

# Doing operating system tasks in Python

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Python has extensive support for operating system tasks, such as file and folder management. The great advantage of doing operating system tasks in Python and not directly in the operating system is that the Python code works uniformly on Unix/Linux, Windows, and Mac (there are exceptions, but they are few). Below we list some useful operations that can be done inside a Python program or in an interactive session.

## 0.1 Make a folder

Python applies the term `directory` instead of `folder`. The equivalent of the Unix `mkdir mydir` is

```
import os
os.mkdir('mydir')
```

Ordinary files are created by the `open` and `close` functions in Python.

## 0.2 Make intermediate folders

Suppose you want to make a subfolder under your home folder:

```
$HOME/python/project1/temp
```

but the intermediate folders `python` and `project1` do not exist. This requires each new folder to be made separately by `os.mkdir`, or you can make all folders at once with `os.makedirs`:

```
foldername = os.path.join(os.environ['HOME'], 'python',
                           'project1', 'temp')
os.makedirs(foldername)
```

With `os.environ[var]` we can get the value of any environment variable `var` as a string. The `os.path.join` function joins folder names and a filename in a platform-independent way.

### 0.3 Move to a folder

The `cd` command reads `os.chdir` and `cwd` is `os.getcwd`:

```
origfolder = os.getcwd() # get name of current folder
os.chdir(foldername)     # move ("change directory")
...
os.chdir(origfolder)     # move back
```

### 0.4 Rename a file or folder

The cross-platform `mv` command is

```
os.rename(oldname, newname)
```

### 0.5 List files

Unix wildcard notation can be used to list files. The equivalent of `ls *.py` and `ls plot*[1-4]*.dat` reads

```
import glob
filelist1 = glob.glob('*.py')
filelist2 = glob.glob('plot*[1-4]*.dat')
```

### 0.6 List all files and folders in a folder

The counterparts to `ls -a mydir` and just `ls -a` are

```
filelist1 = os.listdir('mydir')
filelist1 = os.listdir(os.getcwd()) # current folder (directory)
filelist1.sort()                   # sort alphabetically
```

### 0.7 Check if a file or folder exists

The widely used constructions in Unix scripts for testing if a file or folder exist are `if [ -f $filename ]; then` and `if [ -d $dirname ]; then`. These have very readable counterparts in Python:

```
if os.path.isfile(filename):
    inputfile = open(filename, 'r')
    ...

if os.path.isdir(dirname):
    filelist = os.listdir(dirname)
    ...
```

## 0.8 Remove files

Removing a single file is done with `os.rename`, and a loop is required for doing `rm tmp_*.df`:

```
import glob
filelist = glob.glob('tmp_*.pdf')
for filename in filelist:
    os.remove(filename)
```

## 0.9 Remove a folder and all its subfolders

The `rm -rf mytree` command removes an entire folder tree. In Python, the cross-platform valid command becomes

```
import shutil
shutil.rmtree(foldername)
```

It goes without saying that this command must be used with great care!

## 0.10 Copy a file to another file or folder

The `cp fromfile tofile` construction applies `shutil.copy` in Python:

```
shutil.copy('fromfile', 'tofile')
```

## 0.11 Copy a folder and all its subfolders

The recursive copy command `cp -r` for folder trees is in Python expressed by `shell.copytree`:

```
shutil.copytree(sourcefolder, destination)
```

## 0.12 Run any operating system command

The simplest way of running another program from Python is to use `os.system`:

```
cmd = 'python myprog.py 21 --mass 4' # command to be run
failure = os.system(cmd)
if failure:
    print 'Execution of "%s" failed!\n' % cmd
    sys.exit(1)
```

The recommended way to run operating system commands is to use the `subprocess` module. The above command is equivalent to

```
import subprocess
cmd = 'python myprog.py 21 --mass 4'
failure = subprocess.call(cmd, shell=True)

# or
failure = subprocess.call(
    ['python', 'myprog.py', '21', '--mass', '4'])
```

The output of an operating system command can be stored in a string object:

```
try:
    output = subprocess.check_output(cmd, shell=True,
                                     stderr=subprocess.STDOUT)
except subprocess.CalledProcessError:
    print 'Execution of "%s" failed!\n' % cmd
    sys.exit(1)

# Process output
for line in output.splitlines():
    ...
```

The `stderr` argument ensures that the `output` string contains everything that the command `cmd` wrote to both standard output and standard error.

The constructions above are mainly used for running stand-alone programs. Any file or folder listing or manipulation should be done by the functionality in the `os` and `shutil` modules.

### 0.13 Split file or folder name

Given `data/file1.dat` as a file path relative to the home folder `/users/me` (`$HOME/data/file1.dat` in Unix). Python has tools for extracting the complete folder name `/users/me/data`, the basename `file1.dat`, and the extension `.dat`:

```
>>> path = os.path.join(os.environ['HOME'], 'data', 'file1.dat')
>>> path
'/users/me/data/file1.dat'
>>> foldername, basename = os.path.split(path)
>>> foldername
'/users/me/data'
>>> basename
'file1.dat'
>>> stem, ext = os.path.splitext(basename)
>>> stem
'file1'
>>> ext
'.dat'
>>> outfile = stem + '.out'
>>> outfile
'file1.out'
```

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