.py
```

When invoked as a script, `pdb` will automatically enter post-mortem debugging if the program being debugged exits abnormally. After post-mortem debugging (or after normal exit of the program), `pdb` will restart the program. Automatic restarting preserves `pdb`'s state (such as breakpoints) and in most cases is more useful than quitting the debugger upon program's exit.

New in version 2.4: Restarting post-mortem behavior added.

The typical usage to break into the debugger from a running program is to insert

```
import pdb; pdb.set_trace()
```

at the location you want to break into the debugger. You can then step through the code following this statement, and continue running without the debugger using the `c` command.

The typical usage to inspect a crashed program is:

```
>>> import pdb
>>> import mymodule
>>> mymodule.test()
Traceback (most recent call last):
  File "<stdin>", line 1, in ?
  File "./mymodule.py", line 4, in test
    test2()
  File "./mymodule.py", line 3, in test2
    print spam
NameError: spam
>>> pdb.pm()
> ./mymodule.py(3)test2()
-> print spam
(Pdb)
```

The module defines the following functions; each enters the debugger in a slightly different way:

```
pdb.run(statement[, globals[, locals]])¶
```

Execute the *statement* (given as a string) under debugger control. The debugger prompt appears before any code is executed; you can set breakpoints and type `continue`, or you can step through the statement using `step` or `next` (all these commands are explained below). The optional *globals* and *locals* arguments specify the environment in which the code is executed; by default the dictionary of the module `__main__` is used. (See the explanation of the `exec` statement or the `eval()` built-in function.)

```
pdb.runeval(expression[, globals[, locals]])
```

Evaluate the *expression* (given as a string) under debugger control. When `runeval()` returns, it returns the value of the expression. Otherwise this function is similar to `run()`.

```
pdb.runcall(function[, argument, ...])
```

Call the *function* (a function or method object, not a string) with the given arguments. When `runcall()` returns, it returns whatever the function call returned. The debugger prompt appears as soon as the function is entered.

```
pdb.set_trace()
```

Enter the debugger at the calling stack frame. This is useful to hard-code a breakpoint at a given point in a program, even if the code is not otherwise being debugged (e.g. when an assertion fails).

```
pdb.post_mortem([traceback])
```

Enter post-mortem debugging of the given *traceback* object. If no *traceback* is given, it uses the one of the exception that is currently being handled (an exception must be being handled if the default is to be used).

```
pdb.pm()
```

Enter post-mortem debugging of the traceback found in `sys.last_traceback`.

27.3. Debugger Commands

The debugger recognizes the following commands. Most commands can be abbreviated to one or two letters; e.g. `h(elp)` means that either `h` or `help` can be used to enter the help command (but not `he` or `hel`, nor `H` or `HeLp` or `HELP`). Arguments to commands must be separated by whitespace (spaces or tabs). Optional arguments are enclosed in square brackets (`[]`) in the command syntax; the square brackets must not be typed. Alternatives in the command syntax are separated by a vertical bar (`|`).

Entering a blank line repeats the last command entered. Exception: if the last command was a `list` command, the next 11 lines are listed.

Commands that the debugger doesn't recognize are assumed to be Python statements and are executed in the context of the program being debugged. Python statements can also be prefixed with an exclamation point (`!`). This is a powerful way to inspect the program being debugged; it is even possible to change a variable or call a function. When an exception occurs in such a statement, the exception name is printed but the debugger's state is not changed.

Multiple commands may be entered on a single line, separated by `;`. (A single `;` is not used as it is the separator for multiple commands in a line that is passed to the Python parser.) No intelligence is applied to separating the commands; the input is split at the first `;` pair, even if it is in the middle of a quoted string.

The debugger supports aliases. Aliases can have parameters which allows one a certain level of adaptability to the context under examination.

If a file `.pdbrc` exists in the user's home directory or in the current directory, it is read in and executed as if it had been typed at the debugger prompt. This is particularly useful for aliases. If both files exist, the one in the home directory is read first and aliases defined there can be overridden by the local file.

`h(elp) [command]`

Without argument, print the list of available commands. With a *command* as argument, print help about that command. `help pdb` displays the full documentation file; if the environment variable `PAGER` is defined, the file is piped through that command instead. Since the *command* argument must be an identifier, `help exec` must be entered to get help on the `!` command.

`w(here)`

Print a stack trace, with the most recent frame at the bottom. An arrow indicates the current frame, which determines the context of most commands.

`d(own)`

Move the current frame one level down in the stack trace (to a newer frame).

`u(p)`

Move the current frame one level up in the stack trace (to an older frame).

`b(reak) [[filename:]lineno | function[, condition]]`

With a *lineno* argument, set a break there in the current file. With a *function* argument, set a break at the first executable statement within that function. The line number may be prefixed with a filename and a colon, to specify a breakpoint in another file (probably one that hasn't been loaded yet). The file is searched on `sys.path`. Note that each breakpoint is assigned a number to which all the other breakpoint commands refer.

If a second argument is present, it is an expression which must evaluate to true before the breakpoint is honored.

Without argument, list all breaks, including for each breakpoint, the number of times that breakpoint has been hit, the current ignore count, and the associated condition if any.

`tbreak [[filename:]lineno | function[, condition]]`

Temporary breakpoint, which is removed automatically when it is first hit. The arguments are the same as `break`.

`cl(ear) [bnumber [bnumber ...]]`

With a space separated list of breakpoint numbers, clear those breakpoints. Without argument, clear all breaks (but first ask confirmation).

`disable [bnumber [bnumber ...]]`

Disables the breakpoints given as a space separated list of breakpoint numbers. Disabling a breakpoint means it cannot cause the program to stop execution, but unlike clearing a breakpoint, it remains in the list of breakpoints and can be (re-)enabled.

`enable [bpnumber [bpnumber ...]]`

Enables the breakpoints specified.

`ignore bpnumber [count]`

Sets the ignore count for the given breakpoint number. If count is omitted, the ignore count is set to 0. A breakpoint becomes active when the ignore count is zero. When non-zero, the count is decremented each time the breakpoint is reached and the breakpoint is not disabled and any associated condition evaluates to true.

`condition bpnumber [condition]`

Condition is an expression which must evaluate to true before the breakpoint is honored. If condition is absent, any existing condition is removed; i.e., the breakpoint is made unconditional.

`commands [bpnumber]`

Specify a list of commands for breakpoint number *bpnumber*. The commands themselves appear on the following lines. Type a line containing just 'end' to terminate the commands. An example:

