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## 1.1 Numbers

- 42 (dec, oct, hex, short/long) floating point value
- complex number
- complex number
- real and imag part of z
- constants for boolean values
- absolute value of n
- (x/y, x%y)
- create hex string
- create octal string
- unicode code point of char
- round x to n decimal places
- x<y: -1, x==y: 0, x>y: 1
- (x, y), make same type
- (x\*\*y) % z
- float from string
- int from string
- more math functions
- random number generators

- strings are immutable)
- list creation
- tuple creation
- list/tuple conversion
- list of integers (0-999)
- immut. xrange-sequence
- iterator from sequence
- get list element (1+2J)
- get list element (1.4)
- sequence concat
- repeat s 1 n times
- slicing (i incl., j excl.)
- slice with stride k
- every 2<sup>nd</sup> Element / reverse s
- is x a member of s?
- number of elements
- min/max
- replace slice
- insert before position i
- number of occurrences of x
- first index of x, or error
- append x at end of l
- pop off last element
- append l2 at end of l
- insert x at pos. i
- delete first x
- reverse l
- sort using f (default f =cmp)
- [ (s[0], t[0]), . . . ) , . . .

d={'x':42, 'y':3.14, 'z':7}	dict creation
d['x']	get entry for 'x'
len(d)	number of keys
del(d['x'])	delete entry from dict
d.copy()	create shallow copy
d.has_key(k)	does key exist?
d.items()	list of all items
d.keys()	list of all keys
d.values()	list of all values
i=d.iteritems(); i.next()	iterator over items
i=d.iterkeys(); i.next()	iterator over keys
i=d.itervalues(); i.next()	iterator over values
d.get(k,x)	get entry for k, or return x
d.clear()	remove all items
d.setdefault(k,x)	return d[k] or set d[k]=x
d.popitem()	return and delete an item

<code>s=set(s); fs=frozenset(s)</code>	create set
<code>fs.issubset(t); s&lt;=t</code>	all <i>s</i> in <i>t</i> ?
<code>fs.issuperset(t); s&gt;=t</code>	all <i>t</i> in <i>s</i> ?
<code>fs.union(t); s t</code>	all elements from <i>s</i> and <i>t</i>
<code>fs.intersection(t); s&amp;t</code>	elements both in <i>s</i> and <i>t</i>
<code>fs.difference(t); s-t</code>	all <i>s</i> not in <i>t</i>
<code>fs.symmetric_difference(t); s^t</code>	all either <i>s</i> or <i>t</i>
<code>fs.copy()</code>	shallow copy of <i>s</i>
<code>s.update(t); s =t</code>	add elements of <i>t</i>
<code>s.intersection_update(t); s&amp;=t</code>	keep only what is also in <i>t</i>
<code>s.difference_update(t); s-=t</code>	remove elements of <i>t</i>
<code>s.symmetric_differ... (t); s^=t</code>	keep only symm. difference
<code>s.add(x)</code>	add <i>x</i> to <i>fs</i>
<code>s.remove(x); fs.discard(x);</code>	remove <i>x</i> (/ with exception)
<code>s.pop();</code>	return and remove any elem.
<code>s.clear();</code>	remove all elements

<code>"bla"; 'hello "world"'</code>	string (of bytes)
<code>"""bla"""</code>	triple quotes for multiline
<code>""'bla'"""</code>	cont., backslash, null char
<code>\ \ \ \ \0</code>	unicode char
<code>\N{id} \uhhhh \Uhhhhhhhhh</code>	hex, octal byte
<code>\xhh \ooo</code>	unicode string (of characters)
<code>u"Ünic\u00F8de"; u"\xF8"</code>	raw string (unicode)
<code>r"C:\new\text.dat"; ur"\Ü"</code>	string conversion
<code>str(3.14); str(42)</code>	string formatting
<code>"%s-%s-%s" % (42,3.14,[1,2,3])</code>	join sequences with separator
<code>'\t'.join(seq)</code>	latin-1 string to unicode string
<code>s.decode('utf-8')</code>	unicode string to utf-8 string
<code>u.encode('utf-8')</code>	char from code point
<code>chr(i), unichr(i)</code>	string from number/object
<code>str(x)</code>	

```
search and replace: find(s,b,e), rfind(s,b,e),
                   index(s,b,e), rindex(s,b,e), count(s,b,e),
                   endswith(s,b,e), startswith(s,b,e), replace(o,n,m)
formatting: capitalize, lower, upper, swapcase, title
splitting: partition(s), rpartition(s), split(s,m),
           rsplit(s,m), splitlines(ke)
```

- create set
- all  $s$  in  $t$ ?
- all  $t$  in  $s$ ?
- all elements from  $s$  and  $t$
- elements both in  $s$  and  $t$
- all  $s$  not in  $t$
- all either  $s$  or  $t$
- shallow copy of  $s$
- add elements of  $t$
- keep only what is also in  $t$
- remove elements of  $t$
- keep only *symm.* difference
- add  $x$  to  $fs$
- remove  $x$  (/ with exception)
- return and remove any elem.
- remove all elements

*padding:* center(w,c), ljust(w,c), lstrip(cs),  
rjust(w,c),rstrip(cs), strip(cs), zfill(w),  
expandtabs(ts)

*checking:* isalnum, isalpha, isdigit, islower, isspace,  
istitle, isupper

**String Constants:** import string  
digits, hexdigits, letters, lowercase, octdigits,  
printable, punctuation, uppercase, whitespace

**Regexes:** import re  
r=re.compile(r'rx',re.ILMSUX) comile 'rx' as regex  
(?P<id>...) named group  
m=r.match(s,b,e) full match  
re.match(r'(?ilmsux)rx',s) direct regex usage  
m=r.search(s,b,e) partial match  
l=r.split(s,ms) split and return list  
l=r.findall(string) list of all matched groups  
s=r.sub(s,r,c) replace c counts of s with r  
(s,n)=r.subn(s,r,c) n is number of replacements  
s=re.escape(s) escape all non-alphanumerics  
m.start(g);m.span(g);m.end(g) group-match delimiters  
m.expand(s) replace \1 etc. with matches  
m.group(g); m.group("name") matched group no. g  
m.groups() list of groups  
m.groupdict() dict of named groups

if expr: statements	conditional
elif expr: statements	
else: statements	
if a is b : ...	object identity
if a == 1	value identity
while expr: statements	while loop
else: statements	run else on normal exit
while True: ... if cond: break	do... while equivalent
for target in iter: statements	for loop
else: statements	
for key,value in d.items():...	multiple identifiers
break, continue	end loop / jump to next
print "hello world",	print without newline
[ expr for x in seq lc ]	list comprehension
lc = for x in seq / if expr	with lc-clauses
pass	empty statement
def f(params): statements	function definition
def f(x, y=0): return x+y	optional parameter
def f(*a1, **a2): statements	additional list of unnamed,
	dict of named paramters
def f(): f.variable = 1 ...	function attribute
return expression	return from function
yield expression	make function a generator
f(1,1), f(2), f(y=3, x=4)	function calls
global v	bind to global variable
def make_adder_2(a):	closure
def add(b): return a+b	
return add	
lambda x: x+a	lambda expression
compile(string,filename,kind)	compile string into code object

```
eval(expr,globals,locals)
exec code in gldict, lcdict
execfile(file,globals,locals)
raw_input(prompt)
input(prompt)
```

evaluate expression  
compile and execute code  
execute file  
input from stdin  
input and evaluate

```
class MyExcept(Exception): ...
raise MyExcept , data
```

define user exception  
raise user exception

### 3 Object Orientation and Modules

```
import module as alias
from module import name1,name2
from __future__ import *
reload module
module.__all__
module.__name__
module.__dict__
__import__ ("name",glb,loc,fl)
class name (superclass,...):
    data = value
    def method(self,...): ...
    def __init__(self, x):
        Super.__init__(self)
        self.member = x
    def __del__(self): ...
__str__, __len__, __cmp__,
__iter__(self): return self
__call__
__dict__
__getattr__(self, name),
__setattr__(self, name, value)
callable(object)
delattr(object, "name")
del(object)
dir(object)
getattr(object, "name", def)
hasattr(object, "name")
hash(object)
id(object)
isinstance(object,
classOrType)
issubclass(class1, class2)
iter(object, sentinel)
locals()
repr(object), str(object)
vars(object)
None
if __name__ == "__main__":
```

import module  
load attr. into own namespace  
activate all new features  
reinitialize module  
exported attributes  
module name / "\_\_main\_\_"  
module namespace  
import module by name  
class definition  
shared class data  
methods  
constructor  
call superclass constructor  
per-instance data  
destructor  
some operator overloaders  
use next method for iterator  
call interceptor  
instance-attribute dictionary  
get an unknown attribute  
set any attribute  
1 if callable, 0 otherwise  
delete name-attr. from object  
unreference object/var  
list of attr. assoc. with object  
get name-attr. from object  
check if object has attr.  
return hash for object  
unique integer (mem address)  
check for type

class2 subclass of class1?  
return iterator for object  
dict of local vars of caller  
return string-representation  
return \_\_dict\_\_  
the NULL object  
make modul executable

### 4 Exception Handling

```
try: ...
except ExceptionName:
except (Ex1, ...), data:
    print data
    raise
else: ...
finally: ...
assert expression
```

Try-block  
catch exception  
multiple, with data  
exception handling  
pass up (re-raise) exception  
if no exception occurred  
in any case  
debug assertion

### 5 System Interaction

```
sys.path
sys.platform
sys.stdout, stdin, stderr
sys.argv[1:]
os.system(cmd)
os.startfile(f)
os.popen(cmd, r|w, bufsize)
os.popen2(cmd, bufsize, b|t)
os.popen3(cmd, bufsize, b|t)
os.environ['VAR']; os.putenv[]
glob.glob('*.txt')
```

module search path  
operating system  
standard input/output/error  
command line parameters  
system call  
open file with assoc. program  
open pipe (file object)  
(stdin, stdout) fileobjects  
(stdin, stdout, stderr)  
read/write environment vars  
wildcard search

#### Filesystem Operations

**os module:** access, chdir, chmod, chroot, getcwd, getenv, listdir, mkdir, remove, unlink, removedirs, rename, rmdir, pipe, ...

**shutil module:** copy, copy2, copyfile, copyfileobj, copymode, copystat, copytree, rmtree

**os.path module:** abspath, altsep, basename, commonprefix, curdir, defpath, dirname, exists, expanduser, expandvar, extsep, get[acm]time, getsize, isabs, isdir, isfile, islink, ismout, join, lexists, normcase, normpath, pardir, pathsep, realpath, samefile, sameopenfile, samestat, sep, split, splitdrive, splitext, stat, walk

#### command line argument parsing:

```
restlist, opts = \
    getopt.getopt(sys.argv[1:], \
        "s:oh", \
        ["spam=", "other", "help"])
```

```
for o, a in opts:
    if o in ("-s", "--lol"): spam = a
    if o in ("-h", "--help"): show_help()
```

### 6 Input/Output

```
f=codecs.open(if,"rb","utf-8")
file = open(infilename, "wb")
codecs.EncodedFile(...)
r, w, a, r+
rb, wb, ab, r+b
file.read(N)
file.readline()
file.readlines()
file.write(string)
file.writelines(list)
file.close()
file.tell()
file.seek(offset, whence)
os.truncate(size)
os.tmpfile()
pickle.dump(x, file)
x = pickle.load(file)
```

open file with encoding  
open file without encoding  
wrap file into encoding  
read, write, append, random  
modes without eol conversion  
N bytes ( entire file if no N )  
the next linestring  
list of linestring  
write string to file  
write list of linestrings  
close file  
current file position  
jump to file position  
limit output to size  
open anon temporary file  
make object persistent  
load object from file

### 7 Standard Library (almost complete)

**String Services:** string, re, struct, difflib, StringIO, cStringIO, textwrap, codecs, unicodedata, stringprep, fpformat

**File/Directory Access:** os.path, fileinput, stat, statvfs, filecmp, tempfile, glob, fnmatch, linecache, shutil, dircache

**Generic OS services:** os, time, optparse, getopt, logging, getpass, curses, platform, errno, ctypes

**Optional OS services:** select, thread, threading, dummy\_thread, dummy\_threading, mmap, readline, rlcompleter

**Data Types:** datetime, calendar, collections, heapq, bisect, array, sets, sched, mutex, Queue, weakref, UserDict, UserList, UserString, types, new, copy, pprint, repr

**Numeric and Math Modules:** math, cmath, decimal, random, itertools, functools, operator

**Internet Data Handling:** email, mailcap, mailbox, mhlib, mimetools, mimetypes, MimeWriter, mimify, multifile, rfc822, base64, binhex, binascii, quopri, uu

**Structured Markup Processing Tools:** HTMLParser, sgmlib, htmllib, htmlentitydefs, xml.parsers.expat, xml.dom.\*, xml.sax.\*, xml.etree.ElementTree

**File Formats:** csv, ConfigParser, robotparser, netrc, xdrlib

**Crypto Services:** hashlib, hmac, md5, sha

**Compression:** zlib, gzip, bz2, zipfile, tarfile

**Persistence:** pickle, cPickle, copy\_reg, shelve, marshal, anydbm, whichdb, dbm, gdbm, dbhash, bsddb, dumbdbm, sqlite3

**Unix specific:** posix, pwd, spwd, grp, crypt, dl, termios, tty, pty, fcntl, posixfile, resource, nis, syslog, commands

**IPC/Networking:** subprocess, socket, signal, popen2, asyncore, asynchat

**Internet:** webbrowser, cgi, scitb, wsgiref, urllib, httpplib, ftplib, imaplib, nntplib, ...lib, smtpd, uuid, urlparse, SocketServer, ...Server., cookielib, Cookie, xmlrpclib

**Multimedia:** audioop, imageop, aifc, sunau, wave, chunk, colorsys, rgbimg, imghdr, sndhdr, ossaudiodev

**Tk:** Tkinter, Tix, ScrolledText, turtle

**Internationalization:** gettext, locale

**Program Frameworks:** cmd, shlex

**Development:** pydoc, doctest, unittest, test

**Runtime:** sys, warnings, contextlib, atexit, traceback, qc, inspect, site, user, fpectl

**Custom Interpreters:** code, codeop

**Restricted Execution:** rexec, Bastion

**Importing:** imp, zipimport, pkgutil, modulefinder, runpy

**Language:** parser, symbol, token, keyword, tokenize, tabnanny, pycldr, py\_compile, compileall, dis, pickletools, distutils

**Windows:** msilib, msvcrt, \_winreq, winsound

**Misc:** formatter