```
(Pdb) commands 1
(com) print some_variable
(com) end
(Pdb)
```

To remove all commands from a breakpoint, type `commands` and follow it immediately with `end`; that is, give no commands.

With no *bpnumber* argument, `commands` refers to the last breakpoint set.

You can use breakpoint commands to start your program up again. Simply use the `continue` command, or `step`, or any other command that resumes execution.

Specifying any command resuming execution (currently `continue`, `step`, `next`, `return`, `jump`, `quit` and their abbreviations) terminates the command list (as if that command was immediately followed by `end`). This is because any time you resume execution (even with a simple `next` or `step`), you may encounter another breakpoint—which could have its own command list, leading to ambiguities about which list to execute.

If you use the 'silent' command in the command list, the usual message about stopping at a breakpoint is not printed. This may be desirable for breakpoints that are to print a specific message and then continue. If none of the other commands print anything, you see no sign that the breakpoint was reached.

New in version 2.5.

`s(step)`

Execute the current line, stop at the first possible occasion (either in a function that is called or on the next line in the current function).

`n(ext)`

Continue execution until the next line in the current function is reached or it returns. (The difference between `next` and `step` is that `step` stops inside a called function, while `next` executes called functions at (nearly) full speed, only stopping at the next line in the current function.)

`unt(il)`

Continue execution until the line with the line number greater than the current one is reached or when returning from current frame.

New in version 2.6.

`r(eturn)`

Continue execution until the current function returns.

`c(ontinue)`

Continue execution, only stop when a breakpoint is encountered.

`j(ump) lineno`

Set the next line that will be executed. Only available in the bottom-most frame. This lets you jump back and execute code again, or jump forward to skip code that you don't want to run.

It should be noted that not all jumps are allowed — for instance it is not possible to jump into the middle of a [for](#) loop or out of a [finally](#) clause.

`l(list) [first[, last]]`

List source code for the current file. Without arguments, list 11 lines around the current line or continue the previous listing. With one argument, list 11 lines around at that line. With two arguments, list the given range; if the second argument is less than the first, it is interpreted as a count.

`a(rgs)`

Print the argument list of the current function.

`p expression`

Evaluate the *expression* in the current context and print its value.

Note

`print` can also be used, but is not a debugger command — this executes the Python [print](#) statement.

pp *expression*

Like the `p` command, except the value of the expression is pretty-printed using the `pprint` module.

alias [*name* [command]]

Creates an alias called *name* that executes *command*. The command must *not* be enclosed in quotes. Replaceable parameters can be indicated by `%1`, `%2`, and so on, while `%*` is replaced by all the parameters. If no command is given, the current alias for *name* is shown. If no arguments are given, all aliases are listed.

Aliases may be nested and can contain anything that can be legally typed at the `pdb` prompt. Note that internal `pdb` commands *can* be overridden by aliases. Such a command is then hidden until the alias is removed. Aliasing is recursively applied to the first word of the command line; all other words in the line are left alone.

As an example, here are two useful aliases (especially when placed in the `.pdbrc` file):

```
#Print instance variables (usage "pi classInst")
alias pi for k in %1.__dict__.keys(): print "%1.",k,"=",%1.__dict__[k]
#Print instance variables in self
alias ps pi self
```

unalias *name*

Deletes the specified alias.

[!]*statement*

Execute the (one-line) *statement* in the context of the current stack frame. The exclamation point can be omitted unless the first word of the statement resembles a debugger command. To set a global variable, you can prefix the assignment command with a `global` command on the same line, e.g.:

```
(Pdb) global list_options; list_options = ['-l']
(Pdb)
```

run [*args* ...]

Restart the debugged Python program. If an argument is supplied, it is split with “`shlex`” and the result is used as the new `sys.argv`. History, breakpoints, actions and debugger options are preserved. “`restart`” is an alias for “`run`”.

New in version 2.6.

q(uit)

Quit from the debugger. The program being executed is aborted.

